NASA / OHIO SPACE GRANT CONSORTIUM

2024-2025 SCHOLAR / FELLOW STUDENT JOURNAL

Students Representing Ohio Congressional Districts

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FELLOWSHIP AND SCHOLARSHIP PROGRAM

The Ohio Space Grant Consortium (OSGC), a member of the NASA National Space Grant College and Fellowship Program, awards graduate fellowships and undergraduate scholarships to students working toward degrees in **S**cience, **T**echnology, **E**ngineering and **M**athematics **(STEM)** disciplines at OSGC-member universities. The awards are made to United States citizens, and the students are competitively selected. Since the inception of the program in 1989, 1,668 undergraduate scholarships and 323 graduate fellowships have been awarded.

The Consortium is additionally supported by matching funds provided by the 26 member universities/community colleges and the Ohio Aerospace Institute (OAI).

The research conducted under a faculty mentor for the fellowships and scholarships are a prime aspect of the program by encouraging U. S. undergraduate students to attain higher levels of education and provide more qualified technical employees to industry. The Education scholarship recipients are required to attend a workshop conducted by NASA personnel where they are exposed to NASA educational materials and create a lesson plan for use in their future classrooms.

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- Case Western Reserve University
- Cedarville University
- Central State University
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- University of Cincinnati
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- Kent State University
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OHIO CONGRESSIONAL MAP

Source: https://www.ohiosos.gov/globalassets/publications/maps/2022-2026/congressional_current2023-01_adopted_2022-03-02.pdf

Fellows

Nicholas Baird

Graduate, Mechatronics
Advisor(s): Dr. Mirinejad

Computational Optimal Control: A Strategic Approach to Enhancing Robotics Efficiency and Sustainability

Biography: I started my undergraduate studies at Kent State University, at first, I didn't have a clear direction. This caused me to leave school, and I began working in various manufacturing/ skill labor jobs. Working reignited my interest in problem-solving and innovation. This led me back to school with a focus on mechatronics. Since then, I've taken on hands-on research projects, including developing a Hardware-in-the-Loop testbed for testing automated fluid resuscitation systems. That project made me realize how much I enjoy working on complex challenges where technology can make a real difference. Thanks to the Ohio Space Grant Consortium Fellowship, I am pursuing a master's degree in Mechatronics, focusing on robotics and control systems. My research has focused on developing advanced control techniques, including nonlinear model predictive control and radial basis function optimization for robotics. These experiences have helped me build skills in dynamic control systems, automation, and cyber-physical systems, skills that are integral to mechatronics. Now my goal is to earn a PhD in Mechatronics Engineering and continue contributing to advancements in automation, artificial learning, and autonomous systems.

Abstract: This research project focuses on improving how we solve optimal control problems in robotics by developing better solvers and creating more accurate models of robotic manipulators. It will start with simpler testing and progress to more advanced experiments. By using approaches like nonlinear model predictive control, the goal is to make robotic systems move more smoothly, use energy more efficiently, and handle precise tasks, such as working with sensitive scientific instruments. Overall, this work aims to guide future designs and control strategies for robots so they can be more adaptable, responsible, and effective in a wide range of applications.

Publications: None yet.

14th Congressional District	OH Representative: David Joyce

The Ohio State University

Alex Barnhouse

Master's 1, Aerospace Engineering
Advisor(s): Dr. Nathan Webb

Effect of Reaction Surface Geometry on Control Authority of Asymmetric Plasma Actuation over Subsonic Axisymmetric Jet Aerodynamics

Biography: Alex Barnhouse is currently a first-year master's student pursuing a degree in Aerospace Engineering at The Ohio State University. In May 2024, Alex graduated from The Ohio State University with a bachelor's degree in Aerospace Engineering. During his undergraduate education, he obtained a professional internship in the manufacturing industry and began research for Dr. Nathan Webb in the Gas Dynamics and Turbulence Laboratory at the Ohio State University Aerospace Research Center.

Abstract: Tail-sitter type vertical take-off/landing (VTOL) vehicles require a high degree of maneuverability to operate both during take-off and cruise configurations. One possibility to achieve a high control authority with a single engine is to influence the direction and magnitude of the exit flow. Current methods to influence the exit flow are costly. To provide a lighter, low-power means of thrust vectoring, the ability of localized arc-filament plasma actuators (LAFPAs) to attach a flow to a curved "reaction surface" is being investigated. LAFPAs introduce perturbations which have been shown to induce coherent structures to form within the flow, altering the entrainment near the center of excitation and thus the flow local flow angle.

Using static pressure measurements on the reaction surface, it has been shown that a geometric pressure asymmetry can be induced near the nozzle exit by exciting the LAFPAs. A single metric termed "pressure asymmetry" was defined to simplify these static pressure profiles. The proportionally scaled resultant force vectors from the measured static pressure asymmetry were summed, giving a single magnitude and direction of static pressure asymmetry relative to the center of excitation, for each excitation frequency. By sweeping through frequencies, the LAFPAs' control authority and effect can be shown. Using the defined pressure asymmetry metric, the LAFPAs show the capability to induce asymmetry toward and away from the center of excitation. To confirm the presence of jet deflection and the LAFPAs' control authority inferred from the pressure asymmetry, streamwise PIV measurements were collected. A jet deflection was shown both toward and away from the center of excitation consistent with the pressure asymmetry metric. To achieve larger magnitude flow deflections, the effects of reaction surface geometry are currently being investigated. By altering the backward facing step height, radius of curvature, and the angle of termination within the geometry, the jet deflection could be increased. The new reaction surfaces are 3D printed and are tested using the same static pressure measurements as well as oil flow visualization. Streamwise and cross-stream PIV will also be used to confirm and quantify any increased jet deflection.

Publications:

Barnhouse, A., Mills, D., Cartwright, E., and Webb, N. J., "Controlled Deflection of a Subsonic, Axisymmetric Jet Using Plasma Actuators," presented at the AIAA Aviation 2024 Forum, Las Vegas, NV, 2024. https://doi.org/10.2514/6.2024-3544

6th Congressional District	OH Representative: Michael Rulli

THE OHIO STATE UNIVERSITY

Ethan J. Butler

Master's 1, Aerospace Engineering
Advisor: Dr. Jeffrey Bons

Leading Edge Vortex Response to Active Flow Control on a Cropped Delta Wing

Biography: Ethan is a graduate research fellow at Ohio State University's Aerospace Research Center focusing on delta and swept wing active flow control. In May of 2024 Ethan completed his bachelor's degree in aerospace engineering with an honors research distinction. He then continued this experimental fluid mechanics research into his graduate career, where Ethan has authored three publications on various active flow control strategies for differing wing planforms. Throughout his time in school Ethan has worked internships at The Boeing Company and Precision Castparts Airfoils. He also led the Buckeye Space Launch Initiative's Spaceport Structures team from 2022-2023. Ethan plans to graduate with his master's degree in spring 2025 before continuing with school in pursuit of a PhD.

Abstract: As the need for high-speed aircraft continues to grow, the delta-wing configuration has become an increasingly common choice for both military and commercial applications. Delta wings benefit from low transonic drag and a large nonlinear lift increase from the formation of a leading-edge vortex (May and Gutmark, 2005 & Kegelman and Roos, 1989). The decreased pressure coefficient and thus increased suction peak on the suction surface correlates to strong lift increase (Kolzsch and Breitsamter, 2014 & Kastantin and Paschereit, 2010). However, complications arise at heightened angles of attack. Leading-edge vortex (LEV) bursting occurs when a stable LEV breaks down, resulting in a significant increase in pressure and local loss in lift. This is especially dangerous for vehicles configured for short takeoff and landing. The low speed, high angle of attack maneuvers create stall propagations from the wingtip and severe destabilizing pitch-up moments.

The current study employs a novel active flow control (AFC) system with nine jets oriented outboard near the leading-edge. The half-span model was tested in Ohio State University's Low Speed Wind across a wide range of angles of attack. Both baseline and various AFC configurations were load cell tested to analyze the aerodynamic performance enhancements associated with the jets blowing. Flow visualization techniques allowed for a deeper analysis of the flow feature's position, size, and strength relative to the baseline. The findings from this work will inform future AFC systems and provide insight into the mechanisms that dominate performance changes.

Publications:

Ethan J. Butler and Jeffrey P. Bons. "Leading-Edge Vortex Response to Leading-Edge Spanwise Blowing on a Cropped Delta Wing," AIAA 2024-3757. *AIAA AVIATION FORUM AND ASCEND 2024* . July 2024.

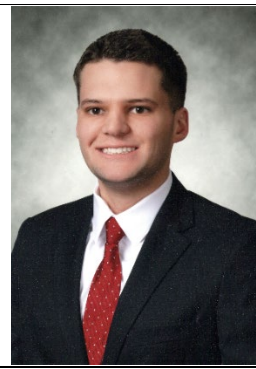
Ethan J. Butler and Jeffrey P. Bons. "Swept Wing Active Flow Control with Distributed Spanwise Fluidic Fences," AIAA 2025-0260. *AIAA SCITECH 2025 Forum*. January 2025.

Collin B. Rambacher, Ethan J. Butler and Jeffrey P. Bons. "Analysis of a Passive vs. Active Boundary Layer Fence on a Low Aspect Ratio Swept Wing in Subsonic Flow," AIAA 2024-1936. *AIAA SCITECH 2024 Forum*. January 2024.

7th Congressional District	OH Representative: Max Miller

The University of Akron

Jonathan B. Clawson



Master's 1, Master of Science in Mechanical Engineering
Advisor(s): Dr. Gregory Morscher

Ceramic Matrix Composite Performance in a Simulated Combustion Environment Under Various Loading Conditions

Biography: Jonathan Clawson is a mechanical engineer and Ohio Space Grant Consortium Master's Research Fellow who combines academic excellence, industry-proven competency, and published research skills. Jonathan earned a Bachelor of Science in Mechanical Engineering, with minors in Business Essentials for Engineers and Applied Mathematics, from The University of Akron where he is currently pursuing a Master of Science in Mechanical Engineering. During his undergraduate studies, he received a Certificate in Cooperative Education for completing three co-op rotations combined between The Timken Company and Kichler Lighting. He has a total of four years of research experience including nearly three and a half years as an Undergraduate Research Assistant at The University of Akron spanning two laboratories: the Materials in Extreme Environments Laboratory led by Dr. Gregory Morscher and the Akron Engineering Tribology Laboratory under by Dr. Christopher DellaCorte. Additionally, Jonathan interned in the Spacecraft Engineering Division – Structural Materials section at the U.S. Naval Research Laboratory in Washington, D.C., prior to his current role as a Graduate Research Assistant. Jonathan is driven by a passion for aerospace and a commitment to continuous learning with a people-oriented mindset that enables him to thrive in challenging environments and foster innovation in aerospace technologies.

Abstract: Ceramic matrix composites (CMCs) are advanced materials, consisting of a ceramic matrix reinforced by continuous ceramic fibers, that exhibit improved thermomechanical properties with excellent oxidation and corrosion resistance at a significantly lower density than conventional nickel-based superalloys that have traditionally dominated high temperature aerospace applications. However, CMC performance is dependent upon many variables including the constituent materials, composite architecture, and processing methods. Additionally, variability in the mechanical properties of CMCs is influenced by stochastic fracture behavior that is inherently more sensitive to pre-existing flaws than monolithic ceramics. Therefore, it is critical to characterize the performance of CMCs in a simulated operating environment at realistic loading conditions. This study aims to evaluate the performance of cutting-edge CMC material in a simulated combustion environment at various loading and environmental conditions and explore the oxidation kinetics as crack openings allow oxygen ingress.

Publications:

[1] **Jonathan Clawson** and Gregory Morscher. "Ambient Temperature Strength Degradation of a Ceramic Matrix Composite Due to Solid Particle Erosion," AIAA 2024-85928. *2024 Regional Student Conferences*. January 2024. https://doi.org/10.2514/6.2024-85928

[2] **Clawson, Jonathan**, "Ambient Temperature Strength Degradation of a Ceramic Matrix Composite Due to Solid Particle Erosion" (2024). *Williams Honors College, Honors Research Projects*. 1841. https://ideaexchange.uakron.edu/honors_research_projects/1841

[3] Morscher GN, Ferguson C, Pratt S, **Clawson JB**, Razavi SM, Subramanian S, "Acoustic emission accuracy from a tensile test of a ceramic matrix composite", J Am Ceram Soc.2024;1–16. https://doi.org/10.1111/jace.20104

[4] Mirza, F., **Clawson, J.**, Panakarjupally, R.P., Morscher, G.N., Baid, H., Choi, S., "Investigating Synergistic Effects of Double-Sided Solid Particle Erosion on Oxide/Oxide Ceramic Matrix Composites at Elevated Temperatures" (GT2025-151279) (accepted abstract and submitted draft to the ASME Turbomachinery Technical Conference & Exposition 2025).

13th Congressional District	OH Representative: Emilia Sykes

Jordan Craft

Master's 1, Mechanical Engineering
Advisor: Manigandan Kannan

Prevention of Hydrogen Embrittlement in Additive Manufactured Metals

Biography: Jordan Craft is a first year graduate student at the University of Akron studying Mechanical Engineering. He currently works as a research assistant for Dr. Manigandan Kannan doing work with additive manufacturing and hydrogen embrittlement. In undergraduate, Jordan studied both Mechanical Engineering and Applied Mathematics, earning two bachelor's degrees at graduation. During his undergraduate, Jordan did co-op rotations at NMG Aerospace, Saint Gobain Performance Plastics, and Allen Aircraft Products, getting real world experience in engineering. Jordan looks forward to graduating with his Master's degree in May 2026 and working in design engineering, specializing in computations and applied mathematics.

Abstract: Hydrogen Embrittlement is a studied process by which metals lose ductility from introduced hydrogen. With the growth of hydrogen fuel cell industries, Hydrogen Environmental Embrittlement (HEE) from the presence of hydrogen in fuel cells is a concern. While additive manufacturing (AM) offers many benefits over traditional manufacturing, some studies have found that AM materials have increased susceptibility to Hydrogen Embrittlement. Different prevention methods, such as LA-UNSM and air coolant-based grinding are explored as methods to introduce residual compressive stresses and mitigate HE susceptibility.

Publications: None yet.

13th Congressional District	OH Representative: Emilia Sykes

Grace Curtician

Master's 2, Applied Biomedical Engineering
Advisor(s): Dr. Nolan B. Holland

Thermal and Rheological Properties of Elastin-like Polypeptides for Drug Delivery

Biography: Grace is a dedicated biomedical engineer with a Bachelor of Science in Biomedical Engineering from The University of Akron, where she contributed to innovative projects, including the development of improved surgical staples and a novel device for pelvic floor therapy. These experiences, coupled with her role as a Research & Development Intern at KYOCERA SGS Precision Tools, provided a strong foundation in designing and advancing biomedical solutions. Currently pursuing a Master of Science in Applied Biomedical Engineering at Cleveland State University, Grace is an Ohio Space Grant Consortium Master's Fellow conducting research on elastin-like polypeptide (ELP)- based hydrogels for drug delivery applications. Her research focuses on understanding the structureproperty relationships of the protein to optimize hydrogel performance for addressing critical challenges in healthcare. Beyond research, Grace is passionate about STEM outreach and leadership, serving as a Student Director for BEST Medicine and the HYLAND STEM Institute, where she has inspired and mentored future engineers through hands-on educational initiatives and community engagement

Abstract: Recombinant protein-based elastin-like polypeptide (ELP) hydrogels offer significant potential to overcome the limitations of current hydrogels used in medical applications such as drug delivery and tissue engineering. ELPs are thermo-reversible polypeptides with a temperature-dependent sol-gel transition, enabling precise control over their aggregation. These hydrogels are biosynthesized using bacterial expression systems, and recombinant DNA technology allows for fine-tuning of their size, composition, and incorporation of bioactive peptide sequences. ELP hydrogels are designed here as triblock polypeptides, with a long hydrophilic mid-block flanked by shorter hydrophobic blocks. Above their transition temperature, the hydrophobic blocks aggregate to form physical cross-links, creating a gel that remains stable at elevated temperatures and disassembles when cooled. The length and hydrophobicity of the blocks govern critical properties, including gelation temperature, density, and mechanical characteristics.

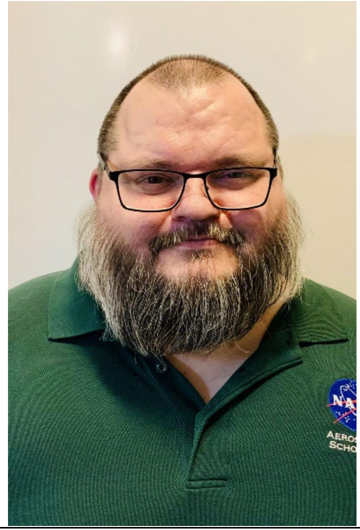
This project aims to investigate the structure-function relationships of ELP hydrogels by systematically exploring how the polypeptide structure influences their physical and chemical properties. Specifically, the study will: produce ELPs with varied block sizes and compositions, characterize their thermal, rheological, and mechanical properties, and develop a predictive model linking ELP structure to specific physical properties. The findings will provide valuable insights into designing hydrogels with tailored functionalities for biomedical applications. By enabling precise control of mechanical properties, gelation dynamics, and bioactivity, the outcomes of this research have the potential to facilitate the development of hydrogels optimized for diverse clinical applications in drug delivery, tissue engineering, and more.

Publications: None yet.

11th Congressional District	OH Representative: Shontel Brown

OHIO UNIVERSITY

Davin Dillon



Master's 2, Electrical Engineering and Computer Science
Advisor: Dr. Jundong Liu

Space Robot Motion Planning through Multi-Sensor Deep Reinforcement Learning

Biography: I am a graduate student in Electrical Engineering and Computer Science at Ohio University, with a focus on Deep Reinforcement Learning. I have a Bachelor of Science in Data Science from the University of Houston-Downtown, with a double minor in Mathematics and Statistics. My research centers on the use of reinforcement learning algorithms to advance autonomous navigation systems, and my aim is to drive innovations in robotics and artificial intelligence. Specifically, I aim to contribute to the development of navigation systems for space debris cleanup and exploration of extraterrestrial terrains.

Abstract: Space exploration and maintenance increasingly rely on sophisticated robotics. For extra-planetary operations and On-orbit Servicing, Assembly, and Manufacturing (OSAM), the need for autonomous systems with advanced motion planning capabilities is growing. In this project, we aim to develop a transformative approach to robot motion planning by taking advantage of the remarkable capabilities of Deep Reinforcement Learning (DRL), as well as multi-sensor data (optical, LiDAR, and radar). We plan to deploy, fine-tune, and test DRL-based motion planning models, previously validated in the Microsoft AirSim simulation environments, on real-world robots, including TurtleBot v3 robots and custom-built rovers. The progression of our project will lay the foundation for future deployment in OSAM tasks, such as space debris cleanup and rover navigation on extraterrestrial terrains, including Mars and the Moon.

Our approach has advantages over the traditional control theory-based solutions, as DRL equips robots with the ability to learn and navigate complex or unpredictable terrains, where pre-defined paths may not exist. DRL also can use neural networks to process and integrate complex input data, such as optical images and LiDAR. We will start with in-house TurtleBot v3 robots and custom-built rovers, and the developments and evaluations will be conducted on the Ohio University campus.

Publications: None yet.

12th Congressional District	OH Representative: Troy Balderson

The University of Akron

Erin Falkosky

1st Year Master's Student, Mechanical Engineering
Advisor: Dr. Manigandan Kannan

Hypersonic CMC TBC Testing

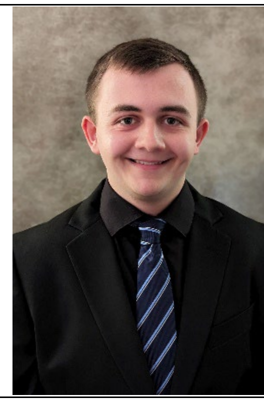
Biography:
I am a master's student at the University of Akron majoring in mechanical engineering. I graduated in May 2024 with my Bachelor of Science in mechanical engineering with a minor in drawing. Outside of school I enjoy spending time with my family and dog, crocheting, and playing computer games.

Abstract:
My thesis is about developing the effects of hydrogen embrittlement utilizing an autoclave system and using non-destructive evaluation methods to understand the change in the materials behavior and cracking behavior. The purpose of this research is to accelerate the commercial viability of hydrogen, its storage, and fuel cell technology.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

Andrew Frankowski



Master's 1, Mechanical Engineering
Advisor(s): Kwek Tze Tan

Performance of Complex Geometry Composite Hydrogen Storage Tanks Using Additive Manufacturing and Machine Learning Algorithms

Biography: Andrew Frankowski is pursuing a Master's Degree in Mechanical Engineering at the University of Akron. He graduated from the University of Akron in Spring 2024 with a Bachelor's in Mechanical Engineering. During his undergraduate degree he began doing research in The Nourhani Research Laboratory in the field of microfluidics and bio-inspired nanorobots. During this time, he co-authored a journal paper that was published in *Physics Review E*. Andrew then began to work in the Advanced Metacomposites Laboratory where he began to focus his research on the recyclability of additively manufactured composites. Andrew continues his sustainability-focused research with additional research on additively manufactured composite hydrogen pressure vessels for use in hydrogen fuel cell vehicles.

Abstract: Recent advances in hydrogen fuel cell technology have allowed hydrogen powered air vehicles to become a reality. One of the remaining challenges for such vehicles is the space efficient storage of liquid hydrogen onboard these air vehicles. This research aims to take advantage of the complex geometry capabilities of Additive Manufacturing to create more space efficient liquid hydrogen tanks than the current cylindrical tanks. Taking inspiration from current airplanes, we find that the fuel for the aircraft is stored within the wing structure. This raises the question; can a hydrogen tank be designed to conform to the complex shape of an airfoil? Furthermore, how would such a tank respond to the combined loading of internal high-pressure forces and external forces experienced by the air vehicle?

Lockheed Martin recently developed an entirely composite hydrogen storage tank. This helped to influence the use of 3D Printed Carbon Fiber Reinforced Polymers (CFRP) to manufacture the tanks for this research. Using the CFRP will also aid in reducing the weight of the components of the aircraft while maintaining the high strength requirements for such an application. It may also be possible to include structural geometry to support the wing structure as part of the design of the hydrogen tanks. This would allow for dual purpose design of the tanks to function as both fuel storage and structural members. This research includes experimental burst testing of pressure vessels with non-circular cross sections, then replicating these experimental results using Finite Element Analysis. Finally, both of these datasets would be used to train a Machine Learning model to predict new hydrogen tank designs and to help to optimize specific design constraints.

Publications:
M. Nabil, A. Frankowski, A. Orosa, A. Fuller and A. Nourhani (2022). Modulating Drift Dynamics of Circle Swimmers by Periodic Potentials, ***Physics Review E***, **105**, 054610.

13^{th} Congressional District	OH Representative: Emilia Sykes

CLEVELAND STATE UNIVERSITY

Sophia Greene

Master's 1, Applied Physics
Advisor(s): Dr Thijs Heus

Ensemble LES Approach to Quantifying Radiative Effects on Stratocumulus Cloud Behavior Under Varying Atmospheric Conditions

Biography: My fascination with the natural world and the mechanisms that govern it started early, but my path to physics was unconventional. While my early education emphasized "Young Earth Creationism," I was also fortunate to receive training in philosophy, logic, and critical thinking. This created a conflict: the more I applied these tools, the more I felt a growing dissonance with the rejection of established scientific consensus on evolution, cosmology, and the age of the universe. This ultimately sparked a burning desire within me to seek truth through scientific inquiry. Inspired by figures like Richard Feynman and Sean Carroll, I turned to physics to understand the universe on a fundamental level, following the evidence wherever it leads and striving to live a life in harmony with reality.

Abstract: Marine stratocumulus clouds (MSc) play a significant role in the Earth's climate, yet their sensitivity to atmospheric conditions remains a subject of ongoing research. This work focuses on the often-overlooked radiative effects of water vapor on MSc formation, specifically investigating how the liquid water path (LWP) is influenced by changes in lower tropospheric stability (LTS) and free-tropospheric total water vapor (Δq_t). While previous studies have primarily focused on entrainment and mixing processes, the impact of increased free tropospheric water vapor on the longwave radiative flux into the cloud layer warrants further investigation.
To explore this, Large Eddy Simulations (LES) were run across a range of LTS and Δq_t values, utilizing DYCOMS-II flight data for initial conditions. The analysis centered on the relationship between LW-Flux at the cloud layer and LWP, as well as how LW-Flux is modulated by LTS and Δq_t. Results demonstrate that increased humidity in the free troposphere leads to enhanced downwelling long wave radiation, which warms the cloud layer. While not directly impacting total water content, this warming effect increases the saturation mixing ration within the cloud layer, leading to a (perhaps counterintuitive) decrease in LWP with an increase in free tropospheric moisture.

Publications: None yet.

11th Congressional District	OH Representative: Shontel Brown

CLEVELAND STATE UNIVERSITY

Emily Hyland

Master's 1, Environmental Science
Advisor(s): Dr. Brice Grunert

Using Imaging Spectroscopy to Assess Shifts in Phytoplankton Community Composition

Biography: My name is Emily Hyland, and I am a first-year master's student at Cleveland State University studying Environmental Science. I was born in Cleveland, Ohio, and my upbringing along the shores of Lake Erie ignited my fascination with water quality and algae. During my B.S. I was an undergraduate research assistant in Dr. Brice Grunert's Carbon and Optics lab at Cleveland State. Through this opportunity, I've developed many skills both in the field and lab environments, gaining proficiency in operating various optical instruments. Additionally, I gained substantial experience with QGIS and Python, particularly in analyzing satellite data. After this experience I knew continuing my research was the right path for me and now I get to assist with Dr. Grunert's NASA PACE Validation Science Team project.

Abstract: For years Chlorophyll has been the main water quality parameter in coastal aquatic systems. However, individual optical constituents like colored dissolved organic matter and phytoplankton absorption are more representative of specific stressors than chlorophyll is. Using bio-optical modeling, we can effectively represent the contributions of these parameters to satellite-observed reflectance. This helps us to assess our ability to observe these optical parameters in coastal waters and assess uncertainty in our observations. This research project will build off demonstrations of satellite retrievals of phytoplankton absorption and community composition in the Great Lakes. Using select satellite imagery (from PACE) paired with an open-source bio-optics Python package to compare individual biogeochemical components to typical water quality indices including chlorophyll and harmful algal bloom indicators. Using code and workflows established by Dr. Grunert and other scientists, I will examine the extent to which phytoplankton absorption and associated pigments are observable in remotely sensed reflectance. I will then use this information to look at how accurately we can assess compositional shifts in phytoplankton community composition in optically complex coastal waters like the Great Lakes.

Publications: None yet.

7th Congressional District	OH Representative: Max L. Miller

Henry Jacques

Master's 1, Mechanical Engineering
Advisor(s): Dr. Taber Wanstall

Quantitative Evaluation of Supercritical Fuel Injection for Rocket Applications via Rainbow Schlieren Deflectometry

Biography: Henry Jacques grew up in Cleveland, Ohio, and attended high school in the nearby suburb of Rocky River, graduating in 2020. He pursued his passion for engineering at the University of Dayton, earning a Bachelor's in Mechanical Engineering in 2024 with an Honors with Distinction diploma. Currently, he is enrolled in the university's graduate program in Mechanical Engineering and is set to graduate in May 2025. Throughout his academic journey, he gained extensive professional experience through three internships at GE Aerospace and one at the University of Dayton Research Institute. He has also been conducting combustion research under the guidance of Dr. Taber Wanstall, utilizing an advanced optical technique called Rainbow Schlieren Deflectometry. With a strong interest in next-generation propulsion systems, he is committed to driving innovations in aerospace technology after graduation.

Abstract: Advanced propulsion concepts, such as rotating detonating rocket engines (RDREs), encounter ongoing operational challenges due to the intricate nature of supercritical injection and mixing. Rocket engines function by injecting liquid and cryogenic propellants at exceptionally high pressures, often supercritical, where unconventional fuel-air mixing takes place. Within this regime, mixing transpires in a gas-like manner, yet with liquid-like density. Despite the critical role of accurate scalar mixing measurements, literature on this subject is scarce and lacks thorough characterization. Hence, for the next generation of rocket engines to be designed and optimized effectively, precise quantitative information on fuel-oxidizer mixing is imperative.

The objective of this project is to obtain quantitative mixing measurements in supersonic supercritical fuel injection scenarios employing rainbow schlieren deflectometry (RSD), a quantitative line-of-sight optical measurement technique. The project will be structured into four tasks: ideal gas with mixing (subsonic), ideal gas with mixing (supersonic), non-ideal gas without mixing (fluid A into fluid A), and non-ideal gas with mixing (fluid A into fluid B). The proposed tasks are arranged in increasing complexity with the end objective resulting in a methodology to acquire scalar mixing measurements in realistic high-pressure fuel injection systems. Quantitative mixing measurements serve a vital role in validating computational models, shedding light on fundamental physics, and establishing a framework for future applications in novel propulsion systems.

Publications: None yet.

7th Congressional District	OH Representative: Max L. Miller

CLEVELAND STATE UNIVERSITY

Joshua Langin

Master's 1, Mechanical Engineering
Advisor(s): Dr. Maryam Younessi

Modeling of Carbon Deposition in Thermo-catalytic Decomposition of Methane with Carbon Catalyst

Biography: Joshua Langin is a Mechanical Engineer and graduated with his Bachelor's degree from Cleveland State University in the Spring of 2024. He has 3 years of experience in Additive Manufacturing and is currently seeking his Master's in Mechanical Engineering through Cleveland State University. Josh enjoys his current job as Production Manager at rp+m which is an Additive Manufacturer in Avon Lake, Ohio.

Abstract: Hydrogen has become an important source of clean energy. One method of producing hydrogen is the decomposition of methane. The goal of this project is to investigate the deactivation of the carbon catalyst during the thermo-catalytic decomposition of methane as a result of soot deposition on the catalyst as a result of the decomposition reaction.

Chemkin, a part of the Ansys software package, will be used to model both the gas-phase and surface reactions of the decomposition reaction. The model will simulate the soot deposition throughout the reaction and account for the resulting catalyst deactivation. This model will be compared to existing literature for validation.

Publications: None yet.

5^{th} Congressional District	OH Representative: Robert Latta

The Ohio State University

Matthew Megazzini

Master’s 1, Aerospace Engineering
Advisor(s): Dr. Jesse Little

Investigation of Hypersonic 3D SBLI

Biography: Matthew Megazzini is a first-year master’s student pursuing a degree in Aerospace Engineering at The Ohio State University. In May 2024, Matthew graduated Summa Cum Laude from The University of Tennessee with a Bachelor’s degree in Aerospace Engineering. As an undergraduate, Matthew interned as a researcher at the University of Tennessee Space Institute, where he discovered his interest in high-speed experimental aerodynamics. Working as a research assistant on the Large Area Reflected Shock (LARS) tunnel at Ohio State has given Matthew hands-on experience as both an operator and engineer with the largest hypersonic wind tunnel at any U.S. university. Outside of his studies, Matthew enjoys playing hockey, running, and traveling.

Abstract: Shock/boundary layer interactions (SBLIs) are inevitable in hypersonic flight, and despite decades of research, there remain many open questions. The unsteady dynamics of these interactions reduce vehicle control authority and can lead to structural failure. The purpose of this study is to determine the influence of leading-edge sweep, which causes a three-dimensional incoming boundary layer, on the SBLI generated by a two-dimensional compression surface. The outcome of this research can be generalized to better understand hypersonic vehicle design and is most relevant to external flows associated with control surfaces. Experimental testing is being conducted in the 45-inch diameter Mach 6 LARS facility at The Ohio State University Aerospace Research Center.

Researchers have explored this type of SBLI for geometries with sharp leading edges and sweep angles less than 50° [1]. The objective of this study is to explore the influence of a high sweep angle (λ = 75°) and a blunt leading-edge (5 mm radius) on the SBLI caused by a compression surface at Mach 6. An understanding of the incoming 3D boundary layer is important for this SBLI investigation. Deem and Murphy developed a semi-empirical model to predict the Reynolds number at the point of peak pressure (a surrogate for the boundary layer transition location) over a flat plate that includes the effects of Mach number, unit Reynolds number, leading-edge sweep, leading-edge bluntness, and wall-to-adiabatic-wall temperature [2]. Based on their findings, an 18-inch centerline chord length was chosen for this study to position the peak Reynolds number near the midpoint of the wing’s half-span at a unit Reynolds number of 10 million per meter. This enables all three boundary layer states - laminar, transitional, and turbulent - to be visible across the span of the wing and for the locations of extreme pressure fluctuations and surface heating caused by the SBLI to be identified in the LARS facility.

Publications: None yet.

3rd Congressional District	OH Representative: Joyce Beatty

Dane Miller

Master's 1, Mechanical Engineering
Advisor(s): Dr. Mark Sidebottom

Evaluation of Polyimide Materials Synthesized Through Multiple Chemical Pathways

Biography: Dane Miller is a final year master's student in the Mechanical and Manufacturing Engineering Department at Miami University. He obtained his bachelor's degree in mechanical engineering at Miami University in May 2024. He is currently completing his master's degree in mechanical engineering and works in the Material Tribology Lab under Dr. Mark Sidebottom. His interests include material science, behavior, and tribology.

Abstract: Polyimide (PI) materials are known for having excellent thermal, mechanical, and electrical properties. They are often used in high temperature operations that require robust wear resistance. Most literature focusing on the mechanical properties of PI materials create them through thermal imidization of polyamic acid. When the polyamic acid is thermally imidized, water is evaporated. This process can cause pinhole and void defects. Another process to creating PI is through a polyisoimide pathway. This process creates PI through chemical imidization and can be dissolved, applied, and cured. This process eliminates the evaporation of water, therefore avoiding the pinhole and void defects. PI made through both processes will be investigated using surface characterization and tribological testing. Improvement in the materials properties through this new manufacturing process could increase the application of polyimide materials in many different industries.

Publications: None yet.

2nd Congressional District	OH Representative: Brad Wenstrup

THE OHIO STATE UNIVERSITY

Caleb Morton

PhD 2, Aerospace Engineering
Advisor(s): Dr. Jack J. McNamara

Modeling Turbulence Using Generative AI with a Multi-Scale Latent Space

Biography: Caleb Morton is a current second-year PhD student pursuing a degree in Aerospace Engineering at The Ohio State University. In May 2023, Caleb graduated *cum laude* from Ohio State with a Bachelor's degree in Aerospace Engineering. Caleb's research experience started in Summer 2022, looking into non-intrusively deriving stiffness matrices for unknown Finite Element Models under his current advisor, Dr. McNamara. This laid the path for him to pursue graduate level research, and introduced him to numerical optimization methods and consequently, machine learning. Outside of his studies, Caleb enjoys playing video games and lounging with his two cats, Max and Pascal.

Abstract: While a decade old, several challenges identified in the NASA-funded CFD Vision 2030 study still remain. We target one such challenge: rapid knowledge extraction and generalization from large computational fluid dynamics (CFD) datasets of highly resolved turbulent flow behavior. Traditional, successful, data-driven models rely upon low-dimensional, broadly-scoped training data. However, CFD data on turbulent flows are inherently high-dimensional and narrowly scoped, presenting a challenge for traditional data-driven models. To address this challenge, this research aims to develop a transformative data-driven modeling framework for high Reynolds number turbulent flows using generative artificial intelligence (AI) and multi-scale latent space representations.

Data-informed Local Subspaces (DLS) show promise as a low-dimensional representation, i.e., *latent space*, due to its use of interpolation functions from the Generalized Finite Element Method (GFEM), which are designed to simultaneously capture large- and small-scale behavior. In addition, the DLS representation can be learned using only one time solution. Thus, large reductions in the dimensionality of CFD data, as well as achieving even larger reductions in the data necessary to generate a latent space. For synthesizing the underlying physics in the DLS latent space, Transformer neural networks are promising for complex spatio-temporal datasets. This is due to their great success in Large Language Models, where they demonstrate the capability to scale up to massive data sets of training data for complex tasks by synthesizing knowledge for text generation. Combining these methods, we hope to create successful, data-driven models of practical scale problems.

Publications: None yet.

3rd Congressional District	OH Representative: Joyce Beatty

Justin Murray

Master's 1, Computer Science

Convolutional Deep Learning for Atmospheric Visibility Estimation in Aviation

Biography: Justin is a second-year master's student studying computer science at Ohio University. He obtained his Bachelor of Science in computer science from Ohio University in May 2023. Justin began his current research project in May 2022 as a research assistant for Prof. Chad Mourning. His research interests include machine learning and interactive computer graphics with a focus on weather and avionics. He plans to pursue a PhD in electrical engineering and computer science starting 2025.

Abstract: This project aims to create a convolutional deep learning model that can accurately determine atmospheric visibility from a photograph for the purposes of aviation, particularly Advanced Air Mobility (AAM). AAM includes the operation of low altitude aircraft over and between urban areas. Visibility in this case is defined as the maximum distance at which a prominent object can be identified. Currently, most Automated Weather Observing Systems (AWOS) use forward scatter sensors to measure visibility. These devices are large and can cost thousands of dollars. For AAM, visibility must be known across a large area, and deploying many of these sensors for that purpose would be unreasonably expensive. A deep learning model could potentially be deployed on low-cost devices forming a distributed network, or on smartphones for on-site visibility estimation. Such devices have limited compute and memory, and my previous research focused on evaluating existing models and modifying them for use in such a constrained environment. This research builds on that by now focusing on improving the accuracy of the model and comparing it against current standards, such as those recently published by the ASTM, so that it may be used to inform safe aircraft operation. This is being done through modification of model architecture, data augmentation, and the collection of additional training data with visibility information from existing AWOS stations.

Publications: None yet.

6th Congressional District	OH Representative: Michael Rulli

THE OHIO STATE UNIVERSITY

Tammy Nguyen-Huynh

Master's 2, Aerospace Engineering
Advisor(s): Randall M. Mathison

Development of a Flexible Optimization System for Next Generation Turbine Cooling Passages

Biography: Tammy Nguyen-Huynh is a second-year master's student in Aerospace Engineering at The Ohio State University (OSU), where she is a graduate research assistant in the Gas Turbine Laboratory working under Dr. Randall Mathison. Her research interest is in design optimization of turbine blade cooling hole passages. Tammy is also a Pathways Intern in the Turbomachinery and Turboelectric Systems Branch at NASA Glenn Research Center, contributing to centrifugal compressor aerodynamics and performance research. She is currently involved with ASME Turbo Expo 2025 as a student liaison for the Heat Transfer technical committee. Prior to pursuing turbomachinery research, she was an intern in the Integrated GN&C Analysis Branch at NASA Johnson Space Center and worked as an undergraduate research assistant at OSU's Center for Design and Manufacturing Excellence. Tammy holds a BS in Aerospace Engineering with Honors Research Distinction from The Ohio State University and an AS from Cuyahoga Community College.

Abstract: In gas turbine engines, cooling flows sourced from the compressor are used to help turbine stages withstand the high temperatures of gases exiting the combustor. However, this negatively impacts the thermal efficiency of an engine as the energy stored in these flows in the form of a pressure rise is lost through turbine cooling processes. An adjoint method built into STAR-CCM+ is used to optimize a baseline turbine cooling passage for minimized pressure loss and maximized heat transfer. The baseline geometry to be improved upon is a simple u-bend passage with no turbulators, based upon the heat transfer model in NASA's HOST experiment. An experimental component to this research serves to validate the geometry's computational model and to evaluate the performance of the optimized geometry. To achieve this, the baseline, then optimized geometries are additively manufactured and assessed using a heat transfer rig. Adjoint methods allow for freeform deformation of the optimized geometry, taking advantage of advanced fabrication methods such as additive manufacturing. Studying the capabilities of this tool will help turbomachinery designers better understand an additional method to improve the thermal efficiency of gas turbine engines, thus contributing to the effort of reducing aircraft fuel emissions.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

MIAMI UNIVERSITY

Joseph Reindl

Master's 1, Mechanical Engineering
Advisor(s): Dr. Luigi Giancarlo Corti

In situ carbonization of PEEK-Lignin composites for Carbon/Carbon composite production

Biography: Joseph "Joey" Reindl is a graduate student pursuing his M.S. in mechanical engineering at Miami University in Oxford, Ohio. Originally from Hilton Head Island, South Carolina, Joseph graduated from Miami University with his B.S. in mechanical engineering and minors in electrical engineering and English rhetoric and writing in May of 2024 and expects to graduate with his M.S. in mechanical engineering in May of 2025. Joseph is interested in polymer engineering, semiconductors, and additive manufacturing.

Abstract: A carbon reinforced Polyetheretherketone (PEEK) composite was made by in situ pyrolization of organic material during melt processing without the presence of oxygen in an extruder as a precursor polymer for Carbon/Carbon (C/C) production. The effects of rice husk (RH) and lignin (L) concentrations on the processability and residual carbon content (RCC) are studied. The effects of processing temperature and time at temperature on RCC are investigated. The thermogravimetric results show that when kept slightly above melt processing temperatures for 15-22 hours, PEEK-RH and PEEK-L composites are capable of leaving 75%-83% of their original weight as carbon. This could be used in addition to the addition of bulk carbon black or carbon fiber to make C/C composites that retain upwards of 90% of their mass after carbonization. Differential scanning calorimetry tests show that the level of degradation of the pre-carbonized material increases as the extrusion temperature increases. Further experiments will include tensile loading, dynamic mechanical analysis, and an assessment of manufacturing applications.

Publications: None yet.

8th Congressional District	OH Representative: Warren Davidson

Collin Schofield

Master's 1, Mechatronics Engineering
Advisor(s): Dr. Syed Shihab

Minimizing the Risk Probability and Impact of UAV-Aerial Wildlife Strikes

Biography: Collin Schofield is a first year Masters student at Kent State University. Prior to college, he completed many Project-Lead-The-Way engineering courses at Bellbrook High School, along with numerous math and computer science courses. Collin was also an active member of Boy Scouts of America throughout High School; he completed a week-long leadership training course and earned the Eagle Scout award. Through all these courses and activities, Collin gained an immense passion in STEM, and knew he wanted to pursue a career where he could regularly use a combination of all these skills. Upon discovery of the Mechatronics Engineering program at Kent State, Collin knew it would be a perfect career path for him. In the spring of 2023, Collin began doing research with Dr. Shihab's Green and Advanced Mobility Engineering (GAME) lab, with which he later participated in the Summer Undergraduate Research Experience (SURE) program. Collin completed his Bachelor of Science in Mechatronics Engineering Technology at Kent State University in May 2024, then continued on to work on his master's the following fall at the same institution. After completing his master's degree, Collin plans to either pursue a Doctorate of Mechatronics Engineering or begin work in Research and Development as a Mechatronics Engineer.

Abstract: Collisions between birds and aircraft have been a safety-critical problem since the dawn of aviation. This issue is especially prevalent at low altitudes, which is where electric Vertical Take-Off and Landing (eVTOL) aircraft and Unmanned Aerial Vehicles (UAVs) are anticipated to spend most to all their flight time. These aircraft also are generally much quieter than traditional fixed-wing aircraft, further increasing the likelihood of bird strikes. Building upon a previous OSGC Project work (Strategic and Tactical Deconfliction between Birds and Aircraft), the objective of this project encompasses adapting and upgrading our algorithms to deconflict eVTOLs/UAVs and aerial wildlife (birds and bats) such that the risk probability and impact of aerial wildlife strikes with these low altitude aircraft is mitigated.

eVTOLs and UAVs are distinct from traditional fixed-wing aircraft in their flight paths and dynamics, as their takeoffs and landings are directly vertical rather than horizontal or angled. Additionally, their flight dynamics are very different; they are much more agile and capable of hovering and completing much more complicated maneuvers than would be possible on a traditional aircraft. Without the ability to glide to a safe landing, these aircraft need to be much more risk averse around aerial wildlife. These factors must be considered in planning adjusted flight paths for these vehicles. Additionally, if time permits, the project will involve the creation of strategies and maneuver algorithms that, if there are no feasible maneuvers to avoid a collision, will work to minimize the risk of the impact to both the wildlife and the UAV, and to anything or anyone that may be below the location of the impact. This will include maneuvers such as slowing down the speed of the UAV to reduce the kinetic energy of the impact, adjusting the orientation and altitude of the UAV to prevent the bird (or bat) from being hit directly by the propellers. To be able to effectively control the location of the impact, we will also need to upgrade our bird prediction algorithm to account for the altitude of the birds, rather than just latitude and longitudinal position.

Publications: Elaheh Sabziyan Varnousfaderani, Syed Arbab Mohd Shihab and Collin Schofield. "Safe to Takeoff: Strategic Deconfliction with Bird Flight Track Predictions to Prevent Bird Strikes With Aircraft," AIAA 2024-4083. *AIAA AVIATION FORUM AND ASCEND 2024*. July 2024. https://doi.org/10.2514/6.2024-4083.

14th Congressional District	OH Representative: David Joyce

Lukas Seggi

Master's 1, Mechanical Engineering
Advisor(s): Dr. Manigandan Kannan

Titanium Turbine Blade Repair and Enhancement through Hybrid Direct Energy Deposition (DED) Additive Manufacturing

Biography: Lukas Seggi is a first year Mechanical Engineer in the University of Akron's Masters Graduate Research Program. Born in Erie, PA, he graduated Summa Cum Laude from the University of Akron in May of 2024 with a bachelor's degree in Aerospace Systems Engineering with a minor in Business Essentials for Engineers. His research under Dr. Manigandan Kannan currently focuses on materials in the aerospace field, specifically with a focus on additive manufacturing, recycled materials, and material processes. He is an avid supporter of 3D printing and hopes to work in the aerospace field after finishing his degree.

Abstract: The focus of this research is to utilize Direct Energy Deposition (DED) Additive Manufacturing as a mechanism to repair and enhance the performance of Titanium 6AL-4V turbine blades. Damaged blades are reconstructed through DED AM and are enhanced through an Air Force Research Laboratory vibration suppression technology – Inherent Damping via Additive Manufacturing Processes (i-DAMP) – where voids are strategically generated within the blade geometry and filled with metal superalloy powder during the DED printing process. These filled voids act as a dampener for blade performance and significantly decrease vibrational output, therefore increasing overall part life. This project is researched in partnership between the University of Akron, Hyphen Innovations, the Ohio Aerospace Institute, and the Defense Logistics Agency (DLA).

Publications: None yet.

13th Congressional District	OH Representative: Emilia Sykes

Andrew Sharkey

Master's 2, Applied Mathematics
Advisor: Dr. Xiaoyu Zheng

Optimization Model of a Regenerative Fuel Cell System

Biography: Andrew Sharkey is a 2nd year Applied Mathematics Master of Science Student at Kent State University. His academic interests include Mathematical Modeling, Differential Equations, and Numerical Methods. Outside of work and school his interests include board games, video games, puzzles, and camping.

Abstract: This research project aims to create a mathematical model of a Regenerative Fuel Cell (RFC) system and utilize this model to optimize several objectives, primarily the overall specific energy, by reducing total system mass while increasing output energy. The RFC system necessitates a multidimensional model that incorporates multiple independent, co-dependent, and variably dependent variables. This model will specifically focus on the behavior of the fuel cell and electrolyzer to meet these optimization goals. Conducting a parameter sensitivity study on the mathematical model will help identify the most significant parameters and variables influencing the system's behavior.

Publications: None yet.

7th Congressional District	OH Representative: Max L. Miller

Isaac Sluder

Ph.D. Student, Mechanical Engineering
Advisor(s): Dr. Kwek Tze Tan

Extreme Environmental Effects on 3D Printed Composites for Space Applications

Biography: Isaac Sluder is a dedicated researcher with a strong background in mechanical and materials engineering. He is currently pursuing a Ph.D. at the University of Akron where his research focuses on the environmental effects on 3D-printed polymers, particularly under varying conditions of humidity, temperature, and pressure. Isaac's work is aimed at advancing the understanding of polymeric composites for space applications and other high-performance environments. Before his doctoral studies, Isaac earned his bachelor's degree in mechanical engineering from the University of Akron. During his time there, he completed a senior capstone project on recycling 3D-printed carbon fiber-reinforced polymeric composites under the mentorship of Dr. Kwek Tze Tan. Isaac's work is driven by a passion for interdisciplinary collaboration, bringing together material and computer science to address real-world challenges. Beyond academics, Isaac enjoys running and perfecting his espresso-making skills. His goal is to work as a leading researcher in a national laboratory or an innovative manufacturing company, contributing to material performance enhancements and environmental sustainability.

Abstract: This project aims to evaluate the environmental effects on 3d printed polymers. The relationship between humidity, temperature and pressure on 3d printed composite parts can be difficult to determine due to the number of flaws that 3d printing usually presents in the materials such as voids in layers, rough surface finish, and material inconsistencies. This project will utilize state of the art 3d printers to manufacture our specimens, an environmental chamber to simulate atmospheric changes, a custom mass monitoring system to continuously measure the weight of our specimens, and traditional mechanical testing devices such as Instron's popular universal testing machines. Many different materials will be selected to test for example Nylon 6 (Onyx from Markforged) and Nylon 12 (Paht-CF from Bambu Labs) which both contain chopped carbon fibers. These materials represent the current trends in the manufacturing world for baseline 3d printed materials. This project will attempt to improve mechanical performance predictions for 3d printed parts by creating machine learning models with the intent on understanding these complex relationships more clearly. The final deliverable aims to be analytical models that accurately predict the performance of 3d printed polymers in any atmospheric environment.

Publications: None yet.

13th Congressional District	OH Representative: Emilia Sykes

UNIVERSITY OF Cincinnati

Nate Steffen

Master's 1, Aerospace Engineering
Advisor(s): Kelly Cohen

Explainable AI for Safety-Critical In-Orbit Proximity Operations

Biography: Nathan is a first-year master's student at the University of Cincinnati studying Aerospace Engineering. His research primarily focuses on the use of responsible and trustworthy AI in space applications. Along with his research at the University of Cincinnati, he is a Pathways Intern at NASA Glenn Research Center where he works in the Mission Architecture and Analysis branch. His most recent work for NASA is concerned with the optimization of low-thrust orbit transfers in cislunar space using automatic derivatives in Q-Law, a Lyapunov based controller. Upon graduation, Nathan intends on continuing his education in pursuit of his PhD so that he can continue studying AI in aerospace systems and ensuring that it is implemented responsibly.

Abstract: As more satellites are placed into orbit, it becomes necessary to utilize autonomous systems to perform routine maintenance and handle debris. Such procedures are deemed safety-critical, so it is important that the methods used in automation are efficient, trustworthy, and transparent. Artificial intelligence (AI) and machine learning (ML) are popular methods to optimize performance in these routines, but they often fall short in safety verification and explainability. AI/ML methods rely on extensive training data, so when a scenario is encountered that the model was not trained for, the controls produced can be unpredictable thus adding risk to the system. Additionally, many AI/ML methods are black boxes, so the logic for why an output is produced is not clear and can cause issues for humans interfacing with the system.

To ease safety concerns, a technique called run time assurance (RTA) is often implemented with AI/ML. This method monitors the controls from some primary controller, and if those controls cause the system to violate some constraint, a safety controller is used instead. For transparency in the AI model, a white box AI system such as genetic fuzzy systems can be utilized. Unlike neural networks and other black box AI, genetic fuzzy systems rely on rules being fired to produce controls. This means that the logic for those controls can be traced with ease allowing for transparency without having to sacrifice performance.

The goal of this research is to apply genetic fuzzy AI to a two degree of freedom robotic manipulator that would be used for in-orbit proximity operations like maintenance and debris handling. Specifically, genetic fuzzy AI is combined with the linear quadratic regulator control law to ensure time and control effort optimality at every timestep. This technique will have its performance compared to an optimal LQR controller, its explainability will be investigated, and its reliance on RTA will be analyzed. This work aims to provide a framework for more genetic fuzzy-based AI controllers to be developed with RTA so that the overall safety of autonomous systems in space can be ensured while maintaining performance.

Publications: None yet.

1st Congressional District	OH Representative: Greg Landsman

KENT STATE UNIVERSITY

Carter Verderico

Master's 1, Aerospace Engineering
Advisor(s): Dr. Stephanie Fussell

Identifying the Relationship Between Photophobia and Simulator Sickness through Blue Light Exposure in VR

Biography: My name is Carter Verderico, and I'm from Cuyahoga Falls, Ohio. I graduated from Walsh Jesuit High School and Kent State University (KSU) with a Bachelor of Science in Aeronautical Systems Engineering Technology, Currently, I'm pursuing a master's degree in Aerospace Engineering at KSU. I was an active Civil Air Patrol cadet for four years and a proud member of the KSU High-Powered Rocket Team. I have been working as an Engineering Intern at Kennametal since August, 2022. After completing my master's degree, I will continue with the company as an Associate in their EMERGE Program.

Abstract: The objective of this research is to investigate the impact of different display modes in a Virtual Reality (VR) headset and conclude if the modes contribute to simulator sickness (sometimes called cybersickness). This study compares VR systems as they impact/interact with user design principles, desired KSAs (knowledge, skills, and abilities), learning outcomes, and actual user experience. The project focuses on different display modes, involving the user fully immersed in VR. The participant will complete procedural tasks using three different display modes (light settings) to understand if the different amounts of light emitted from the headset impact symptoms of photophobia and simulator sickness.

Publications: None yet.

13th Congressional District	OH Representative: Emilia Sykes

Austin Wilson

Master's 1, Computer Engineering
Advisor(s): Dr. Alexis Block

Optimizing Mental Health Support for Astronauts: Wearable Devices and AI Interventions

Biography: Austin Wilson is a first-year Computer Engineering Master's thesis student at Case Western Reserve University (CWRU), specializing in Human-Robot Interaction (HRI). As a member of the SaPHaRI (Social and Physical Human-Robot Interaction) Lab, his research focuses on advancing social robotics, alternative interaction methods, and psychological support systems for long-duration space missions. Austin received his B.S. in Computer Science in 2022, also from CWRU. Wilson's passion for research began during his undergraduate studies when he developed RNA sequence analysis tools and a COVID-19 public health tracker used by the Cleveland Department of Public Health. During and beyond his undergraduate studies, Austin held key engineering roles at two technology startups, one of which successfully exited in 2023. At Structured Monitoring Products, he led a team to build the software behind VetGuardian, a remote veterinary monitoring system, by integrating cloud-first architecture with remote sensing capabilities. At Renalis Health, he led a team to develop CeCe, a digital therapeutic chatbot for pelvic health. In 2017, Austin was named an Amazon Alexa Champion and worked with Amazon to create the Amazon Alexa Certification exam that same year. In Austin's spare time, he is earning his private pilot's license and works on several other startup projects. Through his academic, professional, and personal pursuits, Austin aims to develop technologies that enhance astronaut resilience by contributing to HRI and human space exploration.

Abstract: As NASA prepares for human missions to Mars and beyond, astronauts will face psychological challenges surpassing those encountered on previous missions. Proposed Mars missions introduce temporal isolation due to one-way communication delays ranging from three to 22 minutes, creating significant barriers to real-time technical and psychological support from mission control. AstroPsych (Austin's thesis work) is a multimodal framework designed to address such issues by delivering dynamic mental health support in environments where traditional resources are limited or unavailable. By integrating fine-tuned large language models with asynchronous guidance from remote caregivers and real-time analysis of physiological signals, AstroPsych provides on-demand support tailored to the evolving needs of individuals in crises. It offers multiple interaction options (e.g., text, voice, avatar, and robotic interfaces) to accommodate user preferences effectively.

While AstroPsych is designed to address the unique challenges of deep-space exploration, its applications extend far beyond space missions, offering transformative potential for mental health care on Earth. The United States is experiencing a mental health crisis, where wait times for new patient therapy appointments can be up to six to eight months. In regions where access to mental health professionals is limited due to geographic, economic, systemic, or real/perceived social barriers, AstroPsych can serve as a vital resource. Its ability to provide adaptive, on-demand support during acute need ensures that individuals receive timely intervention, even without traditional care. The AstroPsych framework can also be leveraged in high-stress environments such as military deployments, remote scientific expeditions, and disaster response scenarios, where immediate mental health support is often unavailable. AstroPsych reduces the need for real-time human intervention and bridges critical gaps in mental health care by providing consistent, personalized support anytime, until individuals can connect with a mental health professional.

Publications: None yet.

11th Congressional District	OH Representative: Shontel Brown

THE OHIO STATE UNIVERSITY

Abhilash Yarlagadda

Master's 2, Aerospace Engineering
Advisor(s): Dr. Mo Samimy, Dr. Nathan Webb

High-Frequency Active Flow Control of Heated Supersonic Rectangular Twin Jets

Biography: Abhi Yarlagadda is currently a second-year master's student with the Gas Dynamics and Turbulence Laboratory at The Ohio State University. He majored in aerospace engineering as an undergraduate and began working under Drs. Mo Samimy and Nathan Webb before senior year, transitioning to graduate school with the same group. The lab's focus is entirely experimental and involves the application of plasma-based active flow control to various jet geometries, which concerns topics in supersonic flow physics and acoustics. He intends to pursue a position in industry after graduation, ideally in a research or design role with ties to fluid dynamics, propulsion, or spacecraft in some form. Outside of school, Abhi is an avid musician who plays multiple instruments, writing and recording songs on his own, and he enjoys movies, books, and cooking as well.

Abstract: While twin jet configurations offer many benefits for aircraft, these arrangements also result in elevated jet noise as a result. In supersonic jets, the high-amplitude tonal component of this noise is called screech, and its negative effects range from health issues in personnel who are exposed to it to structural damage to the aircraft itself. Screech is a phenomenon caused by a feedback loop between structures shed at the nozzle exit and the waves produced by the interactions of these structures with the shock train of the jet. When two jets are placed very close to each other, the screech feedback loops can couple and elevate the jet noise further. To mitigate this, passive or active flow control devices can be used. Active flow control (AFC) is desirable because it can be adapted to different flight conditions (as opposed to passive control), and the localized arc-filament plasma actuators (LAFPAs) used by our group allow us to effectively control the flow to study its physics and the various factors that affect the generation of jet noise.

Previous work in our lab has explored relatively low-frequency control in low aspect ratio rectangular twin jets at a total temperature ratio (TTR) of 1 (i.e., room temperature) and at a TTR of 2, which is closer to temperatures in application. We have done preliminary work using high-frequency control with the twin jet geometry, and we recently took a step back to see how the results of high-frequency control in a single rectangular jet could inform future testing of the twin jet. The upcoming results will concern a more detailed examination of the effects of high-frequency LAFPA control on the twin rectangular jet over a range of Mach numbers at TTRs of 1 and 2, and we will observe what impact the LAFPAs have on noise generation and suppression in the near- and far-field of the jet.

Publications:

Yarlagadda, A., Hiler, N., Katterle, K., Webb, N., and Samimy, M., "Active Control of Near-Field Acoustics in Overexpanded Supersonic Rectangular Twin Jets: Effects of Number of Actuators," *30th AIAA/CEAS Aeroacoustics Conference (2024)*, American Institute of Aeronautics and Astronautics, 2024. https://doi.org/10.2514/6.2024-3149

Samimy, M., Katterle, K., Leahy, R., Webb, N., **Yarlagadda, A.**, and Hiler, N., "Active Control of Flow and Near-Field Pressure Fluctuations in Heated Supersonic Rectangular Twin Jets," *Journal of Fluid Mechanics*, Vol. 984, 2024, p. A36. https://doi.org/10.1017/jfm.2024.222

Katterle, K., **Yarlagadda, A.**, Webb, N. J., and Samimy, M., "Active Control of Heated Supersonic Rectangular Twin Jets," *AIAA SciTech 2024 Forum*, American Institute of Aeronautics and Astronautics, 2024. https://doi.org/10.2514/6.2024-2307

Leahy, R. P., Katterle, K., **Yarlagadda, A.**, Webb, N. J., and Samimy, M., "Screech and Coupling in Heated Supersonic Rectangular Twin Jets - Active Control," *AIAA Aviation 2023 Forum*, American Institute of Aeronautics and Astronautics, 2023. https://doi.org/10.2514/6.2023-4486

3rd Congressional District	OH Representative: Joyce Beatty

Scholars

Margo Abrams

Junior; Computer Science
Advisor(s): Nkorni Katte

Bidirectional Reflectance Distribution Function

Biography: I am Margo Abrams, a proud native of Cincinnati, Ohio. I am a determined Computer Science major at Wilberforce University, set to graduate in May 2026. Growing up as an only child, I was raised by my supportive mother and two loving grandparents, who instilled in me a strong sense of family and ambition. Beyond my academic pursuits, I enjoy shopping, learning, traveling, sports, and exploring new cuisines. My aspirations include earning both a Bachelor's and Master's degree in Computer Science and eventually becoming a Chief Information Officer at a company. My motivation to make these aspirations into reality is my desire to care for and love my family as they have for me.

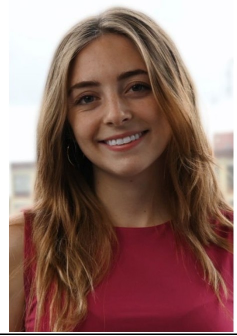
Abstract: The Bidirectional Reflectance Distribution Function (BRDF) is a fundamental concept in computer graphics and optical engineering, describing how light is reflected on an opaque surface. This mathematical model defines the relationship between the incoming light direction, the outgoing reflected light direction, and the surface's reflectance properties four-dimensionally. Widely used in computer graphics, remote sensing, and optics, BRDF models enable realistic rendering of materials by capturing their unique light interaction behaviors, such as diffuse reflection, specular highlights, and anisotropic effects. A realistic representation of surface appearance is essential in applications such as visual effects, material science, and environmental monitoring, which can only be achieved by understanding and applying BRDFs accurately.

Publications: None yet.

8th Congressional District	OH Representative: Warren Davidson

CLEVELAND STATE UNIVERSITY

Chloe Amoroso



Senior, Mechanical Engineering
Advisor(s): Dr. Maryam Younessi Sinaki

Optimization and Exertion Analysis of the Strayton Cycle for Air Mobility

Biography: I am a senior mechanical engineering student at Cleveland State University, driven by a passion for aerospace and environmental sustainability. Growing up, engineering wasn't even on my radar - I didn't know what an engineer was! Instead, my creative side flourished, leading me to devote much of my time to music and art, where I learned to transform ideas into tangible, meaningful creations. It wasn't until two years into my undergraduate journey as an arts major that I discovered I could channel the same creativity and problem-solving into science and math. That realization changed everything. Today, I lead a campus club focused on inspiring young women to discover their own passions in STEM, and I am developing a conference paper to contribute to the advancement of new, sustainable technologies. Looking ahead, I plan to pursue graduate studies and ultimately earn a PhD, furthering my goal of making a significant impact in engineering and beyond. The Ohio Space Grant Consortium has been instrumental in this journey, providing invaluable opportunities to conduct research and turn ambitious dreams into reality.

Abstract: Air mobility plays a critical role in modern society by enabling the rapid and efficient transportation of people and goods over long and short distances. It provides access to remote areas, supports emergency services, and aids disaster relief efforts, solidifying its position as an essential component of public safety and security. In urban areas, air mobility, known as Urban Air Mobility (UAM), facilitates the movement of goods and people, addressing growing transportation demands. As technological advancements and the increasing need for sustainable travel drive the evolution of air mobility, new opportunities for economic growth and innovation emerge. While traditional air mobility systems rely on batteries or fuel cells, the Strayton Cycle, developed by NASA's Glenn Research Center, offers a transformative alternative. Combining elements of the Brayton cycle, commonly employed in aircraft, and the Stirling engine, utilized here as a recuperator, the Strayton Cycle represents a novel approach to propulsion. This cycle is designed to eliminate emissions, supporting the global transition to green fuel and advancing the goal of achieving zero environmental impact. This study investigates the application of the Strayton Cycle in urban air mobility systems for public transportation, with a focus on optimizing propulsion system performance. A numerical model will be developed using MATLAB and the RefProp database to simulate the Strayton Cycle and evaluate its operating parameters. The analysis will leverage first and second law thermodynamics to optimize efficiency and performance, contributing to the advancement of sustainable air mobility technologies.

Publications: None yet.

11th Congressional District	OH Representative: Shontel Brown

WRIGHT STATE UNIVERSITY

Rachael Ballentine

Senior, Mechanical Engineering
Advisor(s): Dr. Michael Raymer

Exploration of Data Science and Machine Learning Techniques for Wildfire Prediction

Biography: Rachael Ballentine is a senior at Wright State University, majoring in Mechanical Engineering with a minor in Computer Science. She grew up in Beavercreek, Ohio and was a College Credit Plus scholar while in high school, eventually graduating from Sinclair Community College with an Associate of Science. During her time at Wright State, she has been a student ambassador for the College of Engineering and Computer Science, an officer for WSU's chapter of Engineers Without Borders, and a member of the Society of Women Engineers. She served as the Treasurer for the Ohio Mu chapter of Tau Beta Pi during the 2023-2024 school year and is now honored to be the President for 2024-2025. During the first two years of her undergraduate degree, Rachael discovered a passion for computer science. She has enjoyed investigating this interest through her minor and her senior OSGC scholarship project, and intends to further her education by pursuing a master's degree in computer science after she graduates with her undergraduate degree in the spring of 2025.

Abstract: Wildfires are defined as unplanned and uncontrolled fires that occur in areas with combustible materials. According to the National Interagency Fire Center, there were over 50,000 wildfires across the US in 2023 alone, affecting almost 3 million acres of land. Ignition and spread of these fires depend on a number of factors, including seasonal weather conditions, available fuel, topography, and proximity to populated areas. Prediction and management of wildfires is a complex but critical problem, as the wildfire crisis continues to develop in conjunction with the rise of global temperature and greenhouse emissions. In this project, data science and machine learning techniques will be applied to a prediction problem in this field. A range of methods will be applied to an identified data set, from exploratory data analysis and interpretive techniques to more complex approaches like neural networks.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

CLEVELAND STATE UNIVERSITY

Michael Borovich

Senior, Mechanical Engineering
Advisor(s): Dr. Liqun Ning

Developing Methods for Testing the Electrical Conductivity of Hydrogel/Conductive Nanoparticle Composites and Subsequent Electrical Stimulation Studies

Biography: Michael Borovich grew up in Olmsted Falls, Ohio, where he graduated from Olmsted Falls High School. Fascinated by problem-solving and understanding the world around him, Michael developed a strong interest in engineering while growing up. This passion was solidified during his participation in all four years of Polaris Career Center's Project Lead the Way high school engineering program. He gained valuable hands-on experience during his time as an engineering intern at a cold forging plant specializing in tapered pipe plugs and as an undergraduate research assistant in a biomedical engineering lab specializing in tissue engineering. Currently, Michael is in his senior year of undergraduate studies in mechanical engineering at Cleveland State University. His involvement in CSU's 4+1 program allows him to start earning credits towards a master's degree as an undergraduate, which he will pursue after completing his bachelor's degree.

Abstract: Peripheral nerve injuries (PNIs) affect millions and can have severe impacts on an individual's quality of life. Current treatment options for large-gap PNIs are limited by donor availability and donor site morbidity, leading to interest in the development of nerve guidance conduits (NGCs). NGCs are fabricated using biomaterials with specific properties which allow the body to bridge larger nerve gaps than it otherwise could without intervention. In PNI applications, NGCs should be flexible with high tensile strength, permeability, and electrical conductivity. Electrical conductivity is of particular relevance for PNI treatments due to nervous tissue operating based on electrical potential differences. Thus, electrically conductive NGCs would allow for increased regenerative capabilities through exogenous electrical stimulation (ES) or endogenous electrical signaling.

This work focuses on two critical aspects in the development of electrically conductive NGCs. The first goal of this work is to develop a simple, cost-effective process for easily measuring the bulk electrical conductivity of hydrogel/conductive nanoparticle composites is developed, specifically focusing on gelatin methacrylate (GelMA) with single-walled carbon nanotubes (SWCNTs). This protocol ultimately consists of sandwiching a sample (of known dimensions) between two flat electrodes which connect to a high resistance ohmmeter. The screen readout of the ohmmeter is recorded for the duration of a trial, then the video is processed using custom python script which outputs a resistance versus time plot. This plot reveals an average resistance value, which in combination with the known dimensions of the sample, is used to calculate the material's bulk electrical conductivity. Knowing this value is critical during the following portion of this study.

The second goal of this work focuses on developing a simple, cost-effective electrical stimulation apparatus to study the effects of ES on human umbilical vein endothelial cells (HUVEC), which will be seeded on GelMA-SWCNT composite samples. In addition to the emphasis on simplicity and cost-effectiveness, this solution must be non-cytotoxic, able to withstand sterilization procedures, and allow for easy access to the cells. The proposed solution consists of two graphite electrodes held in a custom 3D printed pedestal fixed inside a petri dish. A cell-seeded sample is placed between the two electrodes. Spring-loaded, gold-plated contacts, secured through the petri dish lid, contact the graphite electrodes from the top. An electric field (EF) is then applied across the sample by connecting a voltage source to the contacts. This configuration allows for easy removal of the contacts, thereby providing direct access to the cells. Additionally, it avoids the need for holes in the dish, which could leak cell culture media. This system will be used in various experiments to quantify ES's effects on HUVEC growth, proliferation, and alignment due to an applied EF, which will offer critical insights for advancing NGC development.

Publications: None yet.

7^{th} Congressional District	OH Representative: Max Miller

Abigail Boyer

Junior, Mechanical Engineering
Advisor(s): Dr. Rydge B. Mulford, PhD

Design and Testing of a CubeSat Radiator Prototype

Biography: Abigail is a third-year mechanical engineering student at the University of Dayton. Abigail is a born-and-raised Dayton local who graduated from Miamisburg High School in 2022 at 16 years old. She has had the opportunity to work under the mentorship of her favorite professor, Dr. Rydge Mulford, since February of 2024 doing research assistance. Abbey is also an active member of the Society of Women Engineers (SWE), Catholic Life, and TA's for Statics I. Abigail volunteers at the National Airforce Museum in her free time, usually helping with children's day camps and activities. She spent the summer of 2024 pursuing her current research through her school's Summer Undergraduate Research Education (SURE) program and wishes to follow her passion for aerospace engineering after college. She is considering pursuing a higher education to specialize in aerospace engineering and hopes to work at Wright Patterson Air Force Base one day.

Abstract: As part of the NASA CubeSat Launch Initiative, this research consists of designing and testing a CubeSat satellite prototype. Primarily used for research purposes, a CubeSat is a cuboidal nanosatellite with side dimensions of 10 centimeters. Due to the harsh space environment, the CubeSat experiences rapid temperature fluctuations, leaving it susceptible to damage. As a result, only about 50% of current CubeSats complete their mission. Unfortunately, the current technology used to modulate temperature on typical spacecraft is too sizeable to be applied to a CubeSat. Therefore, the objective of this research within the NASA CubeSat Launch Initiative is to design an effective system to maintain the operating temperature of the CubeSat radiator.

As part of the current CubeSat design, a system of fins, coated with phase change material (PCM), has been created to actuate outwards when heat disperses from inside the radio. The fins are coated with phase change material (PCM). Phase change materials are exceptionally effective for their ability to store thermal energy and will remove heat from the CubeSat when its fins are exposed to the environment. We were able to achieve at least 45 degrees of actuation through the use of nickel-titanium wires. Nickel-titanium is a shape memory alloy, meaning it can be manipulated into any desired shape or form and can revert to its original form when heated. Within the CubeSat application, the heat applied to the nitinol wire drives the PCM-coated fin outward. We developed our plaster molds in the lab and used kilns to train the wires reaching temperatures over 800 degrees Celsius. We were able to test our prototype within a vacuum chamber using electrical feed-throughs, thermocouples, and polyamide heaters to see if our fin would actuate under conditions most similar to those of an actual CubeSat.

As verified through laboratory testing, the nitinol wire can be geometrically manipulated and then returned to its original configuration following exposure to heat. Additionally, the nitinol was strong enough to actuate the fins when excessive heat was applied. To conclude, the phase change material opens up endless opportunities for innovation within satellites and spacecraft innovations, supporting the actuation and movement of complex technology without the traditional equipment.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

MIAMI UNIVERSITY

Megan Brockway

Senior, Mechanical Engineering
Advisor(s): Dr. Mark Sidebottom

PFA-PEEK Polymer Blends: Candidate Material for Improved Friction and Wear at Extreme Temperatures

Biography: Megan Brockway is a 4th year student at Miami University studying Mechanical Engineering, with a minor in Humanitarian Engineering and Computing. She will graduate in May 2025, and will look to join the workforce after graduation. She started work in the Materials Tribology lab at Miami University in August of 2022, working under Dr. Mark Sidebottom. She has also worked for Miami's Wilks Institute as a Leadership Development Fellow, working to create leadership programing for students, especially surrounding Gallup's Clifton Strengths. She worked for GE Aerospace in the Summer of 2023 with the facilities team and for FedEx in the Summer of 2024 with the Field Engineering Support Team.

Abstract: The primary research aim of this project is to develop a unique blend of melt-processible (i.e. 3D printable, extrudable, injection moldable) polymer blends of perfluoroalkoxy polymer (PFA) and polyaryletherketone (PAEK) to minimize wear and friction of sliding interfaces. PFA is a fluoropolymer that has low friction and a large temperature range (-200° C to 260 °C). PAEK, in the form of polyetheretherketone (PEEK), has high mechanical strength (90-100 MPa) and a large operating temperature range (-70° C to 250 °C). Another form of PAEK, polyetherketoneketone (PEKK), has 105 MPa of tensile strength and can operate at up to 150°C. PFA- PAEK blends have the potential to be some of the most wear-resistant of any polymer-based system with a lifetime of 10-100x longer than most commercially available composite systems while reducing energy consumed during friction. Additionally, their ease of processing over existing composite systems would make them attractive for aerospace applications.
A series of PFA-PAEK blends using different volumetric percentages to create variety of microstructures (e.g. PAEK matrix with PFA filler and PFA matrix with PAEK filler) in partnership with another institution.

Once the blends have been processed, they will be manufactured using Fused Filament Fabrication and tested for mechanical, thermal, and frictional properties using tensile loading, differential scanning calorimetry/thermogravimetric analysis, and flat-on-flat wear experiments. These experiments will quantify the performance metrics of the material such as its frictional properties, expected lifetime, strength, and thermal limits.

Publications: None yet.

8th Congressional District	OH Representative: Warren Davidson

THE OHIO STATE UNIVERSITY

Alyssa Brucchieri

Junior, Aerospace Engineering

Advisor(s): Dr. Mo Samimy

Active Flow Control with Plasma Actuators in Supersonic Rectangular Jets

Biography: I am currently a third-year Aerospace Engineering student at The Ohio State University. Alongside my coursework, I serve as an undergraduate research assistant in the Gas Dynamics and Turbulence Lab at the Aerospace Research Center, where I am actively involved in the development of plasma actuators for next-generation flow control systems. This research has sparked a deep interest in the potential of active flow control technologies to revolutionize aerodynamic performance and efficiency within the aerospace industry. Looking ahead, I plan to continue my academic journey by pursuing a Master's degree at OSU, where I aim to further explore fluid dynamics in aerospace applications. I am excited to contribute to the field and leverage my knowledge and experiences to make a meaningful impact on the aerospace industry.

Abstract: Jets and shear layers have been extensively studied due to their broad range of applications, particularly in noise generation. Early research demonstrated that jet shear layers are unstable to perturbations over a range of frequencies, due to the Kelvin-Helmholtz instability. The growth of perturbations leads to the formation of coherent structures (CS). These structures are a primary source of jet noise, both directly and indirectly, as confirmed by experimental studies. The instability in the jet shear layer, which forms between the core jet flow (exhausting the nozzle) and the surrounding air, is referred to as the shear layer mode (SLM). The frequency at which the instability is most amplified is tied to the shear layer's momentum thickness and the jet velocity at the nozzle exit. Another significant frequency, associated with the jet column mode (JCM), corresponds to the passage of CS around the jet's potential core.

While early studies used loudspeakers to excite instabilities in incompressible, low Reynolds number flows, our group has demonstrated the use of Localized Arc Filament Plasma Actuators (LAFPAs) to generate thermal perturbations that control high-speed, high Reynolds number flows. In supersonic jets, interactions between CS and shock cells lead to broadband shock-associated noise (BBSAN). BBSAN travels in all directions, including the upstream direction toward the nozzle. When the BBSAN reaching the nozzle lip and CS generation are phase-matched, a self-sustained feedback loop can produce screech, a high-amplitude tonal noise within the JCM. In rectangular jets, azimuthal modes at the screech frequency organize CS in the top and bottom shear layers, typically forming a single antisymmetric "flapping" mode.

As an undergraduate research assistant in the Gas Dynamics and Turbulence Lab at the Ohio State University Aerospace Research Center, I contribute to improving experimental efficiency and am preparing to take on more independent responsibilities in the future. I assist with setting up experiments, including configuring high-precision equipment such as cameras and lasers for flow visualization, microphone arrays for acoustic data collection, and preparing the nozzle and actuators. Working closely with graduate and Ph.D. students, I help troubleshoot challenges to support the success of complex experiments. Outside the lab, I advance data analysis by debugging and running MATLAB scripts to generate results, such as SPOD modes, wavelet phase and coherence plots, and overall sound pressure levels (OASPL). These analyses help interpret actuator performance and contribute to the lab's research goals.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

OHIO NORTHERN UNIVERSITY

Caleb Carlson

Senior, Mechanical Enginering
Advisor(s): Hui Shen

Development of a Device to Track Progression of Degradation and Evaluate Hand Mobility and Strength in Microgravity Environments

Biography: I am currently completing my last semester in undergrad at Ohio Northern University where I am pursuing a Bachelor of Science in Mechanical Engineering with a concentration in manufacturing. My previous professional experiences have been entirely in the transportation and defense industries where I started as a technician and metal fabricator working in auto-collision, from where I moved to interning as a machinist in the marine industry, and then working for the rubber industry as a plant engineer for the last three years. Following graduation, I will be practicing as an engineer in the defense industry. I have spent time doing my own undocumented research and development building motorcycles and small tractors for hobby purposes. This project marks my first endeavor in academic research, biomedical engineering, and integrating sensors into real-world products.

Abstract: This study focuses on the development of a glove equipped with flexible sensors (extended length strain gauges) and pressure sensors to monitor the mobility and strength of the human hand, specifically for tracking hand function degradation in microgravity environments. The glove utilizes a network of the flexible sensors to assess hand mobility by measuring the degree of deflection between joints during movements, while the integrated pressure sensor allows for a pinch-test to evaluate grip strength. This wearable device aims to provide real-time data on the effects of prolonged exposure to microgravity on hand function, enabling early detection of motor and strength impairments. The goal is to enhance astronaut health and performance during long-duration space missions with the potential for this device to be further developed for use in the medical industry.

Publications: None yet.

4th Congressional District	OH Representative: Jim Jordan

Andreas Chaffey

Senior, Mechanical Engineering
Advisor(s): Timothy L. Norman

Stiffness of 3D Printed Titanium Structures

Biography:
My name is Andreas Chaffey, and I am a Junior Mechanical Engineer studying at Cedarville University. I was born in the Bay Area of California but moved to Charlotte, North Carolina when I was about eight. My dad grew up in the Bay Area, while my mom grew up abroad in South/Central America and Africa. I've always been building things, taking things apart, and figuring out how they work for as long as I can remember. My dad has worked in construction his whole life, so I learned how to use tools and basic building concepts at a young age. I have designed and built many different things in my free time, and I'm always thinking of how to make something new. This carried over in my studying Mechanical Engineering and seeking to better understand how various machines and their components are made. I hope to one day bring these skills to bear on whichever field I end up in, whether that be Aerospace, Automotive, or Defense.

Abstract:
Three-dimensional (3D) printing has become common among manufacturers of small complex parts. More recently high-performance metals like Titanium are being used. However, the effects of 3D printing on mechanical behavior are not well understood. In particular, as-printed surfaces can have irregular rough topography resulting in high roughness (Ra) compared to traditionally manufactured parts. Of particular concern is notches, where stress concentrations for conventional manufacturing are well understood. This project will investigate the mechanical behavior of 3D Printed titanium. We hope to answer the questions "how does the printing process alter the notch sensitivity" and "how do current methods (e.g. hipping) to mitigate effects of printing influence the mechanical properties." Material characterization will include strength, hardness, and stiffness. Analysis will include testing and failure characterization using photomicrographs.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

CLEVELAND STATE UNIVERSITY

Lisa Chambers

Junior, Chemical Engineering
Advisor(s): Dr. Chelsea Monty-Bromer

Nanocomposite Fabric Lactate Sensor

Biography: I am a junior majoring in chemical engineering at Cleveland State University. I have been working in research, focusing on the development of biomedical devices since my freshman year and would like to pursue a career in nanomaterials research. I am also the president of CSU's chapter of the American Institute of Chemical Engineers, and I am passionate about fostering student involvement in the competitions and other events we participate in.

Abstract: This work focuses on the development of a wearable fabric sensor using novel nanocomposite materials. Currently, there is no established method for noninvasive and continuous monitoring of lactate levels during exercise. This sensor will facilitate the gathering and analysis of sweat biomarkers, specifically lactate, furnishing insights into human health and performance monitoring. Lactate was selected as the analyte of interest to measure exertion of the participant, and the material to be developed will provide real-time health assessment and performance optimization. Lactate has significance in causing cramping, fatigue, and diminished performance in athletes due to anaerobic glucose metabolism. To fabricate such a sensor, an electrospun nylon fabric is treated via vacuum filtration with a solution. The solution utilizes carboxylic acid functionalized multi-walled carbon nanotubes (MWCNTs) that are dispersed in water with a surfactant using a probe sonicator. These lactate sensing materials were characterized via SEM and FTIR to determine the morphology of the nanocomposite sensor material. The sensor's active layer is then synthesized by electropolymerization using pyrrole, lactate oxidase, and a second aqueous dispersion of carboxylic acid functionalized MWCNTs. Characterization of MWCNT dispersion quality and particle size utilized UV-vis spectroscopy and Zetasizer analysis. Electrochemical properties were evaluated through cyclic voltammetry of the sensor's response to synthetic sweat solutions containing lactate. Further testing involved analyzing sensor responses to spiked and synthetic sweat solutions containing common biomarkers within sweat such as glucose, potassium, calcium, and sodium. Initial benchtop tests have confirmed the sensor's ability to detect physiologically relevant levels of sweat lactate. The nanocomposite sensors are to be validated thoroughly via an IRB-approved on-body lab testing, which will provide feedback to the design to be used for further development. Participants will cycle for 60 minutes and sweat samples will be collected with sterile gauze adhered to the skin using Tegaderm. We aim to test 30 subjects for validation of the wearable fabric sensor. After testing, the gauze is centrifuged and analyzed for the lactate concentration using the gold standard laboratory technique, HPLC.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

Gabe Colbrunn

Junior, Mechatronics Engineering
Advisor(s): Dr. Liu

Development of a Quadruped Robot Prototype as a Guide Dog for the Visually Impaired

Biography: Gabe Colbrunn is a junior undergraduate at Kent State University studying mechatronics engineering with a minor in computer science. He grew up in northeast Ohio and has been interested and involved in robotics nearly his whole life. Gabe joined the Cognitive Robotics and AI lab at Kent State in 2022 to continue this passion in a research environment. Outside of school, he enjoys volunteering and playing intramural sports.

Abstract: The visually impaired face significant mobility challenges, and traditional guide dogs, while effective, involve high costs, extensive training, and ongoing maintenance. This project aims to develop a quadruped robot prototype that functions as a guide dog, incorporating AI tools, sensors, and a handheld device for human-robot interaction. The project will focus on the user experience of a robotic guide dog as navigation technology has already been developed. The robot utilizes OpenAI's GPT APIs and onboard sensors for real-time communication and intelligent navigation. Image analysis capabilities are integrated using AI-driven tools, leveraging pre-trained models to enable environmental perception without the need for expensive hardware. A handheld device is designed to enhance the user experience, featuring vibration alerts for obstacle detection and ergonomic controls inspired by VR controllers. A control system utilizing an attached multi-axis load cell will be developed with the device for user adaptive guidance.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

Emma J. Core

Junior, Civil Engineering
Advisor(s): Matthew Franchetti

Green Energy Storage Utilizing High Pressure Air Storage Vessels

Biography: Emma Core is a Junior at the University of Toledo, majoring in Civil Engineering. She is currently serving her second year as Treasurer of the American Society of Civil Engineers (ASCE) Student Chapter. While studying engineering, Emma also works part-time in the Learning Enhancement (Tutoring) Center and part-time as a Civil Engineering Teaching Assistant. Additionally, she has spent the last 2 summers working for an Engineering Consulting Firm that practices in the areas of: Civil Engineering; Agricultural Engineering; Land Surveying; Structural Engineering; Building Design; Geotechnical Engineering; and Construction Materials Testing and Inspection.

Abstract: Having grown up in a family of engineers on a farm in northwest Ohio, I have witnessed the needless consumption of productive farmland for the development of wind and solar fields. While most people understand the need for a migration away from fossil fuels and thus toward green sustainable energy, we must find a way to utilize land that is already out of production to harvest green energy and save the farmland for food production. A constantly increasing world population completely depends on that premise, but inherent reliability problems exist with this type of green energy when the sun is not shining and/or the wind is not blowing. Additionally, current strategies require large scale concentrations of wind turbines and/or solar panels to access the electric grid for distribution, which puts farmland at risk. I believe this problem can be solved with the development of a much smaller scale clean dependable energy storage system that is replicable. Such a system would allow the energy to be consumed in the area where it is generated and not at the expense of farmland needed for food production. This type of system lends itself to the use of highway medians, parking lots, yards, buildings, and the like for the production and storage of green energy.

One such system could consist of small to medium scale energy storage systems consisting of electric powered air compressors to convert green energy into compressed air and store it in high pressure vessels in the area where it is generated. Pneumatic generators can then convert the compressed air back into electricity when needed and thus create a constant, clean, sustainable green energy source. This project consists of the research and engineering calculations needed to analyze available underutilized real estate for the production of green energy and determine the feasibility and scalability of utilizing high pressure air storage vessels for localized green energy storage and consumption.

Publications: None yet.

4th Congressional District	OH Representative: Jim Jordan

Kamryn Culp

Senior, Chemical Engineering
Advisor(s): Dr. Linxiao Chen

Sustainable Aviation Fuel Production from Plastic and Food Waste on Bifunctional Catalysts

Biography: Kamryn is graduating in the Spring of 2025 and plans to work as a process engineer at DuPont in Circleville, OH. She has co-oped for three manufacturing rotations in Buffalo, NY for Smucker's, Moncks Corner, SC for DuPont, and Circleville, OH for DuPont. In her free time, she helps raise and show pygmy goats on her family farm and enjoys snowboarding, hiking, and traveling.

Abstract: The research entails converting mixed plastic (polypropylene, polyethylene, and polyvinyl chloride) and food waste (fatty acids and esters) to sustainable aviation fuels (C_5-C_{14}) through catalytic hydrocracking with earth-abundant bifunction catalysts. Non-degradable plastic waste causes severe environmental threats. Currently the most effective way to manage plastic waste is incineration, which leads to CO_2 emission as well as wasted carbon and energy resources. Food waste represents a major abundant bio-based unutilized carbon source. Thus, plastic and food waste are an ideal feedstock for carbon-neutral sustainable aviation fuels, which also fulfills the demand for its challenging management.

Catalytic hydrotreating is a suitable process for co-upgrading plastic and food waste into aviation fuels. The main chain cleavage reaction, hydrocracking, is particularly selective towards hydrocarbons in the desired C_5-C_{14} range, and the hydrodeoxygenation reaction can reduce oxygen contents and improve fuel quality. The project will use noble-metal-free Ni/Al_2O_3 and Ni/TiO_2 catalysts with low cost and environmental footprint. The oxide component is expected to extract chlorine from polyvinyl chloride, which creates strong Brønsted acid sites that facilitate the conversion, while alleviating the commonly reported poisoning of metal species by chlorine. The specific tasks include the synthesis and basic characterization of Ni/Al_2O_3 and Ni/TiO_2 catalysts, conducting the reaction with various mixed plastic and food waste feedstock in a batch reactor, and analyzing the product distribution and reaction kinetics.

Publications: None yet.

13th Congressional District	OH Representative: Emilia Sykes

CENTRAL STATE UNIVERSITY

Dylan Damiano

Junior, Computer Science & Mathematics
Advisor(s): Dr. Augustus Morris

Sensor Deployment with Drone and Receiving Sensor Metrics w/ Low-Cost Parts

Biography: Dylan Damiano is a student from Dayton, Ohio attending Central State University (Wilberforce, OH) studying both Computer Science and Mathematics. He has had a long-term passion relating to Software Development and Computer Programming. With his interests, he often likes to take his skills and apply them to various other fields along with other disciplines. He also prefers to and deeply enjoys using his skills to assist others and to further streamline processes into simpler components.

Abstract: The goal of this proposal is to design a drone and a remote sensor using low-cost parts that will communicate across a radio network (433 MHz was chosen for this project). The drone will be designed using Adafruit's QtPy (a smaller-form-factor version of the Raspberry Pi Pico W), with additional on-board modules including a barometer, gyrometer, Arducam's monochromatic camera, 433 MHz radio module, 4x ESCs, 4x brushless motors, and a magnetometer. The remote sensor will contain a Raspberry Pi Pico W, utilizing a barometer, air quality sensor, and a 433 MHz radio module. The 433 MHz radio module will have a localized web interface, sending signals via the Pico's internal Wi-Fi hotspot, enabling commands or telemetry to be sent from a local host to the remote device. The localized web interface will display additional telemetry from the remote sensor relayed across the network whenever the drone is airborne.

Upon the conclusion of this project, there will be an open-source library on GitHub, allowing others to utilize these low-cost drone solutions and integrate them with other open-source projects. All code will be written and published in Python for ease of use and readability.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

Jeremiah Daubon

Senior, Manufacturing Engineering
Advisor(s): Dr. Augustus Morris

Maximizing Solar Capture: Comparison Between Fixed and Tracking Systems

Biography: My name is Jeremiah Daubon. I am a first-generation college student from Chicago, Illinois, pursuing a Bachelor's degree in Manufacturing Engineering with a minor in Sustainable Agriculture, set to graduate in May 2025. My passion for problem-solving and innovation has driven my senior design project, where I am comparing the performance of fixed solar panels and solar tracking systems by building functional prototypes using advanced materials like ASA for 3D-printed components. Beyond academics, I am actively preparing for a career in manufacturing and operations, having previous internship experience in both supply chain and advanced manufacturing. With a strong foundation in engineering and a commitment to sustainability, I aim to contribute innovative solutions to the field of manufacturing.

Abstract: This project explores the efficiency, performance, and cost implications of fixed solar systems versus single-axis tracking systems, focusing on the vertical-axis tracking design that moves east-to-west to optimize energy capture. By comparing these two solar technologies, the project aims to determine which system provides better energy output, storage, and long-term viability. Through rigorous data collection and testing in real-world conditions, including varying weather and geographical factors, this study evaluates the effectiveness of both systems. The research incorporates a multidisciplinary approach, combining mechanical design, electrical engineering, and programming, using Arduino components to control the tracking system's servos and sensors. In addition, the project assesses the cost-effectiveness, societal impact, and environmental benefits of these systems, emphasizing their potential to reduce reliance on fossil fuels and contribute to global sustainability goals. The findings are expected to provide valuable insights into optimizing solar energy solutions, enhancing accessibility, and promoting energy independence, while offering guidance for future renewable energy projects. The use of 3D printing for manufacturing components further reduces costs and supports sustainable practices, ensuring that solar technology is both economically feasible and environmentally responsible.

Publications: None yet.

12th Congressional District	OH Representative: Troy Balderson

WRIGHT STATE UNIVERSITY

Lincoln DeHaven

Senior, Mechanical Engineering
Advisor(s): Dr. James Menart

The Energy Produced by an ICE Class 1 Wind Turbine

Biography: Hello, my name is Lincoln DeHaven, and I am a senior at Wright State University where I am studying mechanical engineering. During my studies at university, I have become very passionate about how energy works in a system along with how fluids flow. Due to these interests I decided to take a class on Wind Power, this class went into all aspects of wind turbine design from how the fluid flows over the airfoil of the rotor to the type of generator. I decided to apply for the Undergraduate STEM Scholarship, this allows me to study aspects of what we have wanted to know more information about. The scholarship has allowed me to investigate the aspects of the energy produced by a wind turbine compared to the raw energy in the wind. I picked to investigate as aspect of renewable energy rather than something related to fluid flow directly because my class schedule for my senior is more based in fluids than it is based in energy.

Abstract: In 2008 AWS Truewind was tasked by the National Renewable Energy Laboratory (NREL) to develop a set of wind resource and plant output data if an area were to require up to 30% retail electric energy to be from the wind. With this goal that the NREL had tasked the question can be raised why wind energy? Wind energy is important to the use of clean and renewable energy in the future as it is an abundant resource as it comes from uneven heating of Earth by the Sun. The energy collected from the wind has a physical limit called the Betz Limit, this limit is 59.26%. This limit can be used to view how much energy we could harness from the wind when using a wind actuator. This is not incredibly useful when trying to predict how much energy an actual wind turbine would produce. To predict how much energy an actual wind turbine would produce the power curve for the wind turbine is used. This power curve allows for predictions using the cut-in speed and the cut-out speed that the wind turbine must stay between. The power curve gives the power generated by the wind turbine at a particular speed. From this it can be determined how much energy is produced when compared to wind speed data of a site. This project uses annuitized wind speed data from Eaton Ohio and applies that to a ICE Class 1 wind turbine power curve that AWS Truewind made. This data from the turbine is being compared to 6 different cases that are caused by either changing aspects of the design of the wind turbine or from changing the properties of the wind. The height of the hub of the wind turbine was changed by multiplying by a factor of 1.5 and multiplying by a factor 0.5, doing the same to the standard deviation of the wind, along with adjusting the Weibull distribution. Each of the changes allows for different characteristics and values for the wind speed to be applied to the turbine so that it can be investigated how it acts depending upon the environment.

Publications: None yet.

1st Congressional District	OH Representative: Greg Landsman

Nicholas Doughman

Senior, Physics
Advisor(s): Andrew Layden

Analysis of Observations to find Period Change in RRL Variable Stars

Biography:
I am a senior physics student originally from Cleveland Ohio. During my high school years, I had garnered a particular interest in the fields of physics and astronomy, continuing to pursue my bachelor's in physics at Bowling Green State University after graduating from high school. My time at BGSU had seen me involved in general physics coursework, and undergraduate work & research in the fields of astronomy, solid state physics, and photovoltaics. Finishing up with my final year of my bachelor's and aiming toward pursuing a graduate physics degree soon, I've begun to endeavor more deeply into research work with the faculty at BGSU.

Abstract:
Globular clusters serve as invaluable laboratories for studying stellar evolution and astronomical separation, including via the observational analysis of variable stars such as RR Lyrae (RRL) stars. From the cluster NGC M107 28 observed RRL variables and their intrinsic periodicities had been observed, 4 of which had displayed novel irregularities to their periods suggesting infinitesimal period changes. These period changes, reported in the foundational study by Arellano Ferro et al., occur on scales of fractions of days per billion years. This project aims to refine and expand upon the original analysis by reprocessing raw CCD photometric data from the Arellano study and integrating additional time-series observations from contemporary datasets, including the Zwicky Transient Facility (ZTF), the All-Sky Automated Survey for Supernovae (ASAS-N), and the Bowling Green State University (BGSU) observatory, bringing the initial Ferro research up to date to the present day.
The refined data is used to generate observed-minus-calculated (O-C) diagrams, enabling a detailed examination of the stability of RRL periods over time. By comparing the behavior of the four known period-changing RRL stars with other RRL stars in M107, this study seeks to assess whether period variations are intrinsic to the evolutionary processes of these stars along the horizontal branch (HB) or arise from other physical phenomena. Possible mechanisms include noise introduced by internal mixing events within the stellar cores or rapid instability strip crossings by pre-zero-age horizontal branch (ZAHB) stars. These findings could provide deeper insight into the astrophysical processes governing RRL variability and contribute to our broader understanding of stellar structure and evolution.

Publications: None yet.

5th Congressional District	OH Representative: Robert Latta

BGSU

Katie Douglas

Year, Major: Junior, Physics Major
Advisor(s): Dr. Layden

How Periods of RR Lyrae Stars in M107 Have Changed

Biography: My name is Katie Douglas, I'm from Parma Ohio and I'm currently a Physics Major at Bowling Green State University and I minor in Astronomy. When I first started college, I was a Biology major, interested in things like animal preservation. However, once I took my first Astronomy class at Bowling Green, it inspired me to go down that path instead. Every class made me more curious about our world, how it all started, and what else might be out there. I decided to switch to being a Physics major so I could become an astronomer. At first, it was very daunting, but now I've grown to really enjoy Physics. My passion for Biology never faded as I started Astronomy and Physics. I then found that I could enjoy all those passions in one field, astrobiology. To achieve this, I've been continuing my Biology major at Bowling Green to become a double major in Physics and Biology. This way I get to study all my passions at once and explore my curiosities.

Abstract: In my astronomy research, I see how periods of RR Lyrae variable stars can change in the globular cluster, M107. A paper by A. Arellano Ferro et. all, published in 2018 showed how some variable stars in M107 have changing periods. Ferro collected data from 1935-1994 as well as 2015-2017, my research expands on this data. There are 24 RR Lyrae stars of interest in M107 that we continued to get data for from the Zwicky Transient Facility, (ZTF), a wide-field automated survey that consistently collects data, I focused on stars V13-V24. Using the known periods from Ferro, we used our code to find good fitting light curves for each separate year of collected data. With this, we added new data to previous O-C curves to see how the periods of different variable stars are changing. The shape of the curve depicts how the period may be changing over time. Some stars have an increasing period while others have a decreasing period, and most are stable stars that don't have a change in period. With accurate data over a long period of time, these period-changing stars can help us better understand horizontal-branch evolution models for variable stars.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

Robert “Max” Drexler

Junior, Mechanical Engineering
Advisor: Robert L. Lowe

An Investigation of the Electro-Mechanical Performance of a Novel Liquid-Metal-Embedded Self-Healing Elastomer

Biography: Robert “Max” Drexler is currently studying Mechanical Engineering with a concentration in Aerospace Engineering at the University of Dayton. His academic excellence has earned him membership in both the Tau Beta Pi Engineering Honor Society and the Pi Tau Sigma Mechanical Engineering Honor Society. Since the summer of 2022, Robert has worked as an undergraduate researcher in the Behavior of Advanced Materials and Structures (BAMS) Lab, under the guidance of Robert L. Lowe. His research mainly focuses on self-healing elastomers, examining their mechanical properties and potential applications.

Abstract: The development of **self-healing** elastomers (highly stretchable polymers capable of giant elongations before fracture) for **soft robotics** is occurring at an increasingly rapid pace due to the need for resilient materials that are capable of **autonomously repairing minor damage** without human intervention. Compared to conventional *rigid* robots, *soft* robots leverage compliant elastomeric materials to enable *safe interactions with humans* and *on-the-fly adaptability to different physical environments*. Recently, the development of self-healing elastomers that are also **3D printable** has paved the way for creating parts with complex geometries and fine features (such as cavities and overhangs) that could not be achieved with traditional polymer casting processes. Similar exciting developments have been unfolding in the field of **stretchable electronics**, an emerging area of research focused on creating *soft, stretchable, and thin electronic circuits* using elastomeric materials. When embedded in a soft robot, sensors and stretchable circuitry enable **soft robotic systems that can sense and react to their environments**. Current methods for producing stretchable electronics (e.g., rigid conductive inclusions like silver flake or nanorods embedded in a compliant elastomer matrix) yield conductive elastomer composites that struggle to maintain conductivity under high elongations or cyclic stresses, both necessary for soft robotic applications. Liquid metal inks represent a groundbreaking departure from this current paradigm. These inks show great promise for creating **highly strain-tolerant conductive traces** within insulative elastomeric materials *due to their capacity to withstand considerable amounts of strain (>700%) without a loss in conductivity*. Further, their liquid state at room temperature enables **inherent self-healing capabilities**. ***Combining 3D-printed autonomously self-healing elastomers with stretchable circuitry and sensing enabled by self-healing liquid metal ink networks presents a compelling opportunity for next-generation soft robotics with embedded resilient electronics.***

Publications:

Beckett, J. G., Thrasher, C. J., Michonski, J., Drexler, R. M., Babu, S., Cox, A. M., ... & Crouse, C. A. (2024). 3D-Printable Elastomers for Real-Time Autonomous Self-Healing in Soft Devices. *ACS Materials Letters*, *7*, 123-132.

10th Congressional District	OH Representative: Michael Turner

CWRU

Rahul Dulani

Junior, Mechanical Engineering
Advisor(s): Dr. Dr. Chirag Kharangate

Flow Visualization Studies in the Closed Loop Two-Phase Flow Chill-down Test Module for Future Space Experiments

Biography: Rahul Dulani grew up in Santa Barbara, California, before moving to Portland, Oregon, where he attended Sunset High School. During high school, he developed a strong interest in engineering through his involvement in robotics. Rahul is currently a junior at Case Western Reserve University, majoring in Mechanical Engineering with a minor in Electrical Engineering. At Case, he works in the Two-Phase Flow and Thermal Management Lab, contributing to research on flow visualization studies in the closed-loop two-phase flow chill-down test module. After completing his bachelor's degree, Rahul plans to pursue a Master's degree at Case Western Reserve University.

Abstract: Success of NASA's future space exploration missions is dependent on cryogenic fluid management systems being able to provide safe, effective, and reliable supply of cryogenic fluid to a variety of systems. A key technological challenge in this, as recognized by NASA, is the line chilldown and transfer process. For understanding chilldown process under microgravity, chilldown tests with a simulant fluid like normal perflourohexane (nPFH) can be conducted in the Flow Boiling and Condensation Experiments (FBCE) module currently available in the International Space Station (ISS). The focus of the present work is to develop and test a chilldown experimental setup under terrestrial conditions in a closed loop with PF-5060 as the working fluid.

In this project, the experimental study will focus on high-speed imaging of the different flow boiling regimes such as film, transition and nucleate boiling regimes during the chilldown of pyrex and quartz tubes. For this purpose, two experimental test rigs will be tested and data will be collected as, (i) Long pyrex test section winded with Nichrome wires for preheating and (ii) Short quartz tubes coated by transparent ITO heating layer for preheating. The flow regimes will be captured and correlated with the wall heat flux data to better understand and predict the transfer line chilldown process. The results from these ground-based flow visualization experiments are crucial to the development of the flow visualization test section for the future space station experiments.

Publications: None yet.

12^{th} Congressional District	OH Representative: Troy Balderson

Julie Dunlap

Neuroscience, Senior
Advisor(s): Dr. Clare Mathes

Quantitatively Analyzing Ethanol-Induced Neural Activity in Male compared to Female Rats

Biography: Julie Dunlap is a senior at Baldwin Wallace University pursuing a bachelor's degree in neuroscience. Julie is currently following the pre-med track required to apply for medical school. She grew up in North Canton, Ohio, and attended Hoover High School, where her interest in the medical field grew after taking a three-year set of biomedical science classes provided by Project Lead the Way. At Baldwin Wallace, she is a member of many clubs including Pre-Medical Society, the Interdisciplinary Neuroscience Society, and the Fellowship of Christian Athletes. She also plays Varsity Soccer, is a Choose Ohio First Stem Scholar Peer Mentor, and is the campus outreach chair of the Student Athlete Advisory Committee. Her research aims to investigate sex differences in neural activity induced by ethanol using a rat model.

Abstract: This study investigates sex differences in ethanol-induced neural activity in rats, with a focus on the lateral septum, a brain region within the limbic system. While previous studies have predominantly used male subjects, this research aims to address whether ethanol elicits distinct differences in neural activity patterns between males and females. On experiment day, males and female rats were administered either ethanol or saline injections. Two hours later, the rats were euthanized and perfused, and their brains were collected, sliced, and stained to visualize Fos protein, a marker of neural activity.

The current phase of the study emphasized quantitative analysis. Microscope images of the lateral septum from all experimental groups were captured and analyzed using ImageJ software to measure Fos expression levels. Statistical analyses are being conducted to determine whether significant sex differences exist in ethanol's impact on this region. These findings will enhance understanding of the neurobiological effects of ethanol and highlight potential sex-specific mechanisms in brain reward processing.

Publications: None yet.

13th Congressional District	OH Representative: Emilia Sykes

Mario Escobar

Junior, Neuroscience
Advisor(s): Dr. Clare Mathes

Establishing Methods for Visualizing Neuroinflammation: A Pilot Study

Biography: Mario Escobar is a first-generation Junior undergraduate Neuroscience student at Baldwin Wallace University from Cleveland, Ohio, with minors in Chemistry and Mathematics. Mario has previously completed an Associate of Science degree at Cuyahoga Community College and has had the valuable opportunity in conducting biomedical research at Cleveland State University through funding and collaboration with the National Institutes of Health. Throughout his academic endeavors at Baldwin Wallace University, Mario has been actively engaged in collaborative research with peers under the mentorship of Dr. Clare Mathes. After graduation, Mario plans to pursue a Ph.D. program in Neuroscience, with the goal of building a lifelong career in academia specializing in the field of neuroimmunology.

Abstract: The present goal of our study is to ensure the capability to visualize markers of neuroinflammation (NI) and to verify our ability to stain for key protein markers of neuroinflammation, IBA-1 and TNF-α, in the hippocampus. In this pilot study, male Sprague-Dawley rats were used to establish a protocol for inducing and visualizing NI. Rats were handled and weighed daily during a one-week acclimation period to minimize stress-induced variability. Rats were then anesthetized using 1-5% isoflurane prior to intraperitoneal injections of either lipopolysaccharide (LPS; 2 mg/kg body weight) to induce NI or saline for a vehicle control. 4 hours post-injection, the rats were euthanized by CO_2 asphyxiation, and brains were extracted and fixed with 4% paraformaldehyde. Histological processing of the brain tissue was done via sectioning and staining using immunofluorescence against IBA-1 and TNF-α to assess microglial morphology. While initial attempts at microglial staining have yet to produce successful results, ongoing efforts aim to optimize and refine this process through further exploration of established protocols in the literature. Quantitative analysis of microglial activation states will be performed using ImageJ once staining is successfully achieved through analysis of morphology.

This pilot study's potential findings aim to establish the reliability of our methods and pave the way for further investigation into the effects of simulated microgravity on NI. Specifically, future work will compare NI levels induced by the tail suspension model (T-HU) and pelvic hindlimb unloading model (P-HU). The T-HU model, while widely used, imposes spinal compression that may confound NI outcomes. In contrast, the P-HU model eliminates spinal compression, providing a refined analog of human microgravity. We hypothesize that NI markers will be significantly lower in the P-HU model due to the absence of spinal compression. This research aims to validate the P-HU model as an ethical and precise tool for ground-based microgravity studies, while enhancing our understanding of NI mechanisms.

Publications: None yet.

11th Congressional District	OH Representative: Shontel Brown

Love Faison

Senior, Biology
Advisor(s): Delbert R. Buffinger

An Investigation into the Synthesis of Novel Schiff Base Fullerene Complexes

Biography: Love Lee Faison is a full-time student at Wilberforce University. She is 22 years old from Cleveland, Ohio, and is currently a Senior, majoring in Biology. Not only is Ms. Love Faison an outstanding student, demonstrated by her Dean's List designation, but she is also community service oriented. She is a proud member of Alpha Kappa Alpha Sorority, Incorporated. Ms. Faison is a smart, talented, and creative young woman with high morale, eager to contribute to the percentage of African American women in STEM.

Abstract: A study on the creation of new Schiff base fullerene complex derivatives has attracted a lot of interest due to their many uses in organic photovoltaics and other fields. Research on materials based on fullerenes has broadened since 2015 to encompass organic thermoelectrics, molecular electronics, organic electrochemical transistors, and perovskite solar cells. This study uses a Schiff base reaction, which is well known for its effectiveness in producing complex organic compounds, to synthesize a new fullerene derivative. To verify its structure and characteristics, the synthesized molecule will be thoroughly characterized using methods including NMR, IR, and UV-Vis Spectroscopy in addition to elemental analysis. If time permits, chelation experiments with transition metal ions will be performed to explore the potential of these complexes in advanced material applications. This investigation aims to contribute to the growing body of knowledge on fullerene-based materials, emphasizing their potential in emerging technologies.

Publications: None yet.

11th Congressional District	OH Representative: Shontel Brown

Colin Fokine

Academic Level, Major
Advisor(s): Dr. Mitch Wolff

Custom Electrical Capacitance Tomography Sensor

Biography: Colin Fokine is a Junior at Wright State University studying Mechanical Engineering on the Thermo-Fluids Track. He is currently enrolled in the 4+1 Program, allowing him to take graduate classes early in anticipation of Graduate School. This last summer he worked as an Undergraduate Research Assistant at AFRL focusing on two-phase flow for thermal management systems. He plans to continue his education through Grad School after his graduation next fall.

Abstract: The desire for a non-proprietary Electrical Capacitance Tomography (ECT) sensor capable of measuring void fraction led to the research, design, construction, and testing of a sensor capable of non-invasively measuring the permittivity in two-phase flow systems. A drop in permittivity across a medium can be used to determine the void fraction. The sensor, built using quartz tubing and copper tape electrodes, used a Silicon Labs C8051F970 microcontroller for data acquisition. The microcontroller was programmed using Simplicity Studio, with results displayed in a terminal via a COM port. Initial calibration used iodized table salt to imitate a "full" and an "empty" reading by tilting the tube. The sensor design was validated through testing, proving its capability to measure changes in capacitance and distinguish between "full" and "empty" readings. This cost-effective, non-propriety sensor provides a solution for measuring permittivity and, eventually, void fraction. Future work will focus on integrating an LCR meter for increased sensitivity, applying the sensor in a two-phase flow system, and integrating it into LabVIEW for real-time measurements of void fractions.

Publications: None yet.

5th Congressional District	OH Representative: Robert Latta

University of Dayton

Michael Foster

Senior, Mechanical Engineering
Advisor: Dr. Sidaard Gunasekaran

Flight Test Validation of Tandem Propeller Performance with Vertical Offset

Biography: Michael Foster is a senior at the University of Dayton, pursuing a bachelor's degree in Mechanical Engineering with a minor in Aerospace Engineering. Throughout his college career, he has enhanced his studies by conducting research under Dr. Sidaard Gunasekaran, where he developed flight testing infrastructure and processes to validate wind tunnel studies of tandem propeller performance with flight test data. Additionally, he led the development of electronic propulsion and safety systems for the university's Solar Splash Team, while also serving as team treasurer. In this role, he helped enable the university's Solar Splash Team to compete on a global scale for the first time in five years. After graduation, he will be joining GE Aerospace as part of their Edison Engineering Development Program. The OSGC Scholarship has played a crucial role in supporting his research and providing the resources necessary for his success.

Abstract: Positioning the aft rotors of a multirotor above the plane of the fore rotors, relative to the freestream, can improve power consumption efficiency in edgewise flight. To validate the results of a previous wind tunnel study at the University of Dayton Low Speed Wind Tunnel (UD-LSWT) with flight tests, a custom-built multirotor was developed. The multirotor accommodated multiple vertical offset configurations of the aft rotors and utilized GPS to sustain altitude and velocity in edgewise flight, thereby ensuring repeatable flight paths. The mass of the multirotor was held constant throughout the tests to isolate the effects of vertical offset on performance. Flight tests were performed for multiple flight speed and vertical offset configurations under calm ambient conditions, as recorded by a custom-built anemometer and wind-direction sensor.

Flight test data confirmed the findings of the previous wind tunnel data, demonstrating a clear correlation between vertical offset of the rear rotors and improved power consumption efficiency. Specifically, at advance ratios between 0.15 and 0.45, a vertical offset of 20% of the propeller diameter led to more than a 15% reduction in power consumption as compared to the baseline configuration without offset. Additional increases in the vertical offset above 20% of the propeller diameter yielded only minimal further efficiency gains. These findings affirm the practicality of using vertical rotor offset to improve multirotor efficiency while maintaining a compact design.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

Kavanaugh Frank

Junior, Computer Science
Advisor(s): Chad Mourning

Reinforcing Airport Safety by Automating the Retrieval of Elevation Data for Flight Simulation Software

Biography: Kavanaugh Frank is currently a 3rd-year student at Ohio University studying Computer Science with a certificate in Business Cybersecurity Management. He started working as a research assistant in the Avionics Engineering Center in his second semester at Ohio University, under Dr. Mourning, writing a user documentation manual for the Ohio University Glideslope (OUGS) modeling software. After finishing the user manual, Kavanaugh began working on unit testing for OUGS. While working on unit testing, he was encouraged to apply for the OSGC scholarship to begin working on this project, which works to improve the usability and safety of OUGS.

Abstract: Safety is a critical priority for both airports and the aircraft that operate within them, and there is flight simulation software to help aid in these processes. Ohio University Glideslope Software (OUGS), which predicts glide slope system performance in non-uniform terrain, and Ohio University NAVAID Performance Prediction Model (OUNPPM), which simulates localizer, glide slope, and VHF omnidirectional ranging (VOR) system behavior. To support the performance and accuracy of these simulations, software has been developed to automate the retrieval and importation of elevation data from Digital Elevation Models (DEMs) hosted by the United States Geological Survey (USGS). The Terrain Extraction Automator (TEA) replaces the former manual process by the user to input with a maximum of 900 elevation data points, which slows the creation of simulations and introduces possible human error.

TEA compiles DEMs in the file format of Geo-Tagged Image File Format (GeoTIFF), which represents elevation data as a raster grid where each pixel's brightness depicts the elevation for that specific geographic point. A web-scraping script is utilized for this compilation process. Elevation data, specified by the use, is retrieved by an Application Programming Interface (API) via an HTTP call to the server that hosts the DEMs and associated programming logic. The API constructs a 3D array representing elevation data from the DEMs, based on the area defined by geodetic coordinates specified in the HTTP POST request. Applying the bilinear interpolation method to this 3D array of elevation data points, TEA shrinks the data to reduce the size while preserving the data's integrity. A conversion of the dataset from geodetic coordinates to Earth-Centered, Earth-Fixed (ECEF) location coordinates is performed to meet requirements of the simulation software and for consistent geospatial positioning. TEA's process for 9E4 data points takes 7.83 seconds and results in data 5.21 MB in size; the process for 2.25E4 data points takes 2.15 seconds and results in data 1.3 MB in size, with both datasets representing the same geographical area and maintaining comparable quality.

Publications: None yet.

12th Congressional District	OH Representative: Troy Balderson

THE OHIO STATE UNIVERSITY

Kyle Frith

Senior, Engineering Physics
Advisor(s): Dr. Jeffrey Bons

Electrostatic Effects on Turbine Deposition

Biography: Kyle is a senior in Engineering Physics at The Ohio State University with Aerospace Engineering as his chosen engineering discipline. Originally from Dayton, OH, Kyle grew up surrounded by Aviation landmarks and aspires to a career in aerospace. He has previously contributed to the Buckeye Space Launch Initiative as a member of the Liquid Engine project as a member of the ground systems engineering team. Upon graduation Kyle aims to pursue an M.S. in Aerospace Engineering with further research in turbine deposition.

Abstract: Gas turbine engines are at risk of ingesting sand and dust particles. Effects from ingested particles include erosion of compressor and fan blades, deposition on surfaces leading to reduced aerodynamic efficiency, and contamination of coolant flow which may result in blocked cooling holes. These effects reduce the life of a gas turbine and can cause components to fail without proper maintenance. It is also known that aircraft acquire electrostatic charge from frictional rubbing with the atmosphere. This project will examine how the acquired charge of an aircraft affects deposition on relevant gas turbine engine surfaces.

Publications: Frith, K. “Microstructure, Heat Treatment, and Applications of Inconel 718 in Aerospace.” NASA/Ohio Space Grant Consortium 2020-2021 Annual Student Research Symposium Proceedings XXVIII, 269-271, 2021

3rd Congressional District	OH Representative: Joyce Beatty

Gianni Gaetano

Junior, Aerospace Engineering
Advisor(s): Ou Ma

Testing Satellite Dynamics and Control Using Robotics Technology in the Lab Environment

Biography: I grew up in Youngstown, Ohio, where my love for building things and exploring the outdoors took root. During my years at Canfield High School, I spent countless hours playing baseball, hitting the ski slopes, and finding adventures wherever I could—activities I still make time for today, even with my busy schedule. My path to engineering really started with model rocket launches with my dad. There was something magical about building those model rockets and watching them soar into the sky. That experience, plus my endless fascination with the stars and mysteries of space, set me on the path to becoming the engineering student I am today. My time at the University of Cincinnati has been incredible, giving me the chance to turn my passion into real-world projects. I've had amazing opportunities to work in aerospace manufacturing and hypersonic research and development. But the real highlight has been achieving my dream of working with space technology, specifically diving into research on space robotics platforms.

Abstract: Space debris and defunct satellites pose increasing challenges for space operations, necessitating advanced robotic solutions for In-Space Servicing, Assembly and Manufacturing (ISAM). This research investigates the dynamics and control strategies required for robotic systems to effectively interact with tumbling satellites in space environments. Using a collaborative robotic arm, we have developed a laboratory-based simulator that accurately replicates the three-dimensional gyroscopic dynamics of tumbling spacecraft. The simulator accepts initial body angles and rates as inputs to model the complex motion patterns of defunct satellites, enabling thorough testing of control algorithms in a controlled environment.

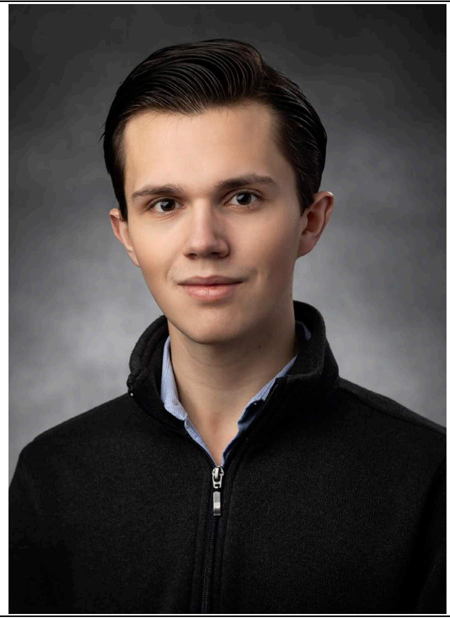
Our research demonstrates successful implementation of the simulation platform, providing a foundation for developing robust control strategies for space robotics applications. The ability to accurately simulate tumbling dynamics in a laboratory setting represents a significant step forward in testing and validating capture mechanisms and control algorithms before deployment in space. This work will contribute to the broader field of space robotics by supporting the advancement of satellite capture and manipulation techniques. The findings from this research will support the development of more effective ISAM solutions, ultimately contributing to the sustainability and safety of future space operations.

Publications: None yet.

6th Congressional District	OH Representative: Michael Rulli

WRIGHT STATE UNIVERSITY

JD Gillum



Senior, Material Science and Engineering, B.S.
Advisor(s): Dr. Mitch Wolff and Dr. Dan Young

Characterization of Inconel Additive Manufactured Inconel 718 Samples with Internal Cavities

Biography: JD Gillum, from Miamisburg, Ohio, is a Senior at Wright State University studying Material Science and Engineering. His interest in additive manufacturing stems from previous work under Dr. Dan Young through an independent study and hopes to continue his growth through his Ohio Space Grant Consortium. He has conducted internships through the Air Force Research Laboratory at Wright Patterson Air Force Base and is currently working at Northrop Grumman in the Material and Processing Department. He has accepted a full-time position pending his graduation.

Abstract: Powder Bed Fusion (PBF) is an advanced additive manufacturing process that selectively melts material, such as metal, layer by layer using a laser or electron beam. PBF is particularly valued for producing intricate, high-performance parts with exceptional detail, making it ideal for industries like aerospace, automotive, and medical devices. This research focuses on Inconel 718, a high-performance nickel-chromium alloy renowned for its strength, corrosion resistance, and thermal stability, which are critical for aerospace applications. The project aims to deepen understanding of Inconel 718 by exploring preliminary manufacturing techniques and testing methods. Specifically, the study investigates the effects of intentionally created cavities within the material during the manufacturing process, examining the influence of internal metal powder distribution and void spaces. Characterization techniques include optical microscopy, scanning electron microscopy, compression, and fatigue testing. Compression testing is conducted under both room temperature and induction-heated conditions, simulating environments encountered in aerospace applications.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

Emily Gilman

Junior, Neuroscience and Psychology
Advisor: Dr. Clare Mathes

The Impact of Habitual Early-Life Low-Calorie Sweetener Ingestion on Anterior Tongue Taste Pore Morphology in Rats

Biography: Emily Gilman is a junior undergraduate student at Baldwin Wallace University. She is a double major in Neuroscience and Psychology. After graduation, she intends to pursue a P.h.D in Neuroscience to further build her knowledge of neurodegenerative diseases, with the hopes of contributing to the current treatment options for Parkinsons Disease.

Abstract:
Early-life exposure to low-calorie sweeteners has the potential to change the gustatory axis and impact later-life behavior. This study questioned whether these changes can be seen morphologically in the anterior tongue fungiform papillae taste pores. In this study, we assessed whether early-life exposure to low-calorie sweeteners influences the number and structure of anterior tongue taste pores later in life in a rat model. We hypothesized that there would be fewer taste buds and higher levels of taste pore denervation in the rats exposed to low-calorie sweeteners when compared to the control group.

We found there was a statistically significant decrease in the number of taste pores in rats that ingested low-calorie sweetener early in life compared to the control group. However, the number of innervated and dennervated pores did not differ between groups. This serves as data supporting the idea that early-life low-calorie sweeteners reprogram the gustatory axis in a way that persists into later life. This data suggests that early-life experience with LCS may decrease the expression of fungiform papillae taste pores on the anterior tongue. This is a step towards investigating the behavioral changes seen in previous studies, which still warrants further investigation and may help guide people in their choice to use low-calorie sweeteners.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

MIAMI UNIVERSITY

Ethan Gullet

Senior, Mechanical Engineering
Advisor(s): Dr. Jeong-Hoi Koo

Integration of a Haptic Actuator with VR Airplane Cockpit

Biography: I am a senior at Miami University, where I am majoring in mechanical engineering with a minor in computer science. On campus I am involved with multiple engineering organizations including Engineers without Borders (EWB), Theta Tau Professional Engineering Fraternity, the American Society of Mechanical Engineers (ASME), and Tau Beta Pi Engineering Honor Society. Through EWB, I have been able to travel ttwice to Kabingo, Uganda to assist with work on an existing water system. I have also had summer internships at Intel Corporation in Chandler, AZ and International Paper in Port Wentworth, GA. After graduating in May 2025, I plan to pursue a doctoral degree in mechanical engineering.

Abstract: Haptic devices have the potential to allow users of virtual computer environments to explore their environment using their sense of touch. To improve user experience, there is a need for a simple and reliable way to interface novel haptic hardware with the VR software. The primary end goal of this research is establish a reliable two way communication between a virtual reality engine and a novel haptic actuator/sensor. This will be done using a simple microcontroller, Unity Game Engine, and some original C# code. After establishing a working and reliable connection, a 3D airplace cockpit simulation will be used to display the completed work and assess the performance of the haptic system. To craft the simulation, Unity Game Engine will be utilized to develop environments and objects that can be used to test the hardware.

Publications: None yet.

13th Congressional District	OH Representative: Emilia Sykes

Liam Hackett

Senior, Mechanical Engineering
Advisor(s): Mitch Wolff

ECT Sensor Generation and L2-Norm Based Flow Regime Analysis

Biography: Liam Hackett is currently a junior, moving to his senior year at Wright State University pursuing a Bachelor's degree in Mechanical Engineering. He plans to move forward with a Master's degree in Mechanical Engineering with a focus on thermal fluids through Wright State's 4+1 program. This allows for early acceptance into some graduate classes. Over the last summer, Liam worked as a research assistant for the Air Force Research Laboratory Power and Controls Division looking into two-phase flow thermal management systems. Liam is interested in aerospace engineering and hopes to move forward in a career around the development and implementation of thermal management systems.

Abstract: An important aspect of two-phase flow research revolves around the ability to accurately measure void fraction within the system. Currently, there is not a satisfactory approach to this in a manner that does not require proprietary components. The work of De Kerpel and Caniere showed promising results as they explored the development of a custom capacitance sensor. The sensor used a non-proprietary, semi-conductor, type setup to determine the permittivity of a given flow. These results will be expanded in this research to optimize the sensor design and calibration. The major contribution of this research will be the use of an industrial Electrical Capacitance Tomography (ECT) sensor to help calibrate the custom sensor. The previous researchers did not have such technology to validate their sensor. Furthermore, additional research utilizing this sensor will expand into two phase flow identification through a neural network application. Previously, Dr. Abdeel Roman used statistical analysis of the permittivity probability density function to train a neural network to predict the flow regime. This research will expand into the development of a neural network model based off image analysis of the tomogram using the L-2 Norm statistic. This approach seeks to develop an accurate way to determine flow regime based upon the tomogram generated by the ECT sensor.

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Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

WRIGHT STATE UNIVERSITY

Anna Hagan

Junior, Mechanical Engineering
Advisor(s): Mitch Wolff, Ph.D

Power and Thermal Management in Aircraft

Biography: Anna Hagan is a junior at Wright State University, pursuing a degree in Mechanical Engineering with an interest in thermodynamics**.** She is gaining valuable hands-on experience through an internship with PC Krause and Associates**,** where she is honing skills in problem-solving and CAD modeling. Upon graduation, Anna plans to enter the private sector where she hopes to contribute to innovative engineering solutions and continue developing expertise in the field of thermodynamics.

Abstract: As aviation technology continues to advance and become increasingly complex, power and thermal management systems have become more intricate and critical to the function of aircraft. With the increasing integration of advanced electrical systems on board, such as those supporting navigation, communication, and other vital functions, the amount of heat generated has risen significantly. This excess heat, if not carefully managed, poses a risk to both the mission's success and the overall safety of the aircraft. Instead of allowing this heat to be discarded as waste, which could compromise the survivability of the aircraft, it can be repurposed in innovative ways. Capturing this excess heat to power a generator and create energy reserves could provide a valuable resource to be utilized during times of peak energy demand, such as during high-load phases of flight or in emergencies, ensuring the aircraft has an additional source of power when it's most needed. Power and thermal management systems improve energy efficiency and enhance the reliability of modern aircraft systems.

Publications: None yet.

10th Congressional District	OH Represent: Michael Turner

Abigail Hall

Senior, Molecular Biology
Advisor(s): Dr. Kaleb Pauley

Differential microRNA Expression in *Dryophytes versicolor* during the Freeze Response

Biography: Abigail Hall is a senior Molecular Biology major with a minor in Chemistry at Cedarville University, where she has researched the interactions of neurodevelopmental proteins and currently researches the expression of miRNA levels in tree frogs during the freeze response. She has also researched the destination of migrating neural crest cells at Cincinnati Children's Hospital and the characterization of induced pluripotent stem cells from patients with Alagille syndrome at Nationwide Children's Hospital. She has received the Molecular Biology Research Scholarship at Cedarville for her research, as well as the President's Scholar Award for her academic performance.

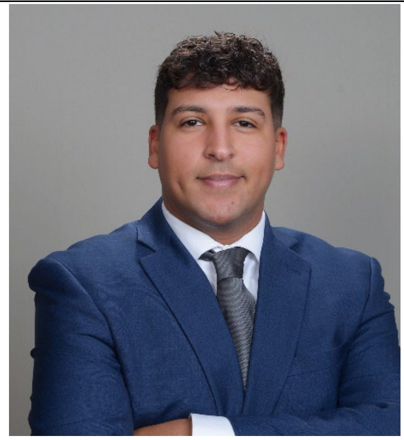
Abstract: Several species of frogs, such as *Dryophytes versicolor* (gray tree frogs), are capable of freezing 42-65% of the water in their bodies and dramatically slowing their life processes (heartbeat, metabolism, etc.) in order to survive the winter. At the end of the winter, these frogs thaw their bodies and restore their vitals and metabolism to normal levels. The freeze response and its associated physiological changes are regulated by microRNAs (miRNAs), which are small, noncoding RNAs that bind to mRNA transcripts and affect their translation. In this project, we quantify the expression levels of three specific miRNA transcripts (miR-181a, miR-206, and miR-101) from *D. versicolor* livers before, during, and after freezing.

Publications: None yet.

15th Congressional District	OH Representative: Mike Carey

THE OHIO STATE UNIVERSITY

Zain Hamid



Senior, Aerospace Engineering
Advisor: Dr. Nathan Webb

Thrust Vectoring a Subsonic, Axisymmetric Jet Using Plasma Actuators

Biography: My name is Zain Hamid. I'm a senior undergraduate aerospace engineering student at The Ohio State University. I was raised in Waterville, Ohio by my parents and took a liking to engineering early in my life. As a kid, I enjoyed playing sports and figuring out how objects around the house worked. My curiosity and problem-solving mindset stems from my father, a civil engineer. I have always had an interest in airplanes and rockets, so choosing my major was not a difficult task. After high school, I realized that I wanted to pursue a career involving advancements at the forefront of the aerospace field. Knowing this, I searched for a research position at Ohio State and was given an opportunity to study a new active flow control method using plasma actuators. Now, I am investigating this active flow control method while finishing my undergraduate degree and would love to pursue a career in aerodynamic flow control.

Abstract: Thrust vectoring is the controlled deflection of a jet to change the angle of thrust generated from the exhaust nozzle. Current thrust vectoring methods include heavy, mechanical nozzles with many complexities to allow greater maneuverability and short or vertical take-off/landing capabilities. Coanda-based thrust vectoring is another method of effectively controlling jet deflection which uses a fixed geometry "reaction surface" and a substantial amount of bleed air relative to the primary mass flow. This is a major drawback in application. This research examines the use of azimuthally evenly distributed localized arc-filament plasma actuators (LAFPAs) and a reaction surface, curved away from the jet axis, to control the deflection of a subsonic, axisymmetric jet. LAFPAs have demonstrated the ability to control the mixing and entrainment characteristics of various flows using thermal perturbations to target the Kelvin-Helmholtz instability in flows with free shear layers. Excitation frequency sweeps were completed at $\boldsymbol{M_J}$ = 0.48 and 0.9 using an array of static pressure taps fixed in the reaction surface to examine the control authority at various frequencies. The excitation frequency is the frequency at which the active LAFPAs are pulsed. The results showed the LAFPAs' ability to create static pressure asymmetry towards and away from the azimuthal center of the active group of LAFPAs. The observed trends show lower frequencies increasing suction downstream of the active LAFPAs while higher frequencies increase suction on the opposing side of the jet. Streamwise PIV results confirmed the measured static pressure asymmetries correspond to jet deflection. Asymmetry has been observed in the baseline flow and current work involves determining the effect of the baseline asymmetry on the control authority of the LAFPA's. Current work also includes investigating the effect of various reaction surface geometries to maximize the thrust vectoring capabilities of this active flow control method.

Publications: None yet.

9th Congressional District	OH Representative: Marcy Kaptur

Marietta College

Adrienne Hammontree

Junior, Planetary Science & Geology
Advisor(s): Dr. Andrew Beck

Martian Meteorite Bulk Chemistry Dataset to aid in Gamma Ray and Neutron Data Interpretation of Phobos

Biography: Adrienne Hammontree is a Junior Geology and Planetary Science double major with a minor in Geographic Information Systems (GIS) at Marietta College with developing interests in meteorite analysis, mineralogy, and petrology. Adrienne works in the Office of Admissions as a Student Ambassador giving campus tours to prospective students and was recently hired as a Peer Tutoring Consultant to help fellow students who may be having difficulty in geology and astronomy classes. She is an active student outside of academics, running and participating in two organizations: The Marietta Geological Society, Marietta College's Geology Club, of which she is the President, and Marietta College's chapter of Sigma Gamma Epsilon, Iota Alpha, where she is also the President. Off campus, Adrienne is also a participant in both the Geological Society of America's On To the Future Program and NASA's Here to Observe Program.

Abstract: The Mars-moon Exploration with GAmma rays and NEutrons (MEGANE) instrument aboard the Martian Moons eXploration (MMX) spacecraft will travel to Phobos, the larger of the two martian moons, to take elemental measurements of the surface. Led by the Japan Aerospace Exploration Agency (JAXA), MMX aims to determine the origin of the martian moons (giant impact vs. captured asteroid) via sample return and orbital measurements of Phobos. MEGANE (orbital gamma ray and neutron detector) data interpretation can be improved by a robust geochemical library of martian meteorites. In this study, we compiled bulk chemical analyses of various martian meteorites in order to calculate gamma ray and neutron measurable ranges for different martian petrographic groups. We employed efforts to ensure chemistries were representative of whole rock composition and applied statistical thresholds to identify outliers in any petrologic group, which were then removed from the dataset. In total, we ended with a dataset of 51 unique petrologies which represents about 17% of the martian meteorite clan.

Publications: None yet.

13th Congressional District	OH Representative: Emilia Sykes

Joseph Hefler

Academic Senior, Aerospace Engineering
Advisor(s): Dr. Rui Liu

Robotic Terrain Traversal: Comparative review of Legs and Wheels

Biography: I am a Senior Aerospace Engineering student at Kent State University with a passion for developing vehicles for space exploration, asteroids, and planetary bodies. With a background in Unmanned Aircraft Systems, I have honed my skills in design, assembly, and flight operations. As the senior propulsion engineer for the Kent State University High Power Rocket Team, I specialize in mixing, testing, and simulating propellants to optimize rocket performance. Previously, I served as Vice President of the Rocket Team, where I led avionics efforts and contributed to our success at the 2022 and 2023 Spaceport America Cup competitions in Las Cruces, New Mexico. I am also a member of the AFS Club at Kent State, where I gained hands-on experience in sand casting and foundry work, and I furthered my knowledge by attending the 2023 AFS Metalcasting Congress in Cleveland.

Abstract: My research aims to compare dynamic legged robot systems and wheeled rovers, focusing on AI for path planning and human-robot interaction to improve planetary exploration on rugged terrains. While wheeled rovers like NASA's Spirit and Curiosity have been reliable on Martian terrain, their mobility is limited in steep or uneven areas. Dynamic legged robots, inspired by biological movement, offer greater adaptability and stability in challenging environments. The project will assess the performance and efficiency of both systems through AI-driven simulations, utilizing technologies like NASA's AEGIS for autonomous navigation.

The methodology involves designing or modeling robotic systems and running simulations based on planetary terrain data to evaluate navigation capabilities. Drawing on my experience with legged robots in Kent State’s Cognitive Robotics and AI Lab (CRAI Lab) and collaborating within the Kent State NASA Robotics Club, the project incorporates advanced AI algorithms to enhance robotic capabilities. This research aligns with NASA’s Space Technology Mission Directorate by improving robotic exploration tools to support astronaut-led missions and advancing space exploration.

Publications: None yet.

14th Congressional District	OH Representative: David Joyce

Elyse Hensley

Senior, Biological Sciences
Advisor(s): Dr. Sarah Wyatt

Understanding Plant Gravitropism Through Protocol Development and Phenotyping

Biography: Elyse Hensley is an undergraduate student at Ohio University in her fourth year. She is pursuing a Bachelor of Science in Biological Sciences with a certificate in Global Health. Elyse is an undergraduate research assistant in the Wyatt Lab, where she studies the plant response to gravity. In her free time, Elyse is on executive boards for her student chapter of Habitat for Humanity and a ski club; she is also an assistant coach for her synchronized swim team. She enjoys outdoor activities like rock climbing, hiking, and snowboarding. Next year Elyse plans to pursue a master's degree in pharmacology, with an interest in drug development for neglected tropical diseases.

Abstract: A plant's perception and response to changes in gravity is necessary for normal growth and survival, but the pathways involved in gravitropism are not fully understood. Growing plants in space is necessary for the health and wellbeing of astronauts during long-term space inhabitation. However, plants face many stressors in spaceflight for which they are not well adapted, such as radiation, µgravity, and water stress. By studying plant gravitropism, we gain an understanding of the plant response to gravity, which can improve our ability to grow plants in space.

The Wyatt Lab has been studying the biochemical components of a plant's gravity response to better understand these pathways. In the BRIC-20 spaceflight experiment, we identified 968 genes that were differentially regulated in *Arabidopsis thaliana* seedlings flown on the ISS, as compared to ground control replicates. A group of proteins that functions in the ubiquitin pathway, E3 ligases, were among those differentially expressed genes. These proteins are involved in the pathway that labels molecules for degradation in the cell. My current research has been characterizing the role of KFB (AT1G23390, *KFB*), a kelch domain-containing F-box protein which was differentially regulated in spaceflight, and CHS (AT5G13930, *CHS*), a chalcone synthase which is labelled for degradation by KFB. Homozygous *KFB* and *CHS* mutants have been generated, and a double mutant in both *KFB* and *CHS* is being generated through selective breeding. Once mutant lines are generated, mutant phenotypes are analyzed through root curvature, gravity persistent signaling, and clinostat disorientation experiments. These data are then compared to the wild-type response to identify the effects of KFB and CHS on gravitropism. These findings will further the knowledge on gravitropism and aim to improve our ability to grow plants in space to fuel long-term spaceflight missions.

Publications: None yet.

14th Congressional District	OH Representative: David Joyce

MIAMI UNIVERSITY

Claire Hopfensperger

Senior, Computer Engineering & Electrical Engineering
Advisor(s): Dr. Mark J. Scott

Reliable Power Conversion for Space Applications

Biography: Claire is a senior studying computer engineering and electrical engineering at Miami University of Ohio. During the summers of 2023 and 2024, Claire was an Electrical Engineer Intern at Cryptic Vector in Liberty Township, OH, where she gained experience working with radio and satellite communication systems. Claire has been named to Miami University's President's List, which recognizes the top 3% of undergraduate students by division, each semester she has studied there. Outside of school, Claire enjoys reading and doing an assortment of arts and crafts. After graduating in May 2025, Claire will be working as a Junior Reverse Engineer at Radiance Technologies in Beavercreek, OH. Claire looks forward to entering the engineering workforce and joining the forefront of defense and space innovation.

Abstract: Power electronics are essential to space innovations, supporting critical functions such as power conversion, conditioning, and management. Due to the complex and dynamic behavior of power electronics, reliable tools and methods for simulation, health monitoring, and failure prediction are not currently widely available. By determining when power electronics will fail, we can balance the expensive costs of frequent component replacement against the risks of unexpected failures. One health monitoring method being explored in the current research space is using a digital twin, or simulated version of a system, for failure detection and prediction. This research aims to design and fabricate a compact, cost-effective, and scalable printed circuit board (PCB) that consolidates a previously developed digital twin-based multi-part system for power electronics health monitoring and failure prediction. The condensed PCB was designed with Altium Designer to fit and interact with a Raspberry Pi 3, enabling adjustable and scalable operation.

Publications: None yet.

8th Congressional District	OH Representative: Warren Davidson

CLEVELAND STATE UNIVERSITY

Sania Imran

Junior, Chemical Engineering
Advisor(s): Dr. Jorge Gatica

Catalytic Gasification for Waste Management and In-Situ Resource Utilization

Biography: Sania Imran is an undergraduate chemical engineering student at Cleveland State University. She has gained valuable hands-on experience in nylon manufacturing, applying her academic knowledge to real-world industrial processes. As a member of the AIChE chapter at CSU, Sania actively participates in various events and is always eager to learn more about the diverse fields within chemical engineering. She is passionate about using her skills and experiences to contribute to innovative advancements in the field.

Abstract: More than 250 million tons of municipal waste are produced by Americans each year. Most of this waste is either unrecyclable, incinerated, or placed in landfills. With the adverse effects caused by incinerators and landfills reaching maximum capacity, finding a solution to this ever-growing problem has become more apparent. The concern from scientists and engineers has grown, and solutions and better alternatives to current waste management practices have become increasingly needed.

One such solution is waste gasification, a process that breaks down carbon-based materials into synthetic gas (syngas). This process has advantages over traditional procedures such as incineration, as it requires a much lower temperature and produces fewer by-products, thus leading to a lower energy footprint.

At Cleveland State University, a catalytic gasification process is being investigated in a low-to-medium temperature and high-pressure reactor. This research project aims to resolve the fluid dynamics of a multi-phase reacting environment where waste substrates are converted to syngas with the aid of solid catalysts.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

CENTRAL STATE UNIVERSITY

Jeremy Jackson

Senior, Manufacturing Engineering
Advisor(s): Dr. Mahmoud Abdullah

Lighter, Faster, Longer Lasting!

Biography: Jeremy Jackson is a senior majoring in Manufacturing Engineering at Central State University, where he maintains an impressive GPA of 3.87/4.0. Born and raised in Baltimore, MD, He has gained valuable experience through internships at Northrop Grumman and the Air Force Research Lab, where he contributed to automation innovations and software development. His technical skills include proficiency in Magics, Solid Edge, and MATLAB. Jeremy has demonstrated leadership as the organizer and inaugural president of the Honors Student Association, President of the Nu Chapter of Phi Beta Sigma Fraternity, Inc., and as a board member of the National Society of Black Engineers**1**. He has been recognized for his research excellence, being named Central State University Student Researcher of the Year.

Abstract: My senior project explores the automation of radar manufacturing through robotics, specifically focusing on the use of a Fanuc robot to replace human labor in placing radar chips into an Electronically Scanned Array. The project was inspired by a problem identified during an internship at Northrop Grumman, where the need for automation in radar chip placement was highlighted. The proposed solution involves programming the robot to pick and place card chips into designated holders, utilizing a combination of sensor-based visuals, X-Y plane orientation, and manual jogging techniques. The project seeks to significantly reduce manufacturing time and allow human workers to focus on more innovative tasks. The implementation plan includes building slots for card insertion, designing a card feeder layout, and programming the robot for precise chip placement. Despite challenges such as limited technological knowledge due to classifications and the need for air compressor integration for the robot's claw, the project is expected to streamline radar production processes.

The significance of this research project lies in its potential to revolutionize radar manufacturing by automating the process of placing radar chips into an Electronically Scanned Array using a Fanuc robot. This automation could exponentially decrease the manufacturing process time, allowing human workers to focus on more interactive and innovative tasks. By successfully programming the robot to perform this task, the project hopes to enhance efficiency and reduce labor costs in the radar manufacturing industry. Additionally, the project contributes to the broader field of robotics and automation by demonstrating the feasibility of integrating advanced robotic systems into complex manufacturing processes.

Publications: None yet.

10^{th} Congressional District	OH Representative: Michael Turner

University of Dayton

Kevin Johnston

Senior, Mechanical Engineering
Advisor(s): Dr. Krishna Bhavithavya Kidambi

Enhancing Quadrotor Autonomy and Stability using ROS-based Control Algorithms

Biography: Kevin Johnston is a senior mechanical engineering student at the University of Dayton. He has conducted extensive research on autonomous drone navigation, integrating SLAM algorithms and control strategies using the Robot Operating System (ROS2). Kevin participated in the Berry Summer Thesis Institute (BSTI) and the Summer Undergraduate Research Experience (SURE), advancing his work on indoor autonomous navigation using Crazyflie drones. He has served as a teaching assistant for Calculus III for the past two years and is the Engineering Representative for the Student Government Association (SGA). Additionally, Kevin has passed the Fundamentals of Engineering (FE) exam, earning his Engineer in Training (EIT) certification. He is also Vice President of Pi Tau Sigma and plans to pursue a master's degree in mechanical engineering, focusing on experimental robotics and control systems.

Abstract: In the evolving landscape of unmanned aerial vehicles (UAVs), the ability to autonomously navigate and avoid obstacles is critical, especially in applications such as indoor exploration, search and rescue missions. This research will focus on developing and implementing simultaneous localization and mapping (SLAM) algorithms and control strategies within the Robot Operating System (ROS2) framework. The initial phase will emphasize integrating basic SLAM algorithm to enable real-time mapping of indoor environments. Subsequent efforts will involve designing and testing robust control algorithms to allow drones to autonomously traverse mapped spaces, effectively avoiding obstacles. Simulations in realistic environments, incorporating real-world constraints, will demonstrate the feasibility of the proposed approach. Further real-world testing is conduced using Crazyflie 2.1 mini drone to validate the integration of SLAM and robust control algorithms, showcasing their potential for indoor autonomous navigation.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

OHIO UNIVERSITY

Kaleb Keichel

Senior, Computer Science
Advisor(s): Dr. Jundong Liu

Artificial Intelligence and Satellite Imagery

Biography:
My name is Kaleb Keichel and I am a very determined computer science undergrad studying at the Russ College of Engineering. I've worked for several internships at the past, including most notably Goodyear and Ohio Lumex. Most recently, I've been part of Dr. Liu's research team, where we come up to innovative solutions for complex and practical problems. I have a wide variety of technical skills, from a wide variety of languages and algorithmic backgrounds, and a huge number of soft skills and leadership capability. I am the team leader for my senior design project, where we are developing a senor suite utilizing AI models for classification for fall detection, to aid in preventing senior accidents. I was privileged enough to earn the OSGC STEM scholarship, where I utilize the funds to diligently develop intricate research with a variety of theoretical and practical usage.

Abstract:
In junction with my advisor Dr. Jundong Liu and his team, we are developing generative AI and other AI solutions to work with satellite imagery and other unique problems facing this growing field. I've spearheaded development on several generative AI models, such as generative adversarial networks (GANs), variational autoencoders (VAE's), and other, more basic convolutional neural networks (CNNs). All these models have been able to provide effective image output, with varying degrees of success. By harnessing this raw generative power, it can be applied to the creation of synthetic data. This synthetic data can be utilized to train detection models, which will be essential for future missions that are concerned about space collisions.
While researching generative models that allow for better classification of foreign objects, the research team has discovered spiking neural networks and neuromorphic hardware. Essentially, this hardware/software combination is meant to imitate human brain neurons and other synaptic structures. By doing this, we are capable of classifications at speeds faster than even the most efficient traditional models, at a fraction of the computing power. Since this revelation, I've moved my focus here, as we have found that this could prove to be much more valuable for satellite-related projects.

Publications: None yet.

12th Congressional District	OH Representative: Troy Balderson

CLEVELAND STATE UNIVERSITY

Brooke Kennedy

Senior, Chemical Engineering
Advisor(s): Jorge Gatica

Waste to Energy – Reaction Engineering & Sustainability

Biography:
Brooke is a senior chemical engineering major at Cleveland State University. She is a member of Tau Beta Pi, AiCHE, Choose Ohio First, and a Lead Engineering Peer Teacher. In addition to her school responsibilities, she works part time as a Process Control Intern at Schneider Electric. Her senior design project consisted of a team building a car for the ChemE Car competition in Michigan at the end of March. Upon graduation, she will be starting the Quality Leadership Development Program at Parker Hannifin for two years. She wants to thank her family, friends, and boyfriend for the immense amount of support over the years.

Abstract:
This research project involves the computer modeling of the catalytic process aimed to gasify household waste materials. This work has applications in sustainability by transforming polymeric chains, typical of household waste, into synthetic gas (syngas). This chemical transformation (the breakdown of large polymeric molecules, solids, into smaller, gas, molecules) can be promoted at low temperatures by means of solid catalysts. This process is known as Wet Thermal Catalytic Oxidation (WTCO). Proof-of-concept experiments, catalytic characterization, and life-cycle analysis of WTCO are undergoing in the Chemical Reaction Engineering (CRE) Research Group at Cleveland State University (CSU).

The design and operation of the WTCO processing unit, a chemical reactor operating at high pressure, requires the optimization of a multiphase (solid, liquids, and gases) reacting environment. Computer modeling is a useful tool for this project as a predictive tool for the distribution of reactants and catalytic media in an intricate fluid flow environment. It enables the detailed analysis of the transport phenomena in a reacting environment and its optimization in a process where visualization is not possible. These predictions will then be tested in a laboratory-scale reactor.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

YOUNGSTOWN
STATE
UNIVERSITY

George Kerg

Senior Chemistry & Spanish Major
Advisor(s): Dr. Douglas Genna

Metal Organic Framework Adsorption and Detection of Precious Metals

Biography: I am a senior at Youngstown State University studying chemistry and Spanish and obtaining a mathematics and biology minor. I grew up in Olmsted Falls, Ohio with my family of seven siblings. After graduation I plan on pursuing a PhD program in the field of inorganic, organometallics, or electrochemistry.

Abstract: The objective of this project is to synthesize already known MOF structures and test them using fluorescence spectroscopy or impedance spectroscopy. Many MOFs already exist with functional groups such as amines, phosphines, and carboxylic functional groups. These have traditionally been implemented for carbon dioxide absorption and storage, catalysis, and in some instances coating for materials. This project will observe the applications of these MOFs and their abilities to adsorb metals for detection in samples. This project has two major components. The first component is to find a MOF that has enough functional groups to be capable of binding to another metal center that is not the MOF itself. In other words, it is necessary to find a metal center in the MOF structure that does not compete for the functional groups attached to the MOF so as to impede the metals of interest. The second component of this project is to find a standardized testing method for the adsorption of the said metals. This means that a way to categorize the effectiveness of the sensor itself must be created for the purpose of this project.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

THE UNIVERSITY OF TOLEDO

Nabeel Khatri

Junior, Bioengineering
Advisor(s): Dr. Chris Sanford

Exploring Optimal Treatment Strategies for Fractures in Microgravity Environments

Biography: My name is Nabeel Khatri, and I'm a bioengineering student at the University of Toledo, graduating in May 2026 with a minor in chemistry. My passion lies at the intersection of engineering and healthcare, inspired by a high school project where I designed a communication device for a nonverbal community member. Since then, I've shadowed orthopedic surgeons, participated in a Clinical Immersion Co-op, and volunteered at the Halim Clinic. Through this, I've learned the importance of cultural competency and community-focused care. I aim to pursue medical school and become an orthopedic surgeon, with a long-term goal of opening a clinic to provide care regardless of a patient's ability to pay. I am passionate about advancing the future of healthcare, both on Earth and in space.

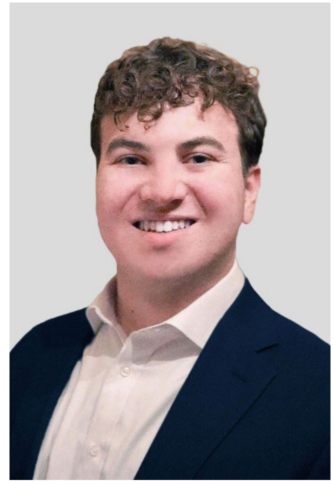
Abstract: The expanding interest in space exploration, including missions to the Moon, Mars, and beyond, necessitates advancements in medical care tailored to the unique challenges of microgravity. Treating bone fractures in such environments presents significant difficulties due to microgravity-induced bone density loss, fluid redistribution, and the absence of mechanical stabilization provided by gravity. Current fracture management methods in space rely on adaptations of terrestrial techniques, which require refinement for effective long-term care in extraterrestrial settings. This review synthesizes existing knowledge from peer-reviewed articles, case studies, and technical reports to identify the limitations of current approaches. It also explores countermeasures like parathyroid hormone therapy to stimulate bone growth and NASA's efforts to mitigate bone and muscle loss through exercise and pharmacological interventions. Additionally, advancements in stabilization techniques, adaptable fixation devices, and innovative methods for promoting bone healing in microgravity environments are discussed. By addressing these challenges, this research aims to propose novel solutions that improve fracture treatment and enhance astronaut safety during long-duration missions. These advancements are critical for ensuring the success of human exploration and habitation beyond Earth, paving the way for sustainable space travel.

Publications: Hasan, S., **Khatri, N.**, Rahman, Z. N., Menezes, A. A., Martini, J., Shehjar, F., Mujeeb, N., & Shah, Z. A. (2023). Neuroprotective Potential of Flavonoids in Brain Disorders. Brain sciences, 13(9), 1258. https://doi.org/10.3390/brainsci13091258

9th Congressional District	OH Representative: Marcy Kaptur

THE OHIO STATE UNIVERSITY

Henry Kitchen



Junior, Aerospace Engineering
Advisor(s): Dr. Jesse Little & Dr. Nathan Webb

Analysis of Real-Gas Effects in the Ohio State University Large Area Reflected Shot (LARS) Tunnel

Biography: Henry Kitchen is junior pursuing a Bachelor of Science in Aerospace Engineering at The Ohio State University. A member of the University's Honors Program, he has been a Dean's List honoree each semester of his collegiate career. He serves on the Executive Board of Ohio State's American Institute of Aeronautics and Astronautics (AIAA) Chapter and is a dedicated member of the University's high-power rocketry team, and Buckeye Space Launch Initiative. Henry was competitively selected for, and completed, an internship with the Air Force Research Laboratory's Aerospace Systems Directorate where he gained valuable Systems Engineering experience as well as High-Speed Propulsion research experience. At The Ohio State University's Aerospace Research Center, he works as an Undergraduate Research Assistant as part of the research group that operates the Large Area Reflected Shock (LARS) tunnel, the largest hypersonic wind tunnel at a U.S. university. During this time, he has gained valuable insights into hypersonic flow physics, shock tunnel operation, and the research analysis of these systems. He hopes to pursue a graduate degree in aerospace engineering after completion of his undergraduate degree.

Abstract: The objective of this research is to estimate operational envelopes for the LARS facility with inclusion of real-gas effects. For speeds below Mach 5, these envelopes can be calculated using calorically perfect gas equations, meaning the specific heat capacity is considered constant. However, for hypersonic flows, temperatures increase such that vibrational effects cannot be neglected. This means that the specific heat capacity becomes a function of temperature. These vibrational effects take energy out of the flow, causing the calorically perfect gas equations to lose their accuracy. Flows with these vibrational effects are described as calorically imperfect—the thermally perfect, calorically imperfect conditions make up the 'real-gas effects' of hypersonic flows. This study involves implementing real-gas equations, using numerical methods, to update existing calorically perfect operational envelopes. This investigation will generate more accurate operational envelopes for the LARS facility and ultimately define its overall hypersonic research capability.

Publications: None yet.

15th Congressional District	OH Representative: Michael Carey

CENTRAL STATE UNIVERSITY

Suraju Lawal

Academic Level, Major: Senior, Manufacturing Engineering Minor Nuclear Engineering
Advisor(s): Dr. Augustus Morris

Design, Modeling, and Analysis of Molded Pulp Packaging

Biography: I was born and raised in West Africa (Nigeria). I moved to United State of America over a decade ago. I attended Sinclair Community College where I obtained an Associate Degree in Aviation Maintenance Technology, then transferred to Central State University where I am currently a Senior pursuing a bachelor's degree in manufacturing engineering and Minor in Nuclear Engineering. I am the President of Society of Manufacturing Engineers (SME) Central State University student chapter. I am currently working for PSA Airlines a subsidiary of American Airlines as an Aircraft Mechanic.

Abstract: This report presents the comprehensive design, modeling, and analysis of molded pulp packaging using the Siemens NX (formerly Unigraphics) engineering design system. Molded pulp packaging is a sustainable and eco-friendly alternative to traditional packaging solutions, designed to meet the growing demand for recyclable materials. This project encompasses the entire design process, from concept development and material selection to simulation and optimization. The report also highlights the integration of advanced design tools, finite element analysis (FEA), and environmental considerations to produce a robust and sustainable packaging solution.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

WRIGHT STATE
UNIVERSITY

Nathan Lewan

Senior, Mechanical Engineering
Advisor(s): Mitch Wolff

Advanced Thermal Management for Military Aircraft

Biography: Nathan Lewan is a fourth-year mechanical engineering student at Wright State University. After completing his undergraduate degree, Nathan will be pursuing the graduate program at Wright State University as well, where he will be working on a heat exchanger related thesis to continue the research conducted through his OSGC project. When given free time, cooking, working out, and welding are all things he is passionate about. Nathan looks forward to contributing new ideas to ongoing research and working with experienced professionals to gain valuable knowledge within the field.

Abstract: Advancements in aircraft systems and supporting equipment have resulted in high thermal loads within new generations of military aircraft without allocating the space requirements that would traditionally be needed for additional cooling. Therefore, the necessity arises of creating more efficient thermal management systems to increase the cooling capabilities of the aircraft. Heat exchangers play a critical role in these systems and operate by transferring energy from a higher potential medium to a lower one. Conventional heat exchanger design has been governed by manufacturability, but with recent improvements in additive manufacturing, conformable triply periodic minimal surface heat exchangers (CTPMS-HX) are now feasible.

This work presents a computational fluid dynamics (CFD) study over a CTPMS-HX created in nTopology software. The bulk of this process included importing geometry to ANSYS, setting up boundary conditions for varying tests, meshing, and finally the solution. As this project is solely numerical, results were compared to existing research and test data to provide a rough order-of-magnitude analysis for validation. This research is designed to serve as a basis for which future CFD studies can be compared to as well as improve upon exiting methods for this type of analysis.

Publications: None yet.

10^{th} Congressional District	OH Representative: Michael Turner

WRIGHT STATE UNIVERSITY

Nathan Lynn

Senior, Mechanical Engineering
Advisor(s): Dr. Mitch Wolff

Mitigation of Two-Phase Flow Instabilities Using Pressure-Based Constant Saturation Temperature Controls: A Hardware-in-the-Loop Approach

Biography: Nathan Lynn grew up in Mt. Healthy, Ohio, where his love for engineering began. What started as playing with RC cars, helicopters, and planes soon turned into a passion for taking them apart to understand how they worked. Nathan quickly advanced to making small modifications, igniting his interest in engineering. As he grew older, Nathan expanded his projects to modifying RC drones, submarines, and boats. After moving to Dayton, he joined a robotics team in elementary school, which further solidified his enthusiasm for the field. Later, he completed high school in Centerville while continuing his “backyard engineering” activities. Nathan pursued his interest in engineering academically by attending Sinclair and Wright State University, where he is working toward his degree in Mechanical Engineering. During his time at Wright State, Nathan secured an undergraduate research position at Wright-Patterson Air Force Base with the Air Force Research Laboratory (AFRL). In this role, he built and maintained an electrical capacitance tomography (ECT) sensor, an experience that deepened his passion for research. Looking forward, Nathan plans to pursue a Ph.D. in Mechanical Engineering upon graduation.

Abstract: Two-phase pumped loop systems are renowned for their ability to reject large quantities of heat without substantial temperature change. However, a major challenge of these systems is introduced by instabilities. The objective of this research is to investigate the feasibility of using active flow controls in a hardware-in-the-loop (HIL) approach to mitigate these instabilities. The project involves implementing communication between hardware components, such as the Speedgoat Data Acquisition System, motor controller, power supply, chiller, thermocouples, and pressure transducers. The Simscape software library within Simulink will then be used to create a thermal model that accurately represents the system. To validate the system, an aircraft model will be created to simulate sample heat loads corresponding to mission profiles, with loads coming from the engine, sensors, electronics, and other essential equipment. Tests will be conducted to apply these heat loads to the experimental system, and results will be recorded using a Speedgoat Data Acquisition System. This HIL test setup will be capable of applying sample mission profiles to a benchtop test skid, ensuring effective simulation and data collection for future system evaluations and instability mitigation research.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

James Lyons

Undergraduate Senior, Mechanical Engineering
Advisor: Dr. Nicholas Gordon Garafolo

Smart Material Actuated Flap

Biography: From a young age, I have been fascinated by anything that flies. Even before I understood what an aircraft was, I was excited driving past helicopters on the commute to preschool. Eventually, this interest grew into a collection toy plane that I would play with for hours. Touring the National Museum of the USAF at age 12, I was enthralled, and knew I wanted to work in aeronautics. When choosing a university program, I selected the Engineering department at the University of Akron, drawn by excellent design teams and research opportunities. I spent two years on the Zips Aero Design Team, and I am an active member in Tau Beta Pi and Engineering Student Council. I completed an internship at Schaeffler Transmission Systems during Summer 2022 and have completed three co-op rotations at Collins Aerospace totaling a year of experience. Upon receiving my degree, I plan to begin a career in the aerospace industry at Collins Aerospace and eventually pursue further education. I am completing this research project as my capstone design project, and I am thankful for the opportunity to refine my skillsets and mentality in preparation for my career. I am grateful for the research opportunity that OSGC has provided and excited for the bright opportunities in aerospace that lie before me.

Abstract: The objective of this project is to develop and evaluate a smart material actuated aerodynamic control surface to determine the viability of these new systems as alternatives to conventional electromechanical and hydraulic systems. The research will begin with the selection of a control surface and actuator design. The concept will then be tailored to create an experimental model for the purposes of this project. Smart materials that suit the model requirements will be selected and procured. Next, the actuators will be shape trained and characterized to meet the model requirements. Then, a benchtop model will be produced for design verification, and iterated until it functions desirably. Finally, a wind tunnel model will be manufactured and experimentally tested to indicate the potential utility of smart materials in aerospace control actuation applications.

The current project design, based on a function tree analysis and weighted decision matrix is a torsional SMA actuated flap actuated by joule heating. The flap will be on a 3D printed wing model with a NACA 2412 airfoil. The bench top model will be mounted with an extended airfoil frame and the wind tunnel model will utilize a sculpted 3D printed adapter with a trantorque insert to interface with the pistol grip sting in the wind tunnel. The bench top model will be controlled using a variable current power supply to manually heat the SMA while the final wind tunnel model will utilize closed loop control to automatically control the SMA temperature. The 3D printed construction will allow for rapid production and redesign. The SMA actuators will be a unique challenge in the development of this model due to their complexity and dynamic behavior. If the actuator achieves consistent deflection and delivers increased lift in the wind tunnel trials the project will serve as a proof of concept for the use of smart material actuators for small arial vehicles like RC planes and drones.

Publications: None yet.

11th Congressional District	OH Representative: Shontel Brown

CLEVELAND STATE UNIVERSITY

Joseph L. Lyons

Senior, Mechanical Engineering
Advisor(s): Dr. Maryam Younessi

Numerical Modeling of Helium-Neon Mixtures for Cryogenic Reverse Brayton Cycle Applications

Biography: I am a mechanical engineering student at Cleveland State University, set to graduate in May 2025, with a GPA of 3.99. Throughout my academic journey, I've been honored with accolades such as membership in Tau Beta Pi, the Parker Hannifin Washkewicz Scholars Program full-tuition scholarship, and recognition as a Division I Wrestling Scholar All-American. My professional experience includes working as a Project Engineer at The Whiting-Turner Contracting Company, where I contributed to diverse projects in the entertainment, hospitality, and government sectors. I also served as a Thermodynamics Teaching Assistant, where I helped students grasp challenging concepts and improve their problem-solving skills. In addition to academics, I've pursued leadership and teamwork opportunities, including competing at the NCAA Division I level in wrestling and completing the United States Marine Corps Officer Candidates School PLC Juniors program, where I ranked in the top 10% of my class.

Abstract: NASA's upcoming missions to the Lunar and Martian surfaces necessitate establishing robust cryogenic storage systems. The advancement of these systems hinges on developing a high-capacity, low-temperature cryocooler, which is crucial for storing liquid cryogenic propellants. NASA's recent technological strides have employed a modified reverse Brayton cycle cryocooler. This project aimed to facilitate numerical modeling of various helium-neon mixtures as the working fluid within a conventional reverse Brayton cycle model. By analyzing the resulting cycle performance factors for each mixture, valuable insights were gleaned regarding the optimal working fluid composition for cryogenic applications. The model was based on the first and second laws of thermodynamics, utilizing a robust digital database and program to evaluate the properties of the working fluid.

The National Institute of Standards and Technology maintains the REFPROP database and program, a comprehensive repository of fluid characteristics equipped with tools for calculating properties. Leveraging the REFPROP database enabled precise modeling of fluids using tools like Microsoft Excel. Overall, this project applied numerical modeling and harnessed the capabilities of the REFPROP database to enhance and optimize the functionality of the reverse Brayton cycle cryocooler. The project results indicated that, in terms of thermodynamic performance, pure neon is the ideal fluid for the operation of the Reverse Brayton cycle at cryogenic temperatures.

Publications: None yet.

7th Congressional District	OH Representative: Max L. Miller

Arnav Manu

Junior, Aerospace and Mechanical Engineering
Advisor(s): Dr. Roger Quinn

Two Phase Flow CFD Simulations on the Vertical upflow Liquid Nitrogen Chilldown Experiments

Biography: I am currently a junior double major in Aerospace and Mechanical Engineering at Case Western Reserve University in Cleveland, Ohio. I originally grew up in Columbus, Ohio. I've always been interested in engineering, so I immediately joined the Baja SAE team at CWRU, where I now serve as a senior member in mechanical design, analysis, and testing, as well as managing the team's finances. I also do research for CWRU's Two Phase Flow and Thermal Management laboratories, where we seek to develop a better understanding of two-phase phenomena that is applicable to industries like aerospace, defense, automotive, and nuclear. Outside of school, I enjoy lifting and motorcycling.

Abstract: Cryogenic fluid management is vital for the safe storage and transfer of liquid nitrogen in aerospace, industrial, and scientific applications. Traditional thermal management strategies combine passive measures, such as multilayer insulation that minimizes heat input through reflective layers, with active cooling techniques, such as cryocoolers, to maintain cryogenic fluids near their boiling points and achieve near zero boil-off. However, during transient operations such as the chilldown process, where transfer lines or storage vessels are rapidly cooled, complex thermal phenomena, including rapid phase transitions and steep temperature gradients, introduce significant challenges. These thermodynamic dynamics can lead to rapid boil-off, thermal stresses, and system inefficiencies. This research aims to investigate how computational fluid dynamics simulations, using ANSYS, can model the chilldown process of liquid nitrogen in a vertical upflow tube. The goal of this research is to enhance the understanding of the thermal-hydraulic behavior during cryogenic fluid handling, resulting in improved insulation performance, reduced boil-off, and the optimization of system design and operational efficiency. These advancements have the potential to improve the functionality of cryogenic systems used in both terrestrial and space applications.
The study employs a mixture model to capture multiphase flow behavior and introduces spatially varying Lee coefficients to improve interphase heat and mass transfer predictions.
Several configurations are examined to assess the effects of these localized thermal parameters. The insights gained from this investigation are expected to support the development of more reliable and efficient cryogenic management systems for a range of applications in both terrestrial and space environments.

Publications: None yet.

12th Congressional District	OH Representative: Shontel Brown

Dimitry Melnikov

Senior, Electrical Engineering
Advisor(s): Dr. Nathan Ida

Simulation of Variable Lunar Joint Sensing and Communications System

Biography: Dimitry Melnikov is a senior at the University of Akron pursuing a Bachelor's degree in Electrical Engineering with a minor in Computer Science. He is also a Pathways intern with NASA's Glenn Research Center. Born in Akron, Ohio, he is passionate about applying engineering to the fields of communications and aerospace as humanity moves toward the stars. At the University of Akron, Dimitry has served as an Avionics subsystem lead for the Akronauts Rocket Design Team, a tutor in circuits and math, a head tutor for the College of Engineering & Polymer Science, and research assistant to Dr. Hamid Bahrami and Dr. Nathan Ida. Dimitry started with NASA's Glenn Research Center in the Aviation Testing Branch, supporting testing campaigns in the Engine Research Building and the Icing Research Tunnel (IRT), as well as assisting with the Measurement Uncertainty Analysis of the IRT aerothermal characterization. After transferring to the Advanced High Frequency Branch, he gained a passion for communications and antenna design through build-up and execution of an in-flight demonstration of the Antenna Deployment and oPtimization Technologies (ADaPT) project. Upon graduating in May of 2025, he plans to pursue a PhD in Electrical Engineering.

Abstract: NASA's Artemis program requires precise navigation capabilities to establish the first sustained presence on the lunar surface. However, as launches bring necessary orbital infrastructure to the Moon, the Artemis program will face a critical period during which reliable lunar navigation will still not be possible. Several proposals have been brought forward for lunar communications infrastructure. Modern wireless technologies include support for Multiple-Input-Multiple-Output (MIMO) processing. The report describes methods to employ the instantaneous Channel State Information (CSI), produced by the radio receiver as part of MIMO processing, for navigational purposes. Under the proposed scheme, the Direction of Arrival (DoA) is determined from CSI, the radio distance is calculated from the Time of Flight (ToF) in the channel, and both are combined to determine the position of Artemis elements, such as space suits or rovers.

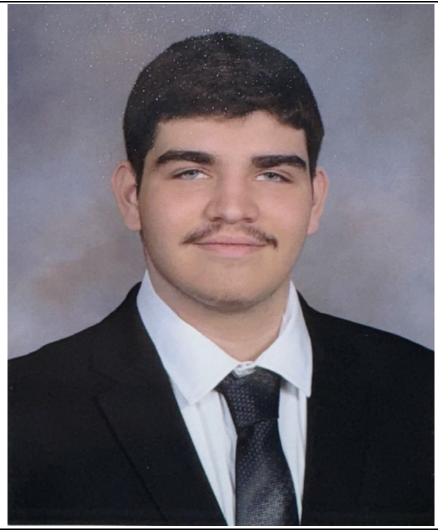
A digital twin of the physical layer of a MIMO communications system is developed in MATLAB. The simulation determines CSI using simulated, transmitted data with a Shooting and Bouncing Ray wave propagator. CSI is then found for a MIMO receiver of variable configuration. Several parameters are adjustable — the count and geometry of MIMO antennas, link conditions (such as Signal to Noise Ratio (SNR), multipath interference, etc.), and more are varied to characterize the effects on navigation state accuracy. The simulation studies are conducted in three environments: an ideal line-of-sight outdoor environment, an indoor environment, and an outdoor lunar analog. Linear distance is estimated from ToF, and several methods of DoA estimation — including applying a naïve phased array steering equation and MUSIC — are implemented and compared. The simulated estimates of DoA are finally compared to a real-world MIMO testbed, constructed from commercial off-the-shelf (COTS) components, developed at the University of Akron.

Publications: None yet.

13th Congressional District	OH Representative: Emilia Sykes

Marietta College

Ethan Miller



Junior, Petroleum Engineering
Advisor(s): Tej Gautam

Formation of Devil's Tower

Biography: I'm Ethan Miller, a Petroleum Engineering Major currently in my junior year of studies at Marietta College. I was born and raised around the area of Marietta and mainly chose Marietta College because it was local and was similar to my high school in terms of smaller class sizes. Some of my hobbies include outdoor activities, working out and staying in shape, and hanging out and playing games with friends. My current goals are to maintain a 3.5 or higher cumulative GPA all throughout my years at Marietta and also to graduate and find a company that aligns with my interests as a Petroleum Engineer here in the next couple of years.

Abstract: In this project I plan on talking about the formation of Devil's Tower, a famous historical monument located in Wyoming. I also plan on talking about the geological structure of Devil's Tower and the geological processes that formed this giant geological monument. I plan on talking about the composition of the monument and how it has been affected over time by the environment and climate of Wyoming as well.

Publications: None yet.

6th Congressional District	OH Representative: Michael Rulli

BALDWIN WALLACE UNIVERSITY

Sydney Miller

Junior, Neuroscience
Advisor(s): Clare Mathes

Sex Differences in Ethanol-Induced Brain Activity

Biography: My career and educational goal is to become a medical doctor specializing in allopathic medicine with a master's in clinical research, focusing on neuroscience. I aim to integrate medical practice with translational research to develop evidence-based treatments and advance understanding of the human brain. As a Neuroscience major, I am gaining research experience to strengthen my competitiveness for MD/MS programs, motivated by my passion for research sparked through opportunities at Baldwin Wallace and mentorship from Dr. Clare Mathes. To achieve this, I will continue research, volunteering, and physician shadowing while preparing for the MCAT. I aspire to enroll in an MD/MS program to gain expertise in medical research, enabling me to scrutinize treatments effectively and collaborate on new strategies. Post-medical school, I plan to pursue a neurology residency in Northeast Ohio, followed by a fellowship to further specialize in neurology or related fields, blending patient care with research.

Abstract: This project's primary goal was to determine if systemic ethanol administration induces neural activity in brain regions differently in male versus female rats. We would not be able to fully understand the effects of ethanol on the brain without looking at both sexes. Previous studies have focused on male rats, rather than female rats. Prevalence of alcohol use disorder is overall decreasing in the United States; however, it is increasing in women. In this study, we assessed differences in ethanol-induced neural activity in the central nucleus of the amygdala (CeC), the Lateral septum (LS), the Lateral hypothalamus (LH), and the nucleus accumbens (NuAc), which are critical in the perception and assessment of reward. To assess this, we quantified the number of cells containing Fos, a protein produced when neurons are active and can be visualized through immunohistochemistry. Male (n= 8) and female Sprague-Dawley rats (n=8) were given an intraperitoneal injection of saline or ethanol (20% at 12.5 ml/kg) and, 2 hours following the injection, euthanized via overdose of barbiturate and transcardially perfused to fix brain tissue. Coronal brain slices (80 µm) were processed for Fos immunoreactivity, mounted on gelatin-subbed slides, and counter-stained with methyl green. Images including the structures were taken, blinded, and Fos quantified using ImageJ. Fos counts per area between EtOH- and saline-injected groups were analyzed via independent-sample t-test (sig = $p<0.05$). The results show significant Fos expression in the CeC ethanol group as compared to the saline group. The second phase of this study will increase the sample size (total n=32) and bring sex differences into account. Understanding the impact of systemic ethanol administration on the brain can lead to a future study on a central mechanism approach. The administration of alcohol *directly into the brain* of rats may differ between male and female rats. This is important because this removes any differences in how the bodies of the male and female rats process alcohol and, instead, looks only at how their brains react to it.

Publications: None yet.

5th Congressional District	OH Representative: Robert Latta

THE OHIO STATE UNIVERSITY

Mason Mitchell

Fifth-Year, Aerospace Engineering
Advisor: Dr. Mo Samimy

Trapped Wave Resonance Tones Radiated Toward the Nozzle in a Supersonic Jet

Biography: I am in my fifth-year of study at Ohio State University in the Aerospace Engineering, B.S./M.S. Combined Degree Program. I work as a student research assistant at the Gas Dynamics and Turbulence Laboratory (GDTL) within the Aerospace Research Center, focusing on the aeroacoustics of screeching military-style jets. For extracurricular actives, I take part in the Buckeye Space Launch Initiative's NASA test engineering team and am the acting treasurer for OSU's chapter of Sigma Gamma Tau, the National Aerospace Honorary Society.

Abstract: The research project aims to provide a physical understanding of trapped wave (TW) resonance tones from a supersonic single jet. It is currently believed that TW is the result of a second mode of free shear layer instability with the spectral peaks of TW strictly appearing in the acoustic near field and forward arc of the acoustic far field. Although the appearance of TW in these regions of the acoustic field has limited documentation in existing literature, there is ongoing research on this phenomenon that has linked screech – a high amplitude resonance tone generated by supersonic jets – to the first or second harmonic of the TW fundamental frequency. In an effort to clarify this relationship, the supersonic single jet will be operated in flow regimes from high subsonic to highly underexpanded conditions to distinguish TW from screech and its harmonics. If this distinction is possible, the underlying physics of TW can be further accessed through an active flow control. In addition, focused schlieren will be utilized to access the nature of the coherent structures developed by the jet. The results acquired through this project will compliment and advance current interests within the aeroacoustics research community. It also has the potential to provide insights on techniques for the mitigation of acoustic loads on military aircraft and cabin noise in commercial aircraft.

Publications: None yet.

12th Congressional District	OH Representative: Troy Balderson

Seth Mitchell

Senior, Mechanical Engineering
Advisor(s): Dr. Joe Miller

Design of a Force Transmission System Within a Real-Time Apogee Control System on a High-Powered Model Rocket

Biography: Seth Mitchell is an undergraduate student at Cedarville University studying mechanical engineering with a minor in Biblical studies. He has always wanted to be a mechanical engineer, and as he started out his undergraduate at OSU in the engineering learning community. He then transferred to Cedarville and has spent much of his undergraduate career involved in both his academics and the music department. He has served as both a tutor and a grader for many engineering and mathematics classes. This year, he has kept himself busy by being the AIAA chairman, conducting graduate fluids research for his advisor Dr. Miller, and playing lead trumpet in the Cedarville Jazz Band. Outside of school, Seth obtained multiple professional internships in the academic, manufacturing, forensics, and aerospace industries.

Abstract: As part of the Cedarville University Mechanical Engineering Senior Design Capstone Course, a high-powered model rocket was designed for the NASA Artemis Student Launch Challenge. For the first time, airbrakes are integrated as a secondary experimental payload to dynamically alter the altitude of the rocket during flight using real-time data. The airbrakes consist of flaps actuated using a crank slider mechanism with a near-constant angular velocity ratio. The mechanical force transmission system was analyzed rigorously using computational (Computational Fluid Dynamics and Finite Element Analysis), analytical, and experimental techniques to determine both internal and external forces on the system. A lockup friction study was conducted for a Polyethylene Terephthalate Glycol collar on a carbon fiber rod to determine the coefficient of friction of this combination of materials. The controls system uses a probabilistic state space model, and the controller runs a Raspberry Pi Pico to control apogee. Full-scale tests are planned to validate the integrated system performance before final rocket delivery.

Publications: None yet.

12th Congressional District	OH Representative: Troy Balderson

THE OHIO STATE UNIVERSITY

Lincoln Montunnas

Senior, Aerospace Engineering
Advisor(s): Dr. Jesse Little

Restoration of High-Speed Wind Tunnel System

Biography: I am a fourth-year aerospace engineering student attending The Ohio State University. Alongside my education, I am also working at the Aerospace Research Center and as a math tutor. In the past, I have held two internships and worked for the engineering education department as an undergraduate teaching assistant. In my free time, I enjoy playing the guitar and soccer. After graduating in May 2025, I will be working as a structural engineer in the defense industry.

Abstract: The Ohio State University has a long history of working with high-speed wind tunnels. Several facilities were created in the past that have gone unused for many years. One such facility was a small size hypersonic wind tunnel. This wind tunnel received supply air from an electric heating apparatus. Restoring this facility, with a focus on the electric heater, could be useful for performing small-scale tests rapidly and at lower cost compared to tests using larger high-speed blowdown facilities.

Due to the time elapsed since its construction, documentation on the wind tunnel's design and capabilities is limited. By reviewing research conducted using the facility, it is possible to estimate the system's maximum capabilities. From this, viable testing conditions can be calculated where the heater could be used as a supply. Furthermore, the entire wind-tunnel system has been evaluated for overall sizing. Estimations have been performed to determine how long the wind tunnel system could run based on a provided vacuum chamber size and pressure. The heater will be inspected for damage and returned to an operational state, where it will be used for supplying heated air to the small-scale wind tunnel facility.

Publications: None yet.

2nd Congressional District	OH Representative: Brad Wenstrup

CLEVELAND STATE UNIVERSITY

Madisyn Moore

Junior, Civil Engineering
Advisor(s): Dr. Josiah Owusu-Danquah

Artificial Neural Network Models to Predict Superelastic Cyclic Response of Shape Memory Aerospace Material

Biography: Madisyn Moore is a junior at Cleveland State University, where she is pursuing a Bachelor of Science in Civil Engineering. With a strong passion for both architecture and engineering, she aspires to foster collaboration between architects and engineers in her future career. After completing her degree, Madisyn plans to launch her professional journey by working full-time in the industry. On campus, she actively contributes as the Chapter President of the National Society of Black Engineers and is also a member of the Link Scholar and ESS Scholar programs. Through the Ohio Space Grant Consortium (OSGC), Madisyn has had the opportunity to apply her classroom learning to hands-on research. She is excited to leverage the skills and experiences gained from OSGC in her academic endeavors, future research, and career development.

Abstract: This project aims to extend the development and application of Artificial Neural Network (ANN) models to predict the cyclic shape memory behavior of NiTiHf alloys, with a focus on aerospace and aeronautic structural components. While previous work centered on modeling the shape memory effect, which occurs due to heating and cooling, my ongoing literature review has revealed the broader potential of shape memory alloys (SMAs), particularly their mechanically activated superelastic behavior. For example, Dr. Santo Padula recently developed airless, non-pneumatic tires using superelastic SMAs, designed for rovers on Mars and the Moon, where traditional pneumatic tires would fail due to extreme environmental conditions. This innovation underscores the significant applications of SMAs beyond actuation, offering new opportunities in fields like space exploration [1].

Building on this, my research through the Ohio Space Grant Consortium (OSGC) seeks to adapt ANN models to capture the superelastic load-unload cycles of NiTiHf alloys. By refining these models, I aim to analyze their predictive accuracy for superelastic behavior under mechanical loading. This expanded approach will enhance our understanding of how these alloys perform under different conditions, ultimately contributing to the design of more reliable and efficient materials for aerospace, space exploration, and other advanced engineering applications.

Reference [1] Padula, S., & Creager, C. (2018, September). Shape Memory Alloy (SMA) Tires-A New Paradigm in Tire Performance. In Annual Meeting and Conference on Tire Science and Technology (No. GRC-E-DAA-TN59946).

Publications: None yet.

11th Congressional District	OH Representative: Shontel Brown

Elias Ng

Junior, Molecular Biology
Advisor(s): Michael Mendel, Heather Kuruvilla

Effects of Freezing on Insulin Regulation of Intracellular Solute Concentrations in the Freeze-Tolerant Spring Peeper (genus Pseudacris)

Biography: Elias Ng is a molecular biology premedical student at Cedarville University. Growing up, he was fascinated with biology and loved catching and examining the creatures around him. As a senior in high school, Elias was given the opportunity to volunteer with a research project concerning frog proteins and cryobiology at Cedarville University and has since become more heavily involved in moving this project forward. He is thankful to his mentoring professors for giving him the opportunity to participate in this research over these past few years and is honored to be able to present at the OSGC Student Symposium.

Abstract: Man's exploration of harsh environments has often been informed by phenomena observed in animals. A prime example is the cryobiology (the study of life in cold, harsh conditions) of certain North American frog species. In this case, scientists have observed members of the frog genera ryophytes, Pseudacris, and Rana, among others, which survive harsh North American winters. In the winter, these frogs undergo a frozen state, during which their body tissues and fluids freeze. Once spring arrives with warmer temperatures, these frogs are then able to re-emerge apparently unharmed by the process. Various studies have been conducted to explain the molecular pathways that lead to this amazing ability. Authors such as Storey and Storey have cited glucose and the associated insulin-glucagon pathway as an important cryoprotectant strategy for certain freezetolerant species in frogs such as wood frogs and leopard frogs. This study will specifically analyze the presence of the insulin signaling pathway in species of genus Pseudacris. To accomplish this, specimens of freeze-tolerant Pseudacris species were incubated, euthanized at different stages of entering into their frozen state, and preserved at -80 C so that their proteins could later be extracted and analyzed. Specimens from non-freeze tolerant species were also prepared in similar fashion, in order that their proteins could be compared to the freeze-tolerant species. The proteins extracted from these specimens were then analyzed using ELISA and western blot testing to characterize the proteins and compare insulin content between the extracts from these frogs.

Publications: None yet.

1st Congressional District	OH Representative: Greg Landsman

MIAMI UNIVERSITY

Jack Nomina

Junior, Mechanical Engineering
Advisor(s): Dr. Jeong-Hoi Koo

Design of Haptic Actuators Based on Smart Materials for Virtual Reality Applications

Biography: I'm originally from West Chester, Ohio, and I am currently a student double majoring in mechanical engineering and music performance at Miami University. Aside from my research, I am also involved in many extracurricular student organizations. For the year of 2024, I held the role of vice president in three of them, namely Engineers Without Borders, the professional engineering fraternity Theta Tau, and the American Society of Mechanical Engineers. I am also involved in the music department at my university, having played principal oboe in both the wind ensemble and symphony orchestra on campus. Outside of school, I love to work out, go for hikes, and take care of my plants.

Abstract: This research is centered on two important technological concepts: haptic systems and smart materials. Haptic systems are methods to receive tactile feedback from digital electronic systems, like how a cell phone vibrates upon a notification's appearance. Smart materials are generally defined as materials that have been designed to respond in a certain predictable way to an external stimulus. The question posed by this research is simple: how can smart materials be implemented to create improved haptic feedback systems? This work is important and valuable for various reasons, both for leisure/entertainment purposes as well as simulations and education. Improved haptic systems allow for a more realistic virtual reality experience. For those who enjoy spending time in virtual environments, an improved haptic system directly correlates with an improved experience. To put it in simple terms, this haptic technology has the potential to allow someone to feel when they touch something in virtual reality. Currently, this research is being conducted by testing the responsiveness of Electro-Rheological fluid (a smart material liquid that becomes more viscous as it is exposed to an electric field) to different stimuli. A testing module, operated by an Arduino (a common circuit board), has been set up to facilitate this. Ultimately, this will allow the feedback released from the material to be predicted and harnessed within a haptic system. Put in simple terms, the Electro-Rheological fluid could be stiffened and relaxed in order to simulate different touch-based sensations for users. This feedback could be very useful for training professionals that work under extreme conditions in a virtual, safe environment. Surgeons could practice while receiving realistic feedback without needing an expensive surgery doll, or potential astronauts could perform simulated maintenance without needing to head up into space. These possibilities mean that this research has the potential to be useful for many different applications.

Publications: None yet.

8th Congressional District	OH Representative: Warren Davidson

University of Dayton

Julian Pabon

Undergraduate Student, Mechanical Engineering
Advisor(s): Sidaard Gunasekaran

Experimental Investigation of PRANDTL-D3C Near-Wake

Biography: Julian Pabon is a senior student pursuing a bachelor's in mechanical engineering with a concentration in aerospace at the University of Dayton. He plans to continue his education and work on a master's degree in aerospace engineering after graduating in May 2025. His background is involved in undergraduate research for two years where he found his passion for aerospace systems and controls. He seeks to continue developing a skillset in research to prepare for the aerospace field.

Abstract: The disappearance of the tip vortex in the near wake of a wing challenges conventional aerodynamic theories and presents new opportunities for drag reduction. Recent computational studies suggested that the PRANDTL-D3C wing—a swept, multi-element, and tapered wing with a bell-shaped lift distribution—exhibits this tip vortex disappearance. The current study explores the wake topology underlying this claim experimentally and numerically. Force-based and Particle Image Velocimetry (PIV) investigations were conducted on a 1:11 half-span scaled model of the PRANDTL-D3C wing to characterize the wake at various angles of attack. All experiments were performed in the University of Dayton Low Speed Wind Tunnel (UD-LSWT) using an open-jet test section configuration. Streamwise PIV was conducted at a chord-based Reynolds number of 185,000 across different spanwise stations to characterize the near-wake momentum deficit, and the non-planar wake formation. The experimental results showed a strong correlation between the wake velocity momentum deficit profiles and the FlightStream® panel method simulations, confirming reduced momentum deficit drag near the wingtips and higher aerodynamic efficiency compared to an elliptical lift distribution without a span increase at the design condition. Additionally, the analysis
demonstrated that the near wake at this angle of attack lacks evidence of a trailing vortex, providing experimental validation of the computational predictions. However, to conclusively confirm the absence of the vortex, cross-stream PIV measurements are required to capture the full three-dimensional wake structure.

Publications:
Experimental Investigation of a Novel Morphing Wing Design
DOI: 10.2514/6.2024-1349

10th Congressional District	OH Representative: Michael Turner

THE OHIO STATE UNIVERSITY

Jinit Patel

Junior, Aerospace Engineering
Advisor(s): Dr. Mo Samimy and Dr. Nathan Webb

Plasma Induced Active Flow Asymmetric Control for Jets

Biography: Jinit Patel is a third-year Aerospace Engineering student at The Ohio State University, pursuing a Minor in Computer Science. He conducts research at the Aerospace Research Center (ARC), focusing on thrust vectoring using plasma actuators on nozzle geometries. His work involves data collection and experimental fluid dynamics, leveraging skills in SolidWorks, MATLAB, and SLA 3D printing. Jinit is an active member of Buckeye Vertical, a drone club on campus, where he contributes to the avionics and structures teams. His work there includes applying computational fluid dynamics (CFD), finite element analysis (FEA), and PID tuning. Additionally, he is a member of the American Institute of Aeronautics and Astronautics (AIAA) and Sigma Gamma Tau, the aerospace honor society, reflecting his dedication to both professional and academic excellence in the field.

Abstract: The Navy has long been interested in adjusting the angle of thrust from exhaust nozzles on aircraft (thrust vectoring) for diverse applications like hyper-maneuverability and vertical take-off/landing (VTOL). VTOL would facilitate the use of fixed-wing unmanned aerial vehicles (UAVs) from non-flight deck-equipped vessels. Alternative applications of thrust vectoring are extensive. Thrust vectoring is currently produced by a complex, heavy, faceted nozzle design. Another method is Coanda-based Thrust Vectoring (CTV), which utilizes the Coanda effect to attach jets to “reaction surfaces” but can bleed up to 15% of primary air flow. As an alternative, this work explores the use of localized arc-filament plasma actuators (LAFPAs). These exploit flow instabilities to control flow characteristics, offering an energy-efficient, low-power method of thrust vectoring. Similar to a CTV, this ability could enable them to attach/detach flow from a reaction surface.

LAFPAs will initially be mounted on a CTV-inspired reaction surface. Experimental sweeps of excitation frequency and other excitation parameters will be conducted, and the resulting flow interrogated using schlieren and pressure measurements to assess the active flow control concept’s (AFCC) jet deflection capability. Additionally, SLA 3D-printed nozzles, Flexible Reaction Surfaces, are now being used to parameterize key factors such as reaction surface length and angle of curvature. These provide a cost-effective alternative to traditionally manufactured boron nitride nozzles, enabling more iterative design exploration. This addition aims to investigate the effects of these varying parameters on jet deflection. Time-resolved schlieren will document flow unsteadiness, while PIV measurements over the surface will confirm thrust vectoring by observing cross-stream velocity and provide insights into LAFPAs' control mechanism.

Publications: None yet.

4th Congressional District	OH Representative: Jim Jordan

Brady Phelps

Senior, Advanced Computing
Advisor(s): Chad Mourning

Pilot Weather Awareness: A 3D Augmented Reality Approach

Biography: Brady is a senior at Ohio University, pursuing a degree in Advanced Computing with a minor in Mathematics. He has a passion for research and has presented his work at conferences both domestically and internationally, many with a focus on the space and aviation industries. Currently, he is an intern at NASA Glenn, with previous research and internship experiences with NASA, the University of Connecticut, the National Park Service, Ohio University, and Procter & Gamble.

Abstract: Weather is the third leading cause for all plane crashes, and the FAA has placed emphasis on creating new applications and techniques for cockpit weather awareness. This research addresses these concerns by introducing a 3D augmented reality alternative for enhanced weather visualizations during flight. The new approach allows pilots to observe comprehensive 3D weather overlays through a headset. The current version of the software is fit for use pre-flight, allowing pilots to make more calculated and informed decisions on their flight plans. The application allows users to be able to physically turn and observe the surrounding weather systems that cannot be seen with the naked eye. This innovative approach seeks to offer better situational awareness and decision-making capabilities. This project represents a step forward from traditional 2D methods, promising a more engaging and effective solution for monitoring weather conditions. Through this work, we aim to increase weather awareness and comprehension through our tool and make the skies safer.

Publications: 9

12th Congressional District	OH Representative: Troy Balderson

OHIO NORTHERN UNIVERSITY

Maxwell Phillips

Senior, Computer Science
Advisor(s): Dr. Firas Hassan, Dr. Ahmed Ammar

A Paradigm for Generalized Multi-Level Priority Encoders

Biography: I am a senior at Ohio Northern University studying computer science with a minor in astronomy. I am from the village of New Washington, Ohio. During my childhood, I became primarily interested in two topics: outer space and video games. Through gaming, I became familiar with computers, participated in robotics competitions, and learned to program. My fascination with the stars led me to study them academically. Now, I am combining these interests in my current program of study and in my future career. I am honored to be supported by NASA and OSGC in my research which I hope to apply to encryption and scientific computing related to extraplanetary endeavors.

Abstract: We introduce a generalized method for constructing high-precision priority encoders by dividing them into multiple levels. This builds upon our previous work which introduced the idea of two-level hardware. We analyze hardware delay and complexity as a function of input precision. Our results show that the two-level priority encoder reduces complexity by about half, with a corresponding increase in delay. Adding additional levels introduces incremental improvements but has overhead and diminishing returns. Thus, each number of levels is best for a particular range of input precisions.

Publications:

1. Maxwell Phillips, Ahmed Ammar and Firas Hassan, “A Generalized Multi-Level Structure for High-Precision Binary Decoders,” IEEE 67th International Midwest Symposium on Circuits and Systems, Springfield, MA, USA, Aug. 11-14, 2024.
2. Riley Jackson, Maxwell Phillips, Firas Hassan, and Ahmed Ammar, “High Precision Carry-Look-Ahead Logic for Negation, Absolute Value, and Two's Complement,” 30th IEEE International Conference on Electronics, Circuits, and Systems, Istanbul, Turkey, Dec. 4-7 2023.
3. Maxwell Phillips, Firas Hassan, Ahmed Ammar, and Nathan Hagerdorn, “Leveraging a Novel Two-Level Priority Encoder for High-Precision Integer Multiplication,” IEEE 66th International Midwest Symposium on Circuits and Systems, Tempe, AZ, USA, Aug. 6-9, 2023.

5th Congressional District	OH Representative: Robert Latta

Marietta College

Alex Posey

Junior, Petroleum Engineering, Geology
Advisor(s): Dave Freeman

Oil and Gas Logistics

Biography: My name is Alex Posey, I am from New Lexington, OH. I am currently studying Petroleum Engineering and Geology at Marietta College. I am heavily interested in all new technology in the oil and gas sector.

Abstract: My project aims to exam the logistics of transporting materials to well pads and attempt to optimize these processes to increase efficiency. The main aim will be to see if several smaller loads would be more efficient than one larger load. The secondary aim will be to examine ways to improve loading density of these shipments to further increase efficiency. By implementing these findings the overall efficiency and potential savings of oil and gas operations should drastically increase.

Publications: None yet.

12th Congressional District	OH Representative: Troy Balderson

Anthony Quear

Junior, Mechanical Engineering (Premed)
Advisor(s): Dr. Sam Song

A Systematic Review of Telemedicine Based on Perception and Interaction

Biography: I am a third-year mechanical engineering student whose also in a premed track. My intent on medical school was not fully realized until midway through my sophomore year. Not wanting to give up my engineering degree entirely, I kept my engineering and medical study separate, that was until I was given the opportunity to work on my current research assignment that explores the latest technology in telemedicine. This happened to be a perfect fit for my unusual educational route. A crossroads between engineering and medicine, this project showed me the ways in which my engineering background and medical future could complement each other. After medical school I plan on specializing in pediatric cardiovascular surgery. I hope to work on the forefront of robotic and telesurgery.

Abstract: Telemedicine is an ever-evolving field that facilitates remote healthcare delivery, essential for reaching patients in remote and underserved areas all over the world. This literature study explores telemedicine technologies focused on perception and interaction. A systematic search was executed on IEEE Xplore and PubMed using keywords (telemedicine or telesurgery) and (visual or vision or perception or interaction) and (3D or touch or body sound or auscultation or palpation) and (remote) NOT (review). The search provided a window into the current state of telemedical technologies ranging from haptic feedback interfaces for telepalpation to mixed reality systems for surgical telementoring and AI-driven image-based diagnostics in wound care categorization. Analysis of these technologies aims to provide an overview of their current state and potential for future advancements in telemedicine.

Publications: None yet.

13th Congressional District	OH Representative: Emilia Sykes

OHIO NORTHERN UNIVERSITY

John Radey

Senior, Mechanical Engineering
Advisor: Dr. David Sawyers

Electromagnetic Traversal Robot

Biography: My name is John Radey, I am a Senior Mechanical Engineering student at Ohio Northern University with a concentration in robotics. My research interests are robotics, autonomous systems, field robotics and space robotics. My professional goals consist of becoming a professor and mentoring students while continuing my research in robotics, field robotics, and space robotics.

Abstract: Maintenance of space structures, such as the International Space Station, currently requires astronauts to conduct space walks, which are time-consuming and pose significant risk. In contrast, satellites are often decommissioned once maintenance becomes necessary, as in-orbit servicing remains a developing technology. This research explores an autonomous solution through the design and prototyping of an Electromagnetic Traversal Robot (EMTR) to address challenges in mobility and localization for autonomous maintenance. The EMTR aims to provide a safer, more cost-effective alternative for in-orbit servicing of space structures. Utilizing the Hall effect to sense the position of its magnetic feet, the EMTR offers enhanced precision in movement. This robot demonstrates the potential for mobile maintenance and surveying robots to extend the lifespan of space structures through autonomous in-orbit servicing and to reduce the need for dangerous space walks.

Publications: None yet.

4th Congressional District	OH Represent: Jim Jordan

BALDWIN WALLACE UNIVERSITY

Caely Ressler

Academic Level, Major: Senior, Engineering
Advisor(s): Paul Penko

Development of a Power Generating Bacterial Fuel Cell

Biography: Caely is a senior at Baldwin Wallace University majoring in engineering with a minor in mathematics. She currently holds a 3.99 GPA and is also an active member of the Baldwin Wallace "Marine Energy Collegiate Competition" team in addition to her individual research project with the bacterial fuel cell. Outside of the classroom, Caely is a member of the Baldwin Wallace chapter of "Fellowship of Christian Athletes" as well as a four-year member of the Women's Basketball Team, where she has garnered All-Conference and Academic All-Conference honors the past two years. Upon graduation, she plans to enter a career in engineering project management.

Abstract: This project has been undertaken to design, build and test a bacterial fuel cell, with the intent of determining the performance of a prototype on local lake water to determine if a series of cells can produce a useful amount of electrical energy. The prototype design consists of a PVC shell, carbon tubing for the anode, and a proton-exchange membrane (PEM) against a copper screen for the cathode. Naturally occurring bacteria consume organic material whereby hydrogen ions are produced, which releases electrons conducted by the carbon tubing. The hydrogen ions migrate to the PEM and combine with free oxygen in the air by taking on electrons from the anode to produce electrical current.

Water from a local lake will be analyzed for bacterial content and the prototype fuel cell will be tested on the lake water. Voltage and current will be measured and recorded. An assessment will then be made regarding the viability of the design and whether the concept can be scaled to produce a useful amount of electrical power.

Publications: None yet.

5th Congressional District	OH Representative: Robert Latta

Collin Richards

Junior, Chemical Engineering
Advisor(s): Dr. Byung-Wook Park

Design of Flexible Microheaters Using Laser Induced Graphene for Biomedical Applications

Biography: I am a junior Chemical Engineering major at Youngstown State University. My biggest academic interests are electrochemistry, math, physics, materials science, and any work in a lab. My career goal is to make meaningful contributions to scientific advancement through academic research, or through a research and development role in industry. Outside my studies, I love watching football and taking nature walks. I have three cats named Lennie, Ronnie, and Max and a dog named Charlie at my parents' house.

Abstract: Microheaters made from nanomaterials offer superior performance for thermal management, making them ideal for applications requiring precise temperature control. Designing compact, cost-effective heating elements that integrate seamlessly with devices is particularly desirable. Flexible microheaters with tunable conductivity and versatile interfacial properties are well-suited for advancing wearable technologies, such as transdermal patches. Laser Induced Graphene (LIG)-based heating devices have garnered significant attention due to their low power consumption, rapid response times, and the ability to be rapidly prototyped using direct laser writing (DLW). This process involves the laser-induced graphitization of polyimide into LIG. In this project, a flexible microheater featuring an innovative design and novel nanocomposite materials was developed and characterized. The findings demonstrate a promising pathway for creating flexible bioelectronics with integrated, controllable thermal management systems, offering vast potential for biomedical applications.

Publications: None yet.

6th Congressional District	OH Representative: Michael Rulli

CLEVELAND STATE UNIVERSITY

Aliah Rodriguez

Junior, Civil Engineering
Advisor(s): Dr. Srinivas Allena

Integrating Carbon Fibers in Ultra-High-Performance Concrete (UHPC)

Biography: Aliah Rodriguez is a first-generation undergraduate student studying Civil Engineering with a minor in Mathematics at Cleveland State University. She currently resides in Cleveland but is originally from the Southeast Ohio area. Aliah harvests a deep interest in the STEM field, and this sparked from a young age through her participation in robotics and SeaPerch teams in junior high. As she grew older, Aliah realized this passion presented the opportunity to further advance and support the world and its people. So, since, she continues to delve into opportunities that further innovate our current understanding of the civil engineering and construction industry to support this endeavor. Additionally, Aliah is also very involved on campus and the Greater Cleveland area where she advocates for Latino and other minority voices through community.

Abstract: Ultra-high-performance concrete (UHPC) is renowned for its exceptional strength and durability, often attributed to the incorporation of steel fibers that enhance its tensile ductility. This study investigates the potential of carbon fibers in UHPC, driven by the growing demand for innovative and sustainable construction materials. The research focuses on optimizing UHPC mixtures with varying proportions of carbon fibers, either fully or partially replacing steel fibers, and evaluates the fresh and mechanical properties of these mixtures following ASTM standards.

The results aim to demonstrate the effectiveness of carbon fibers in improving the tensile ductility and overall mechanical performance of UHPC while offering advantages in sustainability and material innovation. Furthermore, the study explores the practical implications of adopting carbon fibers in structural applications, proposing a transformative approach to the use of UHPC in modern construction. Through systematic analysis and experimental validation, this research seeks to promote the broader adoption of carbon fibers in UHPC, advancing engineering practices and enabling the development of high-performance, sustainable concrete structures.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

OHIO NORTHERN UNIVERSITY

Caleb Scheideger

Senior, Mechanical Engineering Conc. Aerospace Engineering
Advisor(s): Dr. Louis DiBerardino

Minimizing the Gap between Pre-and Post Spaceflight

Biography: I was born and raised in Westerville, Ohio. I have developed a strong passion for bioastronautics through unique research opportunities. Over the summer, I interned at Embry-Riddle Aeronautical University, where I contributed to National Science Foundation (NSF) funded research on investigating countermeasures for musculoskeletal and cardiovascular health in microgravity. This experience solidified my aspiration to pursue advanced degrees in mechanical engineering and biomechanics, with a focus on leveraging interdisciplinary approaches to improve human health and performance in extreme environments through designing systems and applications. My goal is to get the most out of this OSGC experience and leverage my findings with existing research.

Abstract: Long-duration space missions pose significant challenges to astronaut health, primarily due to the detrimental effects of microgravity on musculoskeletal and cardiovascular systems. This research proposal aims to address the critical gap between pre- and post-spaceflight physiological conditions, focusing on the marked decline in muscle mass, bone density, and cardiovascular function. Existing countermeasures, such as resistive exercise, are insufficient to prevent muscle atrophy and bone demineralization, highlighting the need for novel solutions. Neuromuscular Electrical Stimulation (NMES) emerges as a promising intervention, capable of eliciting muscle contractions to maintain function and mitigate atrophy. By integrating NMES into existing exercise regimens, we hypothesize enhanced efficacy in preserving lower body musculature, maintaining bone density, and supporting cardiovascular health. This proposal leverages findings from dynamometer force acquisition and bed rest studies, combined with meta-analytic insights into NMES's effectiveness in clinical settings, to optimize protocols for spaceflight application. The ultimate goal is to develop robust countermeasures ensuring astronaut health for safe interplanetary travel. Further investigations including OpenSim software modeling and predictive framework will be investigated in this research for later implementation and analysis.

Publications: None yet.

12th Congressional District	OH Representative: Troy Balderson

Marietta College

Abigail Shartle

Junior, Petroleum Engineering and Geology
Advisor(s): Dr. Andrew Beck

Petrographic Paring of Meteorites

Biography: Abigail (Abby) Shartle is a Junior (Class of 2026) studying Petroleum Engineering and Geology at Marietta College. Abby is advised by Dr. Andrew Beck at Marietta. This is her first project with OSGC and she plans to research Meteorite Pairs. At Marietta College she is involved in many career development organizations including Society of Petroleum Engineers, International Association of Drilling Contractors, and American Association of Drilling Engineers.

Abstract: In 2021, AMN 44(1) reported a potential pairing of R chondrites PRE 17271 and 17272 with the PRE 95404 pairing group. Forming at relatively high oxidation and sulfidation states, the R chondrites represent a unique reservoir of accretionary material in early Solar System epochs. Thus, if PRE 17271 and 17272 represent a separate fall from PRE 95404, further isotopic and bulk compositional study of those samples could expand upon the understanding of accretion in highly oxidized environments.

In this study, a junior-standing undergraduate student will perform a petrologic analysis of PRE 17271 and 17272 to identify the presence of unique petrologic features reported in PRE 95404. If those unique features are also present 17271 and 17272, a pairing would be supported. Miller et al. (2017, GCA, 209:15) report unique petrologic signatures in PRE 95404 as: large (200 μm) sulfide nodules, containing pyrrhotite, pentlandite, and magnetite with phosphate and Cu-rich lamellae, and, a high abundance of unequilibrated clasts, which contain type 3.0-3.4 Ordinary Chondrite-like silicate compositions. The student will perform petrologic examinations using a petrographic microscope and SEM. SEM analysis will provide elemental maps of sulfide nodules and silicate endmember compositions, and these results will be compared to those reported in PRE 95404 by Miller et al. (2017) to test the petrologic pairing.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

KENT STATE UNIVERSITY

Andrew Shenal

Junior, Environmental Studies
Advisor(s): Dr. He Yin

A Multi-Sensor Approach to Monitor Cropland Irrigation within the Lake Erie Basin

Biography: Andrew Shenal is a junior at Kent State University majoring in Environmental Studies with minors in GIS and Geography. His research focuses on leveraging remote sensing technologies to promote environmental justice and monitor land use and land cover change. Currently, Andrew serves as a Research Intern at the Fair Housing Center for Rights & Research in Cleveland and previously worked as an Environmental Intern with the Ohio Department of Transportation. As an undergraduate research assistant in Kent State's Remote Sensing and Land Science Laboratory (SensLand), he contributes to a project integrating remote sensing with Tribal ecological knowledge to support the return of land to Indigenous communities in California.

Abstract: As shifts within the climate continue to create greater weather variability and overall warmer temperatures across the globe, farmers are feeling a pressing need to irrigate their agriculture. Mapping irrigation within the Midwestern and Eastern US states is challenging as higher availability of water resources has created less interest and therefore less available data and regular monitoring. Despite this, existing studies reported an increasing trend in irrigation in these regions. This research aims to bridge this gap by mapping local temporal trends in the extent of irrigated land around the Lake Erie Basin. Using Landsat 8 and 9 I will apply currently available irrigation mapping methods for the Lake Erie Basin, which will then allow me to compare those results with those of Sentinel-1 and Sentinel-2 as they have not been previously relied on for mapping irrigation change. The final output of this project will include 1) 30-m resolution annual irrigation maps from 2013-2023, 2) a comparison of irrigation mapping with and without Sentinel-1 and Sentinel-2, and 3) maps showing irrigation expansion from 2013-2023.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

Mason Shultz

Senior, Mechanical Engineering
Advisor(s): Dr. Jeong-Hoi Koo

Audio Haptics

Biography: My name is Mason Shultz. I am a senior mechanical engineering student at Miami University. I am from Perrysburg, Ohio, a suburb of Toledo. I am the son of Jackie and Rodney Shultz, and am the brother of Zach, Austin, Bennett, and our dog Milo. I graduated from Perrysburg High School in 2021. In my spare time, I enjoy exercising by running or lifting weights, and love playing a variety of sports including basketball, disc golf, pickleball, softball, and many others. I love attending Miami University sporting events during my free time. Otherwise, I am a lifetime fan of The Ohio State Buckeyes and a fan of all Cleveland sports teams. After graduation in May, I will begin working as an Entry-Level Mechanical Engineer for Salas O'Brien in their Cincinnati office.

Abstract: Audio haptics have many important applications to the virtual worlds that surround us. Touchscreens and other electronic devices that are used daily utilize piezo actuators and haptic signal transmitters to transmit audio and haptic signals to improve the user experience. In this study, the interplay of audio, vibration, and force sensor data during the motion of dragging a solid object across varied surfaces is investigated. Recordings for audio and force signals will be conducted with a UR3e Universal Robot to ensure repeatability of trial. A microphone will be attached to the shaft of a pencil, which will be attached to the robot arm. The robot will be programmed to drag the pencil across a surface at varying speeds and forces. Audio will be recorded by the microphone and downloaded using Audacity software. An accelerometer stuck on a piezo actuator will detect vibrational feedback from the audio file. This acceleration signal will be processed through a data acquisition unit which will then convert the signal into a digital signal which can be analyzed using MATLAB. Once the audio and vibrational feedback signals are converted to readable data, comparisons and conclusions can be drawn between the two signals.

Publications: None yet.

9th Congressional District	OH Representative: Marcy Kaptur

Nathan Smith

Senior, Field Ecology
Advisor(s): Dr. Sarah Wyatt

***Sphingomonas sanguinis*: Microgravity Adaptations and Plant Growth Promoting Traits.**

Biography: I am a senior at Ohio University that majors in Field Ecology with pursuits of a minor in Geography and a certificate in Geographic Information Systems (GIS). In the fall of 2023, I joined Dr. Sarah Wyatt's lab to research the molecular pathways associated with *Arabidopsis thaliana* gravitropism. I am a finalist and winner of the Student Spaceflight Experiment Program put on by the National Center for Earth and Space Science Education. This last fall, my team and I watched our project launch to the International Space Station from Kennedy Space Center. I am currently working with a novel bacterium found on the International Space Station and my research focuses on auxin and how its movement influences primary root and root hair growth and development. I am on track to graduate in the Fall of 2025 and will then pursue a master's degree in plant biology.

Abstract: Plant Growth Promoting Bacteria (PGPB) are increasingly advantageous and appealing for sustainable agriculture practices on Earth. For future long-term space endeavors, bioregenerative agriculture will be vital to the success of missions. Novel bacterium, *Sphingomonas sanguinis* B3A, was identified on the International Space Station (ISS). The bacterium's plant growth promoting properties makes it a prime candidate for assisting in space and Earth agriculture in the future. All organisms on Earth have adapted to habitats and conditions suitable for life, some major influences being gravity, temperature, and radiation. However, on the ISS there is microgravity, more extreme temperatures, and higher levels of radiation which can impact biological functions. To evaluate the interaction of *S. sanguinis* B3A with *Arabidopsis thaliana*, a spaceflight experiment was conducted on the ISS. Additional experimentation of the interaction on the ground has shown that there is increased root and shoot mass in Arabidopsis plants that interacted with the bacteria, compared to controls. Metabolic tests on the bacterium were also conducted to establish the defining characteristics of the strain. Further experimentation will utilize Arabidopsis seed lines with fluorescent tags on proteins in the auxin pathway to observe the movement of internal and bacterium produced auxin in seedling roots responding to an altered gravity vector. Seed lines are currently being grown for the experiment. Understanding the critical interactions of plants and microbes benefits not only terrestrial agriculture, but also further advances the field for bioregenerative agriculture for long-term space missions.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

KENT STATE UNIVERSITY

Mark Stallone

Senior, Aerospace Engineering
Advisor(s): Dr. Jeffery Balcerski

PC/104 Main Control Board (MCB) and Electrical Power Supply (EPS) Development for Space Applications

Biography: Mark Stallone is a current senior Aerospace Engineering Student at Kent State University (KSU). After completing his bachelor's degree, he will further pursue his education by working towards a master's degree in aerospace engineering at Kent State University. During his time at KSU, Mark has worked in manufacturing, process engineering, and product development through computational fluid dynamics at Micropore Inc., providing valuable in-industry experience. As a student, his involvement in the KSU High Power Rocket Team as the Avionics Lead has shaped his love for electronics, rocketry, and solving engineering challenges. This experience has been vital in his development of a flight computer, named H.A.V.O.C., which aims to serve as an all-in-one controller, data logger, and communications system for amateur rocketry. Mark is committed to learning more about the systems responsible for all vital functions of spacecraft and aims to help develop these in his future endeavors.

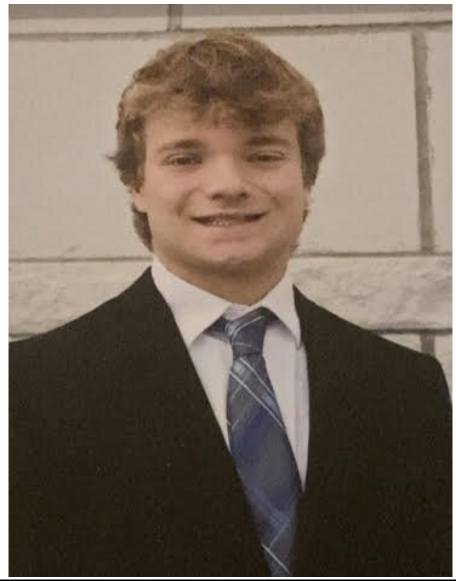
Abstract: This research project focuses on developing low-cost PC/104 PCBs for CubeSats. CubeSats often rely on expensive commercial electronics solutions, notably electrical power supply (EPS) boards and main control boards. These can cost thousands of dollars and pose a financial burden to institutions that are breaking into the CubeSat development field. This project aims to develop in-house EPS boards that reduce costs while ensuring high reliability and adaptability to most commercial systems. By selecting components with high environmental ratings, these boards can withstand the temperature changes and radiation present in LEO, ensuring a long mission lifecycle. Size constraints of the PC/104 form factor prove to be difficult to ensure redundancy and functionality in the physical limitations of the space available.

Additionally, this research aims to develop a main control board that can perform critical functions such as: spacecraft positioning, status monitoring, and system communications. Design challenges include managing high frequency interference, optimizing component selection, and meeting the physical limitations of the PC/104 form factor (90 x 96 mm). Templates designed specifically for this standard ensure fitment with commercial systems and with other in-house developed CubeSat boards.

Publications: None yet.

14th Congressional District	OH Representative: David Joyce

Lucas Stammen



Junior, Mechanical Engineering
Advisor(s): Dr. Ala Qattawi

Transformative Aeronautics Concepts

Biography: Hello, my name is Lucas Stammen, son of Bob and Ronda Stammen. I have two siblings Michael Stammen and Katey Ahrens. I am currently an undergraduate student at the University of Toledo studying Mechanical engineering. While I am in college, I like to involve myself in activities including UT Rocketry as well as intramural sports basketball and football.

Abstract: I am originally from the small town of Versailles Ohio where I attended grade school and was involved in multiple sports and activities. Now while attending the University of Toledo I am in search of my future career in engineering. I am looking forward to my internship with Midmark corporation this coming spring semester.

My last few internships I will be looking to intern at Wright Patterson Airforce Base and will also be looking into internship opportunities with NASA and or SpaceX. Depending on where I am working and if they require it, while I graduate with my bachelor's degree in mechanical engineering, their requirements will determine whether I will continue to go to school to pursue my master's degree.

Publications: None yet.

8th Congressional District	OH Representative: Warren Davidson

Adin Stoller

Junior, Mechanical Engineering w. Robotics
Systems Minor
Advisor(s): Dr. Robert Lowe

Mechanical Characterization of Unique 3D-Printable Elastomer Subspecies

Biography: Adin has been interested in robotics and automation since middle school, where he joined a Lego robotics team to foster his growing passion in mechanical design. Attending the University of Dayton for a degree in mechanical engineering with a minor in robotic systems, Adin has positioned himself in a new field: soft robotics. After an internship at the University of Dayton Research Institute in the Additive Manufacturing Technology Development group, Adin saw the potential for synergy between 3D printing and the next generation of robots.

Abstract: Recent innovations in the space of Additive Manufacturing (AM) and 3D printing have resulted in increasing print complexity and resolution as well as an ever-expanding library of materials from which to print. While this has dramatic implications for every field supported by AM, the field of Soft and Wearable Robotics (SWR) has considerable potential to benefit from continued innovations in AM. 3D-printing methods, such as Digital Light Processing (DLP) in particular, enable developers to design and print complex structural components for SWR systems. Unlike other AM methods, such as Fused Filament Fabrication (FFF), DLP allows for the selection of a wide range of elastomeric materials optimized for SWR needs (e.g., high strain, extreme temperatures, and self-healing). Additive Manufacturing has long allowed for the creation of basic SWR prototypes, such as pneumatically actuated fingers.

The introduction of self-healing elastomeric materials has allowed for even greater innovation and complexity in SWR. By designing modular systems, the ability to selectively heal certain subspecies of a given material will result in graded hardness, percent elongation, and self-healing efficiency across a structure with distinct printed components. Work therefore must be done to characterize and identify suitable subspecies via varying chemical composition within each 3D-printable resin and performing mechanical characterization via uniaxial tension testing. Using this data, optimized variants of the material can be highlighted for future use in modular soft robotic systems.

Publications: None yet.

1st Congressional District	OH Representative: Greg Landsman

Bryce Stoltz

Senior, Geology B.S.
Advisor(s): Dr. Courtney Wagner

Identifying Magnetotactic Bacteria in Acid Mine Drainage Sites

Biography: I am currently pursuing a Geology B.S. with a chemistry minor. I have always had a deep fascination with the natural sciences. I remember growing up doing at-home- experiment kits, one of which was growing our own crystals. I also remember my grandpa giving my sister and me tons of different minerals and rocks growing up, which I spent much of my time looking at. I would go on walks down my grandparents' driveway, through the woods and various other common areas, and pick up rocks that I thought were interesting. In high school, I still did not know that I could pursue a profession in geology.During my time in high school, I took dual credit courses such as biology, government, and others. My favorite of these was a course I took in environmental science which cemented my interest in the Earth Sciences. This prompted me to begin my undergrad journey as an Environmental Studies major at Kent State University, and my previous dual credit courses allowed me to jump ahead a year in my undergraduate standings. I took a course called "Earth and Life Through Time" which I enjoyed so much that I ended up switching to a Geology major. In my undergraduate studies, I have been exposed to minerals and geologic structures. Both of these experiences have helped me developed an interest in mineral formations. I hope to impact the lives of others through mineral exploration and through sustainable mining practices.

Abstract: Magnetotactic bacteria (MTB) are microscopic organisms that biomineralize magnetic particles in their cells to navigate within the water column toward the oxic-anoxic interface (OAI), a chemocline which is typically found near the water-sediment interface. MTB are abundantly found across the globe and can even live in some 'extreme' environments with pH levels ranging as low as 1 and as high as 10, and temperatures ranging from near freezing to 60 degrees Celsius. These harsh environments make MTB great analogs for extraterrestrial life and early life on Earth. For this project, water samples were taken at various parts of a stream that has been impacted by agricultural practices and, more importantly, acid mine drainage. Samples were collected along a transect, starting upstream from the acid mine drainage (where there was just agricultural impact) and finishing downstream of the acid mine drainage. This acid mine drainage is the result of coal mines that were active up to the 1970s, when they were then abandoned. Water and oxygen react with pyrite present in the mines/spoils which contribute to increased levels of dissolved heavy metals and decreased pH and dissolved oxygen levels. These conditions serve as our extraterrestrial analog environment in this study.

Water quality monitoring has been performed to track how dissolved oxygen and pH has evolved in the samples along with changes in temperature. Moving forward, I have plans to implement light microscopy to identify MTB in the samples. Electron microscopy will then be used to further image and identify the MTB and the magnetic particles that they are biomineralizing. This will help in our understanding of potential extraterrestrial life forms and how they might record these environments.

Publications: None yet.

14th Congressional District	OH Representative: David Joyce

WRIGHT STATE UNIVERSITY

Auna Tack

Undergraduate, Electrical Engineering
Advisor(s): Dr. Saiyu Ren

Measuring Time Delay with Time Domain Reflectometry

Biography:
I am a third-year electrical engineering student at Wright State University. I have served for over four years in the Ohio Air National Guard (OHANG) as a Radio Frequency (RF) Transmissions Specialist. My career choice in the OHANG has driven my decision to specialize in RF engineering. I am currently an intern at Northrop Grumman and contribute with RF testing and PCB troubleshooting. Eventually I'd like to use my skills in RF engineering to obtain a career in Electronic Warfare.

In my free time I enjoy going backpacking, cooking, and spending time with my friends and family.

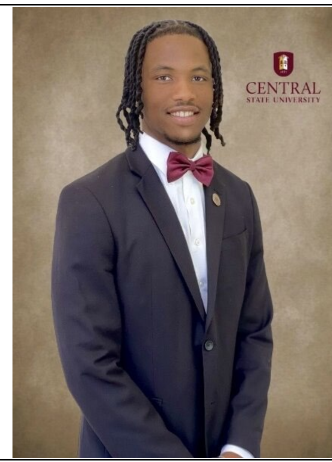
Abstract:
This study investigated time delay in various coaxial cables using Time Domain Reflectometry (TDR) theory and a Vector Network Analyzer (VNA). Three cables of varying lengths and manufacturers were tested: a 12-inch Mini Circuits cable, a 24-inch Times Microwave Systems cable, and a 1.5-meter Coaxis cable. Theoretical time delays were calculated based on cable length and permittivity, and compared to measured delays obtained using the VNA's TDR capabilities. The VNA setup, including the use of a Hann Low Pass Filter, was carefully controlled to minimize measurement error.

The experimental results showed reasonable agreement with the theoretical calculations, although some discrepancies were observed. The measured time delays were consistently lower than the theoretical values, with percentage errors ranging from 3.1% for the shortest cable to 12.2% for the longest. This experiment successfully demonstrated the application of TDR for characterizing coaxial cables and provided empirical validation of the theoretical time delay calculations, while also highlighting potential sources of error in practical measurements.

Publications: None yet.

9th Congressional District	OH Representative: Marcy Kaptur

Stephon Thomas



Academic Level, Major
Advisor(s):

Maximizing Solar Capture: Comparison Between Fixed and Tracking Systems

Biography: Stephon Thomas is a graduating senior in Manufacturing Engineering at Central State University, where he is a member of the Honors College and will graduate with University Honors. He is also a BOW AG-STEM scholar. Stephon gained valuable hands-on experience during an internship with GE Aviation as a Quality Engineer, where he worked on software solutions to maintain plant equipment and optimize resource usage. He also earned certifications in 3D printing under the guidance of Dr. Saleah Almestiri, further enhancing his technical skills in emerging manufacturing technologies. Beyond academics, Stephon has been an active student leader throughout his five years in college, serving in various leadership roles and earning a certification in Professional Development from the Harvard Leadership Program. His leadership skills, combined with his technical expertise, have positioned him to pursue a master's in business administration (MBA) to merge his engineering background with business management.

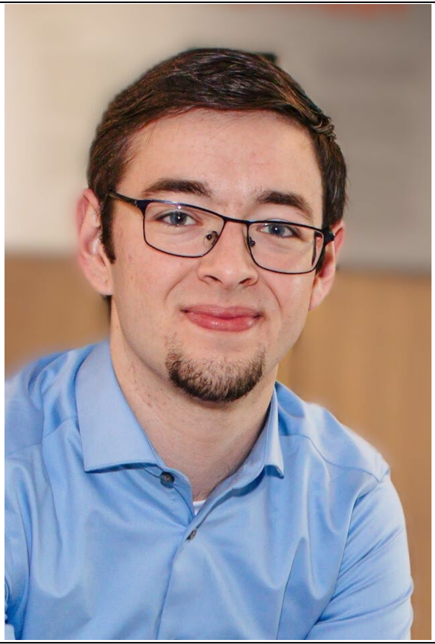
Abstract: This project explores the efficiency, performance, and cost implications of fixed solar systems versus single-axis tracking systems, focusing on the vertical-axis tracking design that moves east-to-west to optimize energy capture. By comparing these two solar technologies, the project aims to determine which system provides better energy output, storage, and long-term viability. Through rigorous data collection and testing in real-world conditions, including varying weather and geographical factors, this study evaluates the effectiveness of both systems. The research incorporates a multidisciplinary approach, combining mechanical design, electrical engineering, and programming, using Arduino components to control the tracking system's servos and sensors. In addition, the project assesses the cost-effectiveness, societal impact, and environmental benefits of these systems, emphasizing their potential to reduce reliance on fossil fuels and contribute to global sustainability goals. The findings are expected to provide valuable insights into optimizing solar energy solutions, enhancing accessibility, and promoting energy independence, while offering guidance for future renewable energy projects. The use of 3D printing for manufacturing components further reduces costs and supports sustainable practices, ensuring that solar technology is both economically feasible and environmentally responsible.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

OHIO NORTHERN UNIVERSITY

Zachary Toth



Senior, Mechanical Engineering
Advisor(s): Dr. Joshua Gargac

Evaluation of Cortical Bone Microstructure's Effects on Bone Strength via the Generation of Virtual Bone Scans

Biography: Zachary Toth is a senior Mechanical Engineering student at Ohio Northern University with a concentration in Biomedical Engineering and a minor in Applied Mathematics. He has participated in research combining his multidisciplinary interests in mechanical and biomedical engineering since his freshman year. Zachary serves as the vice president of the Ohio Iota of Tau Beta Pi, as well as the Habitat for Humanity and Fencing clubs at Ohio Northern. After graduation, Zachary plans to pursue a PhD in Biomedical Engineering.

Abstract: The microstructural properties and cortical porosity of cortical bone are large contributors to the overall bone strength. Evaluating this contribution, however, can be difficult due to the complexity of controlling changes to pore structure in human or animal samples. This research was in the development of a computer program that is able to generate three-dimensional models of micron-scale cortical bone. A wide array of variable input parameters allows for the generation of samples with similarity to µCT scans of cortical bone or with specific geometric features, depending on the values used. This program aims to help provide a better understanding of how cortical bone microstructure contributes to overall bone strength, which could have major applications into the effects of extended time spent in microgravity on human bone strength.

Publications: None yet.

14th Congressional District	OH Representative: David Joyce

Jayanti Upadhyay

Junior; Biology and Chemistry Double Major
Advisor(s): Dr. Blake Petersen

Defining the Relationship between Bacterial Motility and Virulence in *V. campbellii* & *V. parahaemolyticus*

Biography: Hello, my name is Jayanti. I am a junior at Baldwin Wallace University pursuing a double major in Biology and Chemistry. I have been the recipient of the Peterjohn Family Research Grant, which has allowed me to pursue my research in bacterial motility and virulence through genetics and microbiology techniques alongside my professor, Dr. Blake Petersen. Outside of academics, I work as a support teacher at a preschool/daycare and am also a Home Health Aide (HHA). When I am not working or studying, I enjoy spending time with family and friends. I am also passionate about playing the violin, crocheting, and anything art-related. After completing my undergraduate education, I aim to pursue medical school or a combined MD/PhD or DO/PhD program. My interest in this field is rooted in the gratitude I feel for being able to live a happy and comfortable life. I now desire to give back and contribute to the well-being of my community and underserved populations locally and internationally.

Abstract: *Vibrio campbellii* is a gram-negative marine bacterium that impacts the aquaculture industry as a pathogen of various aquatic organisms. In other pathogenic *Vibrio* species, such as V. *parahaemolyticus*, bacterial flagellar motility acts as a virulence factor that aids in host colonization and escape; it serves as a promising target for developing potential antibiotics and treatments. In my previous work, I infected gnotobiotic *Artemia franciscan* larvae (brine shrimp) with *V. campbellii* flagellar mutants under varying environmental conditions to clarify the relationship between flagellar motility and virulence. I found that an aflagellate mutant (Δ*flrC*) showed reduced virulence, while a mutant with a paralyzed flagellum (Δ*pomB*) exhibited significantly increased virulence. There was also an increase in biofilm formation, a multicellular matrix that aids in attachment and protection during infection, while also contributing to the rise in antibiotic resistance. The increase in virulence and biofilm formation in the paralyzed flagellar mutant were abolished under turbulent conditions but not static conditions. These results suggest a mechanosensory pathway that controls *V. campbellii*'s transition between motile and sessile states during infection and changing environmental conditions.

To further investigate the relationship between this motile-sessile switch in determining *Vibrio* virulence, my work has been split into two main goals. First, I am investigating the role of biofilm formation in *V. campbellii* virulence to further study the potential flagellar mechanosensing pathway. I am working towards deleting VpsR, a response regulator that is responsible for controlling the expression of the vibrio polysaccharide (*vps*) genes that compose the exopolysaccharide matrix of biofilms in other *Vibrio* species. Upon successfully deleting vpsR in both wild-type and paralyzed flagellar mutant backgrounds, I will conduct a biofilm and brine shrimp infection assay. These results will help us further understand how biofilms impact virulence and allow us to understand the mechanosensing mechanism of the Vibrio flagellum further. My second goal is to determine whether the mechanosensing behavior of *V. campbellii*'s flagellum is conserved across other species. To answer this question, I am constructing aflagellate (Δ*flrC*) and paralyzed flagellar (Δ*pomB*) mutants in *V. parahaemolyticus*, a closely related *Vibrio* species which is also a human pathogen. These *V. parahaemolyticus* mutants will be compared alongside their homologous *V. campbellii* mutants in brine shrimp infection assays to determine whether there is a similar pattern in mechanosensing behavior between *Vibrio* species further solidifying previous V.campbellii data I collected. Exploring the similarities between both *Vibrios*; one that is an aquatic pathogen and one that is a human pathogen and replicating the relationship between motility and virulence in both can provide insights for developing novel therapeutics targeting virulence factors in *Vibrios* and similar bacteria.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

OHIO NORTHERN UNIVERSITY

Cael Vanderhorst

BSME, Senior, Mechanical Engineering
Advisor(s): Dr. David Sawyers

Hybrid Engines for Aircraft Propulsion

Biography: My name is Cael Vanderhorst, and I am pursuing a Bachelor of Science degree in Mechanical Engineering from Ohio Northern University, with a minor in Business Administration. I am also a part of Tau Beta Pi here at ONU. I am striving to build engineering skills through my schooling that will allow me to perform important work in my career. In addition to my schooling, I have interned during the summers at Northrop Grumman, where I have been able to apply what I have learned in the classroom as I get my feet wet in industry. I have interests in thermodynamics as well as aerospace engineering, and working on my OSGC project has allowed me to tie the two together, and gain skills and experience performing research along the way.

Abstract: This research seeks to evaluate the feasibility of using hybrid engines for aircraft propulsion through analyzing the performance of a basic hybrid propulsion system across varying flight parameters. The results of this analysis will provide information on the general utility of hybrid systems for aircraft propulsion. As hybrid systems are becoming increasingly popular in automobiles and are being developed for aircraft, analyses such as the one presented in this study will prove important engineering design tools in the future.

This project began with a literature review to determine the energy requirements of an aircraft during different portions of flight, namely takeoff, climb, and cruise. From this review, mathematical models were created to determine the thrust and power requirements for each of these flight portions, based on variable input parameters such as aircraft weight and flight duration. These mathematical models were used to create a computer model using Microsoft Excel, allowing input parameters to be quickly varied when repeating calculations. Using the requirements during each flight portion, a series-arrangement hybrid propulsion system is developed and sized to provide the required thrust and power for the duration of a flight. Using the computer model, flight parameters are varied (and propulsion system size requirements recalculated) to determine the feasibility of such a hybrid system across different flight conditions.

Publications: None yet.

15th Congressional District	OH Representative: Mike Carey

Justin Verhosek

Senior, Computer Science and Philosophy
Advisor: Dr. Brian Krupp

Title: **Fine-Grained Air Quality Sensing with IoT – LoRa Network Deployment**

Biography: Justin Verhosek is a senior Computer Science and Philosophy double major at Baldwin Wallace University. He is working with LoRa Networks to test their compatibility with air quality sensors that a larger research group is developing. This research is another step in his research that combines technology with sustainability, as he is also part of the Campus Plate dev team seeking to reduce both food insecurity and food waste on college campuses. Outside of his academic pursuits, Justin enjoys archery, film, and hikes in his pastimes.

Abstract: As the use and application of the Internet of Things (IoT) expands, the search for reliable and efficient communications between devices to provide real-time data to end users continues. Given its open-source and low-cost nature, LoRa, a popular wide-area network, is a favorable choice for providing network coverage to IoT devices. This research paper provides an analysis of the performance of two distinct LoRa boards with different types of antennas. The first board, the RFM9X, is paired with a small and inexpensive spring antenna, which has been directly soldered to the board, while the second board, the RP2040, utilizes a pigtail antenna with an SMA IPEX connector. In addition, a Raspberry Pi 3 is used to receive data packets from the RFM9X and the RP2040 and responds by sending a confirmation packet back to the RFM9x and the RP2040. It is hypothesized that the RFM9X with a spring antenna will fare best in a network environment. This hypothesis is supported by previous research conducted with these LoRa sensors and will be put to the test in the following paper. This research aims to empower IoT enthusiasts, practitioners, and engineers to make informed decisions about the hardware they utilize, thereby enhancing the overall performance and reliability of LoRa-enabled devices in diverse environments.

Publications: Comparative Analysis of LoRa Antennae for Low-Cost IoT Deployments

11th Congressional District	OH Representative: Shontel Brown

MIAMI UNIVERSITY

Cory Webber

Senior, Mechanical Engineer
Advisor(s): Dr. Carter Hamilton

Laser Welding Simulation of Aluminum Alloys in EV Battery Assemblies

Biography: My name is Cory Webber, and I am a senior mechanical engineer at Miami University. I am a dedicated student and enjoy furthering my education outside of the classroom by conducting research into artificial skin and laser welding. With my research into artificial skin, I was a recipient of the undergraduate research award for my work. After completing my bachelor's degree, I will be continuing my education with a master's degree in mechanical engineering while continuing my research into laser welding. During two different summers, I completed internships. My first internship was at Makino, a CNC manufacturer, where I was tasked with material and product quality control. This internship helped me see the results of poor engineering and the tasks that must be done to remedy the mistakes. My second internship was at Timbertech, a subsidiary of Azek where composite and plastic decking board are manufactured. I was a process engineer in the plastics plant and gained exposure to using recycling in products and continual improvement measures. All these different areas of engineering I have experienced have helped me become a more well-rounded engineer.

Abstract: For manufacturing electrical vehicle (EV) batteries, joints need to be created with dissimilar metals to obtain lightweight and mechanically-sound structures. However, the chemical and mechanical incompatibilities of dissimilar metals can degrade weld quality through traditional fusion welding methods. Modeling and simulation of laser welding applications using COMSOL applied to 6061 aluminum alloy in EV batteries is needed to assess the correlations between properties and microstructures of the welds. By first creating a working model simulating the laser energy pulses on the material, future adjustments to the battery casing geometry, laser parameters, and joint orientation can be made depending on the requirements. To optimize the laser parameters for 6061 aluminum alloy, the model must show the transition from the solidus, to liquidus, and back to solidus temperature at the joint surface to show fusion between the two surfaces being welded together. The purpose of this model is to improve repeatability and quality of manufacturing EV batteries with the use of laser welding technology.

Publications: None yet.

2nd Congressional District	OH Representative: Brad Wenstrup

Leo Wible

Senior, Earth Sciences
Advisor(s): Dr. Joseph Ortiz, Dr. Jeffrey Balcerski

Hunting for Hydrothermal Vents on Mars

Biography: My name is Leo Wible, and I am an undergraduate Earth Sciences major from Avon, Ohio. Many of my family members are science teachers, and they introduced me to the fields of biology and geology. Visits to museums, hikes, and science summer camps further heightened my interest in studying the natural world. After watching the landing of the Perseverance rover in 2021, I began to wonder if I could apply what I had learned about natural processes on Earth to Mars and other worlds. Upon arriving at Kent State University, I decided that I wanted to become involved in planetary science and geology. Thanks to the Ohio Space Grant Consortium and my professors, I now have the opportunity to conduct meaningful research! When I'm not engaged in research, I participate in Kent State's fencing club, play video games, and explore various parks around northern Ohio to search for interesting rocks and fossils. I also have a particular fondness for ginkgo trees.

Abstract: Many people wonder whether Mars ever hosted life in its past. If it did, a likely location for the origin of life could be a hydrothermal vent, sheltered in the depths of an ocean that has since disappeared. Hydrothermal vents can provide both energy and raw materials. Located many meters beneath the surface, these vents would have been shielded from the harsh conditions at the surface of the young planet. Previous studies have detected hydrothermally sourced minerals like saponite in data from the Mars Reconnaissance Orbiter, particularly in the Eridania Basin, using infrared light. These findings support the hypothesis that hydrothermal vents existed on early Mars.

I plan to take a different approach to detecting hydrothermal minerals on Mars. Before searching for any specific minerals, it is essential to understand the conditions under which they form. After reviewing several books and papers, I developed hypothetical sets of conditions that could have been present on Mars when it had oceans. I then used TACT and SPECE8 in the community version of the Geochemist's Workbench to simulate which minerals could have formed under these conditions. Once I have compiled a complete list of potential minerals, I plan to use a novel remote sensing technique developed by Dr. Joseph Ortiz to map out potential hydrothermal deposits in selected regions of Mars. This method will employ visible light, rather than infrared, and could offer new insights into previously mapped regions such as the Eridania Basin.

Publications: None yet.

5th Congressional District	OH Representative: Robert Latta

THE OHIO STATE UNIVERSITY

Brady Wilson

Senior, Aerospace Engineering
Advisor(s): Dr. Randall Mathison

Thermoelectric Generator Implementation in Aircraft Exhaust Systems

Biography: My name is Brady Wilson, and I am currently a senior in aerospace engineering at the Ohio State University (OSU). After graduating from New Albany High School in 2016, I enlisted in the Marine Corps and served from 2016 to 2020 as a Field Radio Operator. Upon leaving the service, I enrolled at Columbus State Community College where I obtained my associate of science degree in 2022. I then transferred to the OSU to study aerospace engineering and have been heavily involved with various student organizations. Some of these organizations include the Buckeye Space Launch Initiative as well as the aerospace honors society, Sigma Gamma Tau. Along with my student involvement, I have conducted research at the OSU Aerospace Research Center and have interned at Pratt and Whitney in the summer of 2024. I plan to pursue a master's degree within my university and continue my passion within this exciting field of study.

Abstract: Increasing overall engine efficiency within the aerospace industry has been a continuous challenge. One measure of increasing efficiency is perfecting the method by which thermal energy is used throughout the engine cycle. Often, generated heat is lost to the environment which results in thermal efficiencies below 60%. While there are several proposed methods to increase this efficiency value, one approach is through converting the wasted heat into usable electrical energy. Thermoelectric Generators (TEG's) have been used in various fields where there is a desire to convert excess heat energy into usable power. Due to the high temperature gradients commonly seen in aircraft engines, strategically installed TEG's could prove to be another method by which to decrease energy losses.

For this research project, a computational and experimental setup will be used to prove the efficacy of TEG's in aerospace applications. An analytic model of a TEG will be constructed through MATLAB software and the results will then be compared to computational data obtained through Ansys Thermal-Electric simulations. Previously run simulations have shown power outputs of TEG's anywhere from 500 W to excess of 1 kW. Improving these power outputs is necessary to justify the installation of hardware within an already congested engine environment. Once the analytic and computational models have shown converging power outputs, a controlled experimental setup will be constructed at the OSU Gas Turbine Laboratory (GTL). Experimentation will consist of a fabricated steel pipe that will emulate the exhaust system or nozzle of a small scale aircraft. Thermoelectric materials will be integrated within the pipe which will output a voltage when experiencing a temperature gradient. Further research is needed in selecting the ideal implementation of the TEG material within the pipe, and what TEG modules will be able to sustain the expected heat loads.

This research is being conducted with the National Aeronautics and Space Association personnel who specialize in thermoelectric generators. It has been requested by these personnel that I prove the efficacy of my tests with commercially available TEG modules. Once the experimental data begins to show expected curves for the module performance, NASA will provide more advanced hardware for further testing.

Publications: None yet.

3rd Congressional District	OH Representative: Joyce Beatty

CEDARVILLE UNIVERSITY

Johanna Wood

Junior, Geology
Advisor(s): Dr. John Whitmore

Towards a More Thorough Understanding of Banded Iron Formations

Biography: Johanna is a junior at Cedarville University, where she is pursuing a B.S. in Geology with minors in Chemistry and Biblical Studies. She was born in North Carolina but moved to Lakeville, Minnesota when she was seven years old, which ignited her passion for studying the geology of the Great Lakes region. Through Cedarville University, she is currently using petrographic microscopy to identify uranium radiation markings in rock samples from Michigan and Canada, and she is also working with the geology department to reorganize its laboratory library. Outside of school, she enjoys rock hunting, hiking, playing her violin and piano, and creating watercolor paintings.

Abstract: Banded iron formations (BIFs) are anomalous sedimentary and metamorphic rocks composed primarily of iron oxide minerals such as hematite, magnetite, and grunerite layered with silicate cherts. Often found among the oldest rocks on earth, similar iron oxides have also been recently discovered on Mars. Given that numerous recent studies are favoring microbial over chemical precipitation as a more viable formation mechanism for BIFs, these rocks contain significant implications for life origins. To determine whether chemical, microbial, or other processes are most likely to have formed the terrestrial BIFs, this project will seek to build an Excel spreadsheet of typical BIF characteristics as displayed around the world.

A dramatic shift in depositional style occurs across the Archean-Proterozoic time period, so it is important to compare criteria between these two general BIF types. However, to avoid overgeneralization of data, individual basins both stratigraphically near and far from each other were also compared. Criteria considered included chemistry, mineral texture, deposit thickness, microfossil concentration, conventionally interpreted depositional setting, and association with other mineralogically unique strata. Since the continents would have been arranged differently during the Archean and Proterozoic than they are today, possible BIF correlations across basins were accounted for to avoid double-counting formations. Upon accumulation of data, it is hypothesized that the observed qualitative trends may offer a more robust interpretation of biological and chemical signatures in the rocks. As researchers continue to study Martian iron oxides, these trends may prove useful for determining their similarities or differences from terrestrial BIFs. Future goals for this research project include developing a public BIF database and performing further chemical reactions in appropriate formation conditions to encourage more detailed comparative studies.

Publications: None yet.

10th Congressional District	OH Representative: Michael Turner

CENTRAL STATE UNIVERSITY

Isabella Wynter Mitchell

Junior, Double Major in Computer Science and Psychology
Advisor(s): Deng Cao

A Human-Centered Approach to Improving Campus Information Accessibility

Biography:
Isabella Wynter Mitchell is a computer science and psychology student at Central State University and is proud to be the first student from Panama at her institution. As a member of the Honors College and a STRADA Presidential Leadership Scholar, she exemplifies a commitment to academic excellence and leadership within her community.

Isabella is passionate about the intersection of technology and human behavior, with interests in human factors engineering and digital accessibility. She advocates for STEM education and mentorship, particularly for underrepresented groups in technology.

With aspirations for graduate studies, Isabella aims to deepen her understanding of the relationship between engineering and psychology, ultimately contributing to advancements in user experience (UX) research and cognitive systems engineering.

Abstract:
Effective access to campus resources is a critical factor in student engagement, well-being, and academic success. This study applies human-centered design (HCD) methodologies to develop a digital platform prototype in Figma that improves information accessibility for students at Central State University. The prototype consolidates essential university resources, including daily cafeteria meal schedules with nutritional data, student organization events, official university announcements, and extracurricular opportunities. The objective is to reduce barriers to information retrieval and improve student interaction with campus services through an intuitive, structured interface.

Publications: Damiano, D., Wynter, I. M., & Ahmed, E. (March 2024). “A Survey of Digital Security in Applications and Networking”. 39th International Conference on Computers and Their Applications, Volume 98, 2024, Pages 77–88.

10th Congressional District	OH Representative: Michael Turner

MIAMI UNIVERSITY

Lisa Zhang

Senior, Mechanical Engineering

Advisor(s): Dr. Kumar Singh & Dr. Fazeel Khan

Fabrication and Testing of 3D Printed Polymers for its Torsional Dynamic Properties towards Aeroelastic Model Prototypes

Biography: Lisa Zhang is a first-generation college student at Miami University, where she is currently a senior pursuing a double major in Mechanical Engineering and East Asian Language and Culture. In addition to her academic pursuits, Lisa serves in the Army Reserve as a Horizontal Construction Engineer. Her passion for engineering innovation, cross-cultural studies, and hands-on problem-solving underscores her versatile skill set and commitment to advancing scientific research.

Lisa's research, conducted under the mentorship of Dr. Kumar Singh and Dr. Fazeel Khan, focuses on the mechanical properties of 3D printed materials, specifically investigating the effects of build orientation on dynamic characteristics such as shear modulus and damping capacity. Her work aims to improve the reliability and performance of 3D-printed structural components under torsional loading, with applications in rotating machinery and advanced manufacturing systems. Lisa aspires to contribute to the field of material science and mechanical engineering by bridging the gap between theoretical modeling and experimental validation, ensuring the practical usability of additive manufacturing technologies.

Abstract: Additive manufacturing, commonly known as 3D printing, has evolved from prototyping technology to widespread applications in industries such as aerospace, biomedical engineering, and automotive manufacturing. While significant progress has been made in optimizing material properties and dimensional accuracy, ensuring the mechanical reliability of 3D-printed components under dynamic loads remains a critical challenge. This research investigates the torsional response of 3D-printed polymers with varying build orientations to characterize their dynamic properties.

The study utilizes four polymer materials—ABS, PLA, PETG, and Carbon Fiber—fabricated in both horizontal and vertical orientations using a Dremel DigiLab 3D printer. Tensile samples were designed in Fusion 360 and subjected to shear modulus testing using a Material Test System (MTS). Experimental results revealed that the horizontal orientation generally exhibited higher shear modulus values than the vertical orientation, highlighting the influence of print direction on mechanical performance.

A numerical simulation model was developed to predict torsional vibration behavior, including natural frequencies and mode shapes, based on experimental data. The findings provide insights into optimizing print parameters to improve damping characteristics and dynamic stability for rotating components such as motors and shafts. Future work will focus on dynamics.

Publications: None yet.

1st Congressional District	OH Representative: Greg Landsman

Community College

Lorain County Community College

Olivia Bogna

Sophomore, Mechanical Engineering
Advisor(s): Dr. Monroe Kennedy, Dr. Timothy Dolch

Re-discovering PSR B0904+77 Using Regional Spectral Data from Astronomical Surveys

Biography: Olivia Bogna is a second-year student at Lorain County Community College who will be transferring to Cleveland State University for a Bachelors in Mechanical Engineering. Beyond her position as the Program Assistant for the Ohio Space Grant Consortium, she has been involved in various NASA workforce development programs: Here to Observe, NASA's Community College Aerospace Scholars, and L'SPACE Mission Concept Academy. As a two-time recipient of the OSGC Community College Research Scholarship, she has previously conducted analysis on Active Galactic Nuclei spectra, and is now doing research on a pulsar that disappeared from recent astronomical surveys through the NANOGrav sponsored Student Teams of Astronomy Researchers.

With an interest in the thermal and mechanical properties of materials, Olivia intends to delve into research into material science throughout the rest of her undergraduate degree and through gruadate school. She aspires to spend her future specializing in materials R&D materials with aerospace applications. Outside of her academics, she volunteers at the Burrell Memorial Observatory at Baldwin Wallace University, is a member of the Society of Women Engineers, CWRU's GoAerOhio UAV Design Team, and actively works to support STEM Engagement in her community.

Abstract: PSR B0904+77 is a pulsar with a spin period almost equivalent to pi/2 seconds. It was detected in 1970 but has disappeared in astronomical surveys. Using spectral data from astronomical surveys in the region, in particular from Low Frequency Array (LOFAR) and the Very Large Array (VLA), we can test the hypothesis that this pulsar's location still corresponds to a steep spectrum source. We also propose various follow up techniques.

Publications:

Bogna, Olivia. (2025, July). *Analysis of Active Galctic Nuclei Emissions Using Spectroscopy.* Ohio Space Grant Consortium 32nd Research Symposium Proceedings Report.

9th Congressional District	OH Representative: Marcy Kaptur

Lorain County Community College

Jocelyn Mateo

Sophomore, Universal Art and Science
Advisor: Dr. Regan Silvestri

Quantifying Antioxidants in Non-Alcoholic Beers: Part 1, the Brewery, the Antioxidant, and the Analytical Method

Biography: Jocelyn Mateo is a sophomore at Lorain County Community College, studying to obtain her dual associate's degrees in art and science in spring 2025. She joined Dr. Silvestri's chemistry research group in August of 2022, where she discovered how enjoyable research can be. From there, she would go on to be involved with NASA's Here to Observe (H2O) program, providing her further insights into the science world. Then, in summer of 2024, she interned for NASA's Europa ICONS program, where she would conduct geology research with science team members on the Europa Clipper mission. Currently, she is working with the Student Teams of Astrophysics Researchers (STARS-UP) program and the Pulsar Search Collaboratory. After graduating, she is looking to pursue her bachelor's degree in either astronomy and astrophysics or planetary science in fall 2025. She is very thankful to the Ohio Space Grant Consortium for this opportunity.

Abstract: High-performance liquid chromatography (HP-LC) has been used to quantify the antioxidant xanthohumol in nonalcoholic beers provided by industry partner Surreal Brewing, San Francisco. Xanthohumol is a natural product originating from hops, an ingredient used to impart desired bitter flavors to beer. The flavonoid xanthohumol has recently attracted substantial attention regarding potential health benefits as an antioxidant. Under standard beer brewing techniques however, the concentration of xanthohumol unfortunately diminishes as xanthohumol is converted to byproducts due to the brewing process. In an effort to increase the concentration of xanthohumol in beer, Surreal Brewing has produced several non-alcoholic beers via a modified brewing technique. An existing analytical method using HP-LC was applied to quantify the concentrations of xanthohumol in these various experimental beers produced by Surreal Brewing.

Publications: None yet.

5th Congressional District	OH Representative: Robert Latta

Lorain County Community College

Stephen Zbornik

Sophomore, Physics
Advisor(s): Dr. Monroe Kennedy, Dr. David Van Arsdale

A Cam Device to Maximize Bicep Strength Without Injury

Biography: Forgoing college initially after high school, I would spend the majority of my 20s working the personal training industry working for a company called Max Strength Fitness. I decided to take my passion and understanding for exercise and human physiology to the next level and reenrolled in college with a focus in psychology and pre-med academics. The experience I gained during my time at my personal training would be considered unique to the industry. Despite this superficial perspective, it simplified the practice of exercise, making it safer and more effective. I plan to apply my experience to give the public and medical community a simpler, more effective, and safer way to approach exercise. Recently, my wife and I moved to Toledo so that my wife could pursue her residency in foot and ankle surgery. I am continuing to take courses at Lorain County Community College before transferring to complete my undergraduate degree.

Abstract: My project for the Ohio Space Grant Consortium reflects my passion for exercise physiology, as well as the work I did at Max Strength Fitness. Focusing on a particular but crucial part that is built into a large amount of commercial strength training equipment, a cam device. What this very simple device does is mediate the amount of resistance an individual with experience as they travel through the range of motion of a particular exercise. Why would we want the resistance to change throughout the range of motion? Simply because we are stronger or weaker in certain positions throughout a range of motion. The exercise I have chosen to focus on is the biceps curl. There are some basic assumptions that can be made on determining where someone is stronger or weaker in an exercise, i.e. muscle fiber overlap, lever arm distance, etc. But a precise and optimal cam will need more data to determine how much the resistance needs to increase or decrease. To do this I sought to collect data on how much force could be produced in specific positions/elbow angels relative to others. With this data collected and plotted I was able to derive an equation that best represented this change.

To apply the data to cam the data had to translated into how much the radius of the cam needed to change as an induvial went through the range of motion of the exercise. With radius values determined, a CAD model of the cam was designed and 3-D printed. The cam can now be placed on a strength training machine, connected between the lever arm and weight stack to provide vary resistance.

Publications: None yet

9th Congressional District	OH Representative: Marcy Kaptur

Education Scholars

Morgan Briley

Senior, Early Childhood Education
Advisor(s): Dr. Brandi Seither

Energy of the Sun

Biography: Morgan Briley, from Brunswick, Ohio, attends Baldwin Wallace University. She is completing her final semester and plans to graduate in May while student teaching at Brook Park Elementary School. Morgan is passionate about early childhood education and enjoys creating engaging, hands-on learning experiences that foster curiosity and creativity in her students. She believes in the importance of nurturing the whole child, focusing on both academic success and social-emotional growth. Additionally, Briley is a 2024-2025 NASA/Ohio Space Grant Consortium scholarship recipient. Her commitment to lifelong learning inspires her to seek innovative teaching strategies and continuously improve her practice. Outside of teaching, Morgan enjoys spending time outdoors, playing golf, traveling, and is dedicated to making a positive impact on her students' lives. She looks forward to starting her career as an educator and inspiring young learners to reach their full potential.

Abstract: This lesson introduces kindergarten students to the essential role of the sun in sustaining life on Earth. The teacher will begin by presenting an anchor chart and prompting students to share what they already know about the sun, facilitating a discussion to capture their prior knowledge. The teacher will then provide fundamental information, emphasizing that the sun is a star and the primary source of energy, heat, and light, which enables all living things to thrive. Using high-quality images from NASA, students will explore the sun's features, such as its color, texture, and sun flares, fostering curiosity and critical observation skills. Student contributions will be added to the anchor chart alongside simplified explanations of scientific concepts. Additionally, the teacher will incorporate a NASA video to further explain how the sun generates energy, reinforcing new learning through accessible and age-appropriate language.

Following the discussion and charting activity, students will engage in a hands-on art project to solidify their understanding. Using materials like paper plates, tissue paper, and markers, students will create their own representations of the sun. Each student will attach strings with stars to their sun, writing three key facts about the sun’s energy on the stars with teacher guidance. This creative activity not only reinforces factual information but also encourages fine motor skills and self-expression. By the end of the lesson, students will have a foundational understanding of the sun’s energy and its significance to life on Earth, bridging scientific concepts with visual and tactile learning.

Publications: None yet.

7th Congressional District	OH Representative: Max Miller

Elizabeth Denman

Senior, Early Childhood Education
Advisor(s): Dr. Bridget Mulvey

Preparation and Selection of Food for Travel in Space

Biography: Elizabeth Denman is a senior at Kent State University, set to graduate in the Spring of 2025 with a degree in Early Childhood Education. In her senior year of high school, she took on the role of an Education Aide in a Kindergarten classroom, sparking her passion for teaching. As a teacher today, she is dedicated to creating a positive and supportive classroom environment where students feel encouraged to engage with materials, explore their ideas, ask questions, and reach their full potential as lifelong learners. Her creativity drives her to make learning fun and engaging for all of her students, ensuring that each lesson is memorable. From a young age, she has had an interest in space and scientific discoveries, she enjoys finding ways to make STEM subjects exciting and accessible for young learners. As a future educator, she is committed to fostering a love of learning and helping children build a strong foundation for lifelong success.

Abstract: Through this three-day lesson, students explore the importance of food preservation for space travel, focusing specifically on NASA's role and the science behind preparing food for astronauts. The lesson introduces NASA's history and its contributions to space exploration through class discussions, videos, and hands-on activities. Students also delve into the challenges astronauts face regarding nutrition during long space missions, and learning about food preservation techniques such as dehydration and freeze-drying. They simulate the space food preparation process by weighing and dehydrating food items and calculating the percentage of moisture lost from the items.

This lesson promotes students to reflect on their findings and connect them to real-world applications, such as the need for lightweight and long-lasting food for travel in space. Students use a collaborative, inquiry-based approach to learning through peer discussions, graphic organizers, and guided worksheets to track their learning and questions throughout the lesson. To assess students' learning, a taste-testing panel provides students with the opportunity to explore the textures, appearances, and flavors of dehydrated and freeze-dried foods. They then vote on which foods they would take on their own space mission, using their evaluations and newly acquired knowledge to make informed decisions. Through these activities, students gain a deeper understanding of the science behind space food and how preservation methods contribute to astronauts survival on long missions.

Publications: None yet.

13th Congressional District	OH Representative: Emilia Sykes

UNIVERSITY OF Cincinnati

Cora Gill

Academic Level - Senior
Major - Secondary Education Integrated
Sciences: Chemistry
Minor: Biological Sciences
Advisor(s): Laura Dell

Weather and Our World

Biography:
My name is Cora Gill. I am a senior at the University of Cincinnati. I am studying to be a high school biology or chemistry teacher. My father is a physics teacher at my alma Mater and has been the main source of my love of the sciences. I hope to be as inspiring to my students as he has been to his.

Abstract:
This lesson would be for a 7th-grade Earth Science course. It would highlight the importance of clouds for our Earth's environment. The lesson would take place over one whole week of school and begin with a few days of lectures where students will learn about the different types of clouds that exist and what they each contribute to our world. Students will also be taught the importance of clouds when it comes to global temperatures and maintaining the environment that they enjoy every day. Concepts like the albedo effect, the water cycle, and global warming will all be touched on to give students a well-rounded look into the importance of clouds.

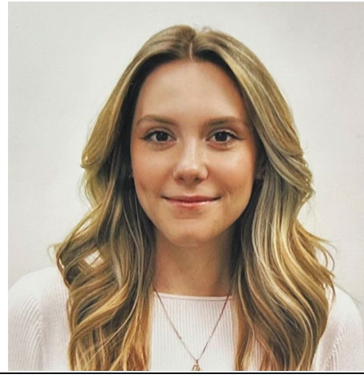
After this, the students will begin the lab portion of the lesson. They will be introduced to the GLOBE program that NASA has and will first get to explore the site and what information it offers in the way of data and scientific discoveries. For the last two days of the week(weather dependent), students will be taken outside to observe and record the cloud cover for the day and the size and type of visible clouds. They will then compile all the class data and submit it to the NASA GLOBE program so that they can contribute the data that NASA uses to observe and study our world.

Publications: None yet.

5th Congressional District	OH Representative: Bob Latta

KENT STATE UNIVERSITY

Taylor Grasse



Senior, Early Childhood Education
Advisor(s): Michelle Schultz, Bridget Mulvey

Gibbs Students' "Eyes On" Climate Change

Biography: Taylor Grasse is a Senior at Kent State University, pursuing a degree in Early Childhood Education. As a first-generation, non-traditional student Taylor is committed to expanding her knowledge and developing the skills necessary to achieve her academic and professional goals. Taylor has worked diligently to receive a 4.0 GPA for each semester, as well as maintaining her position on Kent State's Dean's List. She is eager to bring all that she has learned into a classroom, but she also has ambitions of returning to school to acquire a master's degree to expand upon her career advancements, specialized skills, and personal growth. Taylor is a recipient of the *Education, Health, and Human Services Study Abroad Scholarship* as well as *the Diversity in Education Abroad Scholarship*, which allowed her to explore her love of literature and science abroad during the summer of 2023. Taylor was thrilled to be nominated for the Ohio Space Grant Consortium scholarship and just as excited to explore NASA's resources with her field students.

Abstract: With this study, third-grade students from Gibbs Elementary explored the impact of climate change by using multiple NASA climate resources to engage them in hands-on learning. The goal was to enhance students' understanding of climate science through interactive tools and data visualizations available on NASA's website. Students were introduced to key concepts such as the greenhouse effect, global temperature changes, and the role of human activities in climate change. Activities included exploring the satellites NASA utilizes to study climate change and the images they produce, reviewing and breaking down real-time climate data, using climate models to observe and analyze the effects of rising temperatures, melting ice caps, and shifting weather patterns, and engaging in group discussions to connect scientific information with their everyday lives. Through these guided activities and group discussions, students were able to connect the scientific data to tangible, real-world examples, gaining insight into how global warming is altering ecosystems and communities. Results indicated that students demonstrated a deeper understanding of climate change, with an improved ability to identify its causes, effects, and potential solutions. For most of the students, this project marked their first exposure to the topic of climate change; by providing them with access to interactive tools and data visualizations from NASA's website, they were able to construct foundational knowledge about environmental science and recognize the importance of taking action. The study highlights the effectiveness of using accessible digital resources to teach complex scientific concepts to young learners, fostering environmental awareness and critical thinking skills.

Publications: None yet.

13th Congressional District	OH Representatives: Emilia Sykes

CEDARVILLE UNIVERSITY

Alyssa Hart

Junior, Mathematics Education Major
Advisor(s): Sarah Gilchrist

7-8th Grade Math Lesson on Planets and Ratios

Biography:
Alyssa is from Cincinnati and is a junior mathematics education major at Cedarville University. After graduation, she hopes to become a high school math teacher and make learning math fun and engaging for her students. At Cedarville, Alyssa enjoys working as a math tutor and grader. Other than math, Alyssa enjoys traveling, hiking, dancing, theatre, and sports.

Abstract:
The project will be centered around comparing the size and distances of the different planets using ratios. Students will begin by doing some research using NASA's resources to learn more about the size of the planets compared to each other and their distance away from each other. Then, a brief overview of finding the volume of a sphere, using the given radius, will be given to further prepare the students for the calculations. Next, students will build scale models of the planets, given a base model of planet earth. To do this, they will have to use their knowledge of ratios to find the ratios of each planet compared to earth and to make the whole model directly proportional to the actual size of the planets. Not only will students get to strengthen their ratio and geometry skills, but they will also get to discover more about the true scale of the planets and the solar system.

Publications: None yet.

2nd Congressional District	OH Representative: Brad Wenstrup

OHIO NORTHERN UNIVERSITY

Rachel Penno

Junior, Early Child Childhood Education
Advisor(s): Todd France

Solving Environmental Issues in Second Grade

Biography: I am Rachel Penno from Coldwater, Ohio. I am currently a junior attending college at Ohio Northern University majoring in Early Childhood Education and minoring in TESOL (Teaching English to Speakers of other Languages). At Ohio Northern University I am involved with various clubs and organizations. I currently serve as the Public Relations Manager for the College of Arts and Sciences Dean's Student Advisory Board. I am also the Center for Teacher Education Representative for ONU's Student Senate. Along with this I am involved in Teachers of Tomorrow, Student Planning Committee, Kappa Delta Pi (Education Honor Society), ONU's Steel Drum, and Symphonic bands.

Abstract: For this project I created a series of lessons designed to teach students in second grade about changes humans and other living things can make to the environment. The purpose of these lessons is for students to learn about different causes of environmental changes, learn about the three R's (reduce, reuse, and recycle), and use critical thinking skills to create a project that can fix some of these issues. These ideas align with the Ohio second grade standard Life science 2.LS.1 (Living things cause changes on Earth.) Students will be able to learn about changes humans and other organisms cause in the environment through the use of a variety of multidisciplinary activities and skills.

The lessons will be based on a variety of topics that include learning about living things and environmental changes, causes of environmental changes, learning about how they can prevent environmental changes, and learning about recycling. The students will then take what they have learned from the lessons to create a project out of recycled materials. With these materials the students will create either a model or a working object that is designed to help eliminate or solve an environmental issue. For this activity they can either work individually or in groups of 2-3 to create a model or solution. The projects will then be presented to the class where each student or group will have the opportunity to explain what they made and what environmental issue it was designed to help or solve.

Publications: None yet.

5th Congressional District	OH Representative: Robert Latta