NASA / OHIO SPACE GRANT CONSORTIUM

2022-2023 SCHOLAR / FELLOW STUDENT JOURNAL

Students Representing Ohio Congressional Districts

OHIO SPACE GRANT CONSORTIUM

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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, 1,455 undergraduate scholarships and 288 graduate fellowships have been awarded.

The Consortium is additionally supported by matching funds provided by the 24 member universities/community colleges, the Ohio Aerospace Institute (OAI), as well as additional funds provided by the State of Ohio Department of Higher Education. With these funds, the Ohio Space Grant Consortium was able to award an additional 17 undergraduate scholarships, 10 Master's fellowships, and 2 internships.

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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- Central State University
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- University of Cincinnati
- University of Dayton
- Kent State University
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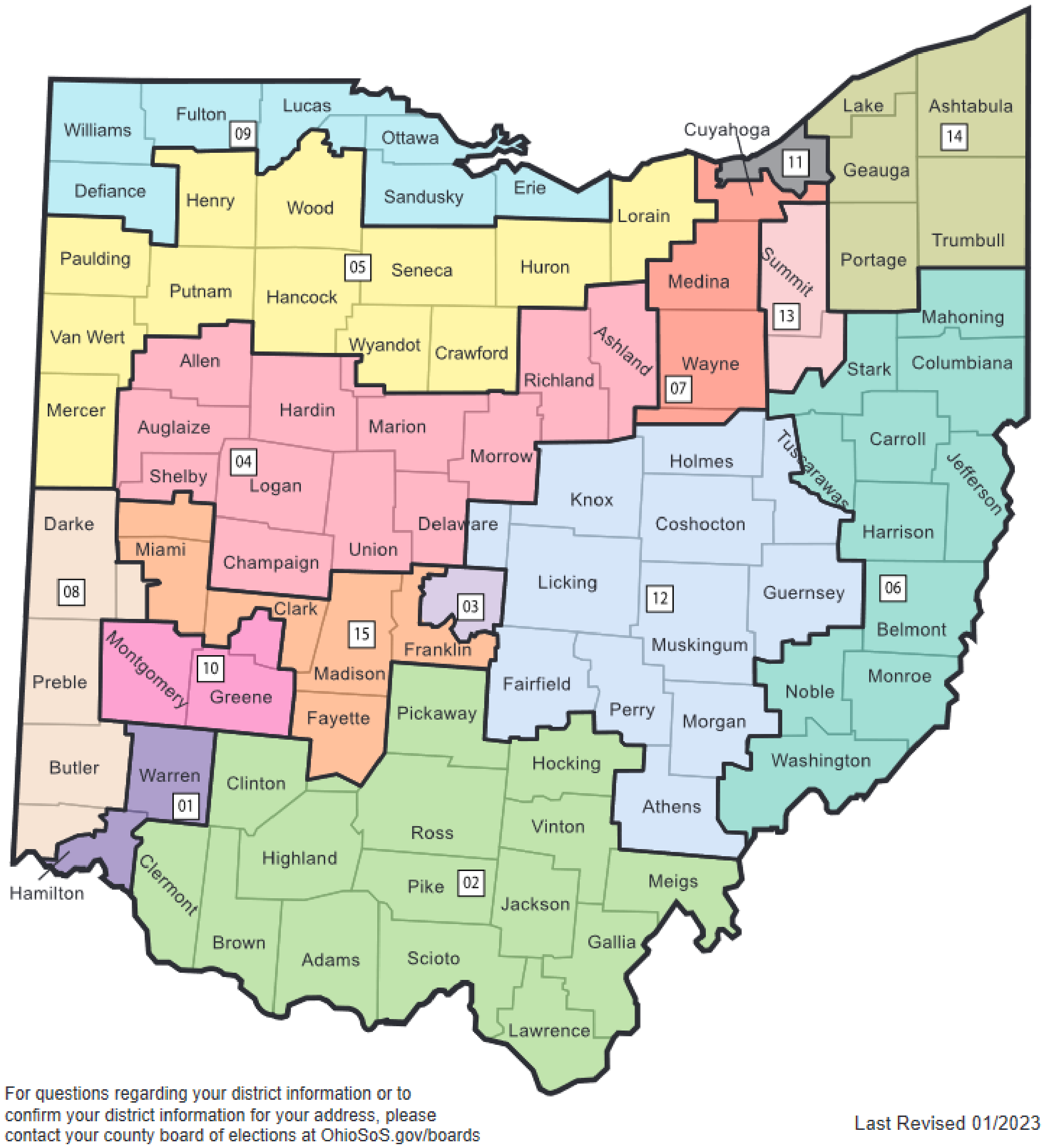

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Fellows

The University of Akron

Blake A. Bowser

Master's 2, Mechanical Engineering
Advisor(s): Dr. Gregory Morscher

Characterizing the Mechanical and Microstructural Properties of an Additively Manufactured Nickel-Based Superalloy ABD-900AM using Electrical Resistance, Digital Image Correlation, Acoustic Emission, and Microscopy

Biography: Blake grew up in rural Suffield Ohio, where he first fell in love with the field of engineering and engineering technologies. From working on cars in the garage, to building an 8' tall trebuchet in senior physics class in high school, engineering became a dream. He then began seeking his degree in Mechanical Engineering at The University of Akron, where he participated in various student organizations, including the Akronauts Rocket Design Team. During his time on the Akronauts, Blake tenured as the Chief Engineer and previously the Lead Payload Engineer, which helped the team successfully place top 5 in two national rocket engineering competitions. Blake also set the team up for future success by pioneering the teams research and development group for collegiate-scaled bi-propellant liquid propulsion rocket engines and the testing systems capable of characterizing said engines, which sets UA's Akronauts into an elite group of universities capable of liquid propulsion. He has since finished his undergraduate degree, and is pursuing his Doctorate under Dr. Gregory Morscher, in the high temperature composites and superalloys field performing research for various private sector aerospace and defense companies, as well as various government agencies including the Air Force Research Lab, and NAVAIR. Blake has had opportunities to work with Parker Hannifin's Parflex Divison Mechanical and Polymer Innovation Laboratories, being responsible for maintenance, testing, and research of multimillion dollar extrusion processes. As well he has also had the opportunity to intern with Northrop Grumman's Propulsion Systems, where he acted as a Project Engineer and Systems Engineer, supporting the development of the Missile Defense Agency's Next Generation Interceptor project, as well as the continuation of the U.S. Navy's Trident II missile program.

Abstract: Jet propulsion and gas turbine engines are presently extraordinary systems that require materials that can withstand high load, high temperature, and highly corrosive environments. Considering this, components within these propulsive systems can be highly complex and made from advanced materials and alloys. When repairs are needed, it can cause significant downtime for a flight vehicle due to component lead times as well as a consistently high cost of repair when using conventional manufacturing techniques for advanced materials. With the advent of additive manufacturing, methodologies such as Directed Energy Deposition (DED) can be used to provide repairs on an existing wrought component, significantly reducing repair lead times, and considerably decreasing cost of service. Laser Powder Bed Fusion (LPBF) is also an additive manufacturing process that significantly decreases time of production and possibly manufacturing cost. Due to this, Nickel-based superalloys optimized for additive manufacturing processes are of high interest regarding this application. The Nickel-based superalloy, ABD-900AM, provided by the Air Force Research Lab (AFRL) will be analyzed using Non-Destructive Evaluation (NDE) techniques such as acoustic emission, digital image correlation, and electrical resistance to characterize flaw propagation in the material in various build orientations and manufacturing techniques under uniaxial tension, high cycle fatigue, and fatigue crack growth testing. The microstructural properties of the material will also be characterized via SEM, digital microscopy, and other analysis techniques.

Publications: None yet.

16	Anthony Gonzalez

OHIO UNIVERSITY

Calvin Coffin

Master's Student, Plant Biology
Advisor(s): Dr. Sarah Wyatt

Characterizing Transcription Factor Activity within the Arabidopsis Gravity Response

Biography: Calvin Coffin is a second-year master's student in the department of Environmental and Plant Biology at Ohio University. Calvin started his collegiate career at the University of Oklahoma, then transferred to Ohio as a junior and graduated with a B.S. in biochemistry in 2021. With half a decade of research experience under his belt, he elected to pursue his M.S. degree in the lab of Dr. Sarah Wyatt, studying the plant gravity response in *Arabidopsis thaliana.* Among other honours, Calvin was recently awarded an Ohio Space Grant Consortium Master's Fellowship to fund his final year of research.

Abstract: Gravity is among the most critical environmental cues in shaping plant growth; however, its ubiquity on Earth limits available options in the study of the plant gravity response. This obstacle has been overcome with the advent of experimentation aboard the International Space station. Analyses of Arabidopsis seedlings grown in space has provided a wealth of data regarding how plants respond to this unique gravity condition. When intersected with similar expression data from terrestrial plants exposed to a new gravity vector, several novel components in the gravity signaling pathway were implicated. Of particular interest in the analysis were transcription factors (TFs) for their role in regulating downstream expression patterns. Two TFs were identified at this fundamental level of the Arabidopsis gravity response: *ERF104*, upregulated on earth in response to a new gravity vector and downregulated in microgravity, and *IQD21*, displaying the inverse expression pattern. A third gene, *CIB1*, was shown to be upregulated in both scenarios. Phenotypic characterizations of mutant lines of each of these genes show significant gravity sensitivity in the root and/or shoot. With their gravitropic roles having been phenotypically confirmed, Human Influenza Hemagglutinin (HA) tagged lines of each of these proteins have been generated and placed under the control of a constitutive promoter. These lines will enable ChIP-Seq to identify the binding sites of these three TFs on the Arabidopsis genome and with them their regulatory targets, contextualizing the gravity response pathway as well as shedding light on the complex web of interconnected signaling events it entails.

Publications: None yet.

15	Michael Carey

Kyle Duke

Master's 1, Chemical Engineering
Advisor(s): Dr. Byung-Wook Park

Impedimetric determination of cortisol levels using gold nanoparticles functionalized laser induced graphene electrode for smart wound dressing application

Biography: Kyle Duke is a first year Master's student from Perry, Ohio studying Chemical Engineering at Youngstown State University. In 2022, Kyle Duke received his B.S. in Chemical engineering (Summa Cum Laude) from Youngstown State University. Kyle began his research in 2021 where he studied microbial fuel cells as a research assistant for Dr. Park. Kyle was first introduced to his current thesis topic his senior year at YSU which he found extraordinarily fascinating and led him to pursue his Master's degree. Kyle was first introduced to his current thesis topic his senior year at YSU which he found extraordinarily fascinating. With his newfound passion for research, he plans to pursue his PhD after graduation.

Abstract: Conventional wound dressings typically deliver therapeutics through passive diffusion which is both inexpensive and easy to produce. However, it is often limited by undesirable release profile. To overcome the limitations, recent developments have focused on smart wound dressings; a transdermal device capable of diagnosis of wound parameters and releasing therapeutics in a controlled manner. By implementing a biosensor into the device, biomarkers critical to the wound status can be monitored in real time providing vital information on the wound healing progress. Elevated levels of cortisol in wound fluid have been previously correlated with inflammation and infection, making it an ideal biomarker for evaluating wound status. To further investigate, we are currently developing a smart wound dressing capable of controlled drug release and the impedimetric detection of cortisol.

In this study, a carbon dioxide laser was utilized to produce a flexible laser-induced graphene (LIG) on polyimide (PI) film for the detection of cortisol. First, gold nanoparticles (AuNPs) were formed to the sensors surface via electrodeposition, followed by Self-Assembled Monolayer (SAM) formation of MPA on the AuNPs via thiol chemistry. With the SAM in place the carboxylic acid (-COOH) groups of the MPA were activated to immobilize antibodies via EDC/NHS chemistry. After MPA activation, the LIG was incubated in an anti-cortisol antibody solution to immobilized on the surface. Lastly, to avoid unwanted signals during detection, the LIG was incubated in a solution containing the blocking agent bovine serum albumin (BSA). Surface characterization of the LIG was performed at each step of modification by cyclic voltammetry (CV) and Electrochemical impedance spectroscopy (EIS) in a phosphate buffered saline (PBS) solution containing a 5 mM $Fe(CN)_6^{3-/4-}$ (1:1) redox couple. Further characterization of the modified LIG electrode was achieved through scanning electron microscopy (SEM), surfaced-enhanced Raman spectroscopy (SERS), and X-ray diffraction (XRD). The detection experiment using EIS was carried out in increasing concentrations in cortisol (1-100 ng/mL) in PBS. For detection in PBS containing the redox couple, data analyzed using an equivalent circuit model exhibited an increase in R_{Ct} as cortisol concentration increased, verifying it detects cortisol. As for the PBS solution, a change in Z_{Mod} was found after an increase in concentration, further verifying its functionality. Selectivity, reproducibility, and sensitivity experiments were estimated. A wearable miniaturized sensing device along with interdigitated electrode (IDE) system will be used further for detection experiments. The overall goal is to implement this new system into a smart wound dressing. The developed sensing platform will be implemented in engineered flexible smart wound dressing to be used in the fabrication of a POC device applicable to improving wound care technology.

Publications: None yet.

The University of Akron

Christopher A. Ferguson

Master's 2, Mechanical Engineering
Advisor(s): Dr. Gregory Morscher

Burner Rig Optimization for High Temperature Materials and Coating Systems

Biography: Christopher Ferguson is a current master's student at the University of Akron where he received his bachelor's degree in mechanical engineering in May of 2021. He is from Munroe Falls, Ohio, and attended Stow-Munroe Falls Highschool making enrolling in the University of Akron an easy decision due to the proximity and quality of education. During undergraduate, Chris was an active member of ASME and Tau Beta Pi, eventually becoming President of both engineering student organizations in his final year. This was coupled with his involvement in undergraduate research, working under Dr. Gregory Morscher. In this he studied a non-destructive evaluation (NDE) technique called Acoustic Emission (AE) which was used in conjunction with ceramic matrix composites (CMC) to study their failure mechanisms in situ. After graduation, the Ohio Space Institute funded a summer internship to study CMCs under a combustion environment and to begin the automation process of the test rig as described below in the abstract. Over the past summer, he worked with GE's Global Research Center in Niskayuna, New York where he worked on creating a simple screening test for thermal barrier coatings. He decided to accept a position there and will start soon after graduation.

Abstract: The burner rig optimization project will utilize the University of Akron's pre-existing combustion rig to simulate the environment within the combustion chamber of a jet engine and optimize it for different flight conditions. The main improvement being proposed for this project is in the optimization and automation of the testing capabilities of the system. Aircrafts operate at different conditions depending on its stage of flight. At takeoff, the engines are at full throttle, placing a high stress on the internal components of the jet engine due to the temperatures and thrust generated. After takeoff, the aircraft reaches its cruising stage which significantly reduces the stress experienced. The material cycles through high stress and high temperature and low stress and low temperature through the duration of the flight which represents a gap in the capabilities of the burner rig in its current iteration.

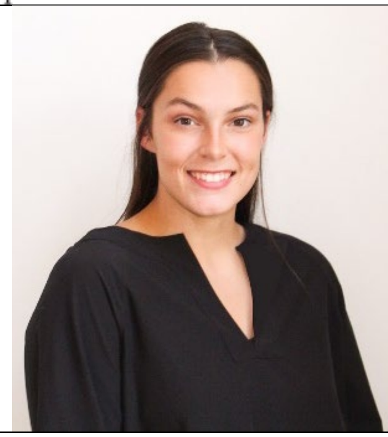
Due to the conditions that high temperature materials undergo, thermal fatigue and thermal mechanical fatigue are considerations that need to be discussed to understand their true capabilities. A system was built that coordinates the temperature the specimen experiences as well as alters the axial load applied in accordance with the different flight stages. Testing will soon begin on various high temperature materials at either a hypersonic velocity or lower to determine the performance during a simulated flight path.

Publications: None yet.

14	David P. Joyce

MIAMI UNIVERSITY

Alexandra Filiatraut



Master's 1, Mechanical Engineering
Advisor(s): Dr. Mehdi Zanjani

Machine Learning-Based Study of Building Block Interactions and Material Properties in Crosslinked Polymer Networks

Biography: Alexandra Filiatraut is a master's student at Miami University studying Mechanical Engineering. She is a part of Miami University's combined B.S./M.S. degree program and will graduate in Spring 2022. In January 2021, Alexandra began conducting undergraduate research with Dr. Zanjani surrounding the intersection of machine learning and material science. She continues pursuing this line of research in her master's thesis, focusing on building machine learning algorithms to aid in material synthesis and property prediction for complex polymer systems. Filiatraut has obtained internships in the automotive industry with Mercedes-Benz in 2019, and in the paper industry, working with Georgia-Pacific in 2021 and 2022 as a research and development engineering intern. Outside of academic pursuits, Alexandra was a member of Miami University's Varsity Track and Field Team from 2018-2022 as a javelin and discus thrower. After graduation, she will return to Georgia-Pacific full-time as a research and development engineer.

Abstract: In recent years, Machine Learning techniques have evolved to address many complex issues across different disciplines, including unique materials science applications. Two such Machine Learning techniques, Convolutional Neural Networks (CNNs) and Graph Convolutional Neural Networks (GCNNs) provide algorithms that process a network's particle interactions and architecture to predict various system features and properties. This project is focused on the study of polymer composites synthesized from dynamically crosslinked networks, which consist of polymer backbones and crosslinking agents that interact with one another in unique and complex ways. Due to system complexity, there is little that is understood about the particle-level interactions that are key to a complete understanding of these systems. In order to provide insight into the fundamental particle-level interactions governing these dynamic systems, this study compiles a data set using Molecular Dynamic (MD) simulations that map particle trajectories and creates a GCNN to learn and predict the particle interactions based on the aforementioned data set. The GCNN features nodes representing particle-level dynamics and edges trained to learn the particle-level interactions defined as the forces acting on each particle by its neighbors. Once trained, the GCNN is used to predict particle interactions at any point in time during the simulation, providing insight into the fundamental particle interactions that govern a dynamic polymer network.

The components within a dynamic polymer network can form multiple architectures with the potential to deliver a wide range of desirable physical properties. In addition to understanding complex particle interactions, this study seeks to investigate the relationship between polymer network configuration and the resultant mechanical properties of crosslinked polymer composites. MD simulations are run for a variety of crosslinker and backbone configurations, the results of which detail the mechanical strength properties of a dynamic polymer system based on network architecture. The results of the MD simulations and "3D images" of each polymer network configuration are used to train the 3D CNN model to predict polymer strength properties based on network architecture. The results of this work detail the efficiency and accuracy of the use of CNN and GCNN techniques to predict particle interactions and mechanical properties using particle trajectory and 3D representations of polymer systems respectively. Additionally, this work furthers understanding of fundamental particle interaction law and helps identify crosslinked polymer network architectures that can deliver desired mechanical properties for future experimental implementation.

Publications: None yet.

8	Warren Davidson

KENT STATE UNIVERSITY

Zach Fitzgerald

Master's II, Aerospace Engineering
Advisor(s): Dr. Ye Lu

Robust Low-Thrust Trajectory Design Incorporating Uncertainty Propagation

Biography: Zach grew up in Orrville, Ohio and received his bachelor's in Mechanical Engineering Technology from the University of Akron. Throughout his job search following graduation he worked as a substitute teacher at his local middle school. Falling short of finding an engineering job that fit his career goals, he decided to return to school to obtain a master's in Aerospace Engineering from Kent State University. Zach's first course in the program introduced him to a new desired career path and his current research advisor, Dr. Ye Lu. The research is looking to push the trajectory design process forward by implementing uncertainty propagation. Zach plans on pursuing a career as a Guidance, Navigation and Controls Engineer for space exploration missions. Outside of the classroom, he competes as a powerlifter for the United States Powerlifting Association. Zach takes pride in applying a high level of dedication and discipline to achieve his goals.

Abstract: The current mission design process considers the optimal trajectories and Monte Carlo analysis separately. The state-of-the-art onboard guidance algorithms tend to find a single optimal solution based on the current navigation knowledge, which is then used for reference tracking. This research focuses on robust low-thrust trajectory design methods that integrate uncertainty propagation to provide a probabilistically optimal trajectory.

A nominal optimal low-thrust trajectory is generated using basic polynomial collocation to covert the optimization problem to a nonlinear programming problem where it will then be solved with commercial nonlinear programming software. The statistical performance of the solution will then be analyzed using Monte Carlo simulation. Using the nominal trajectory generated as a baseline comparison for the research, uncertainty propagation will then be implemented into the problem formulation. The results from each solution method will then be analyzed and compared to determine the cost and benefits of implementing uncertainty propagation into trajectory optimization. The goal is to show that with uncertainty propagation, the trajectory design can become robust compared to current methods, opening new doors for the future of space exploration.

Publications: None yet.

13	Emelia Sykes

Grant Guggenbiller

Master's 2, Biomedical Engineering
Advisor(s): Dr. Andrew Weems

Tunable Morphology Photopolymer Electrospun Fibrous Mats Derived from Natural Product Pro-Drug Salicylic Acid

Biography: Grant is currently a master's student studying biomedical engineering under Dr. Andrew Weems at Ohio University. Grant's interests started out as just devices for tissue engineering but have since grown to include natural and sustainable materials and their many uses. Grant has gone on to publish a paper, "Poly(β-hydroxythioether)s as Shape Memory Polymer Foams for Oil Sorption in Aquatic Environments" in the Journal of Applied Polymer Science (IF = 3.13), and is currently continuing a tissue engineering related project involving the electrospinning processing technique. After his obtaining his MS degree, Grant is planning on pursuing his PhD in chemical engineering with the intent to work as a clinical trial researcher or tissue engineering researcher.

Abstract: More than 500,000 Americans per year suffer from third degree burns, with nearly 10% resulting in scarring, loss of function, and other significant morbidities including death.[1], [2] The gold standard in burn treatment is skin grafts, which reduce healing time and scarring, but are limited by size and suffer from sepsis, infection, and tissue necrosis.[3], [4] Alternative therapeutic strategies are required to overcome these current limitations to aid burn patients, and include hydrogels, foams, collagen, natural material sheets, and electrospun fibrous meshes. Of particular interest is electrospinning, which offers the advantage of nanostructures (fibers) which produces porous 3D mats with morphology mimicking the extracellular matrix and possessing a high surface area, which aids in the proliferation of cells while reducing scaring.[5]–[7] However, electrospinning has had only limited materials leveraged towards burn wounds, in addition to limited clinical testing.[6]–[9]

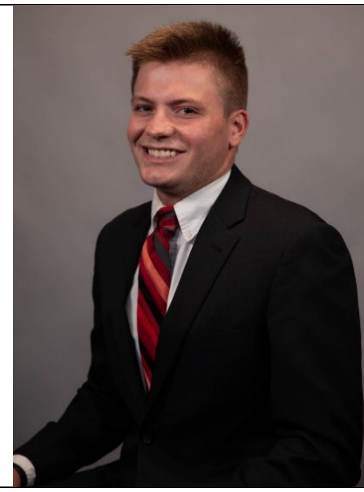
Electrospinning offers a unique opportunity as a processing method that is compatible with a wide array of polymers and conditions that may all be tailored to produce similar morphologies in the resultant 3D porous scaffolds. An additional benefit of electrospinning is the ability to leverage external stimuli, such as light, to drive *in situ* reactions including thiol-ene photoclick reactions to produce thermoset polymer network fibers. Grant is working on a series of bioderived, pro-drug photopolymers derived from salicylic acids to achieve a series of composite fibrous mats intended to reduce infectious risk and to accelerate healing. The mats are examined for physical properties to determine the role of the composition, the fiber morphology, and the active additive species. Of specific note, these materials display shape memory, allowing for minimally invasive medical device opportunities, as well as cytocompatibility and antimicrobial behaviors. Ultimately, these composite fibrous mats display excellent promise for both implantable tissue scaffolds as well as for medical devices including face masks or burn wound coverings.

[1] W. Norbury *et al*, *Surg Infect (Larchmt)* Apr. 2016. [2] S. Shlash *et al, Int J Burns Trauma*, Jun. 2016. [3] A. El Khatib *et al, Medicina (Kaunas)*, Apr. 2021. [4] D. P. Orgill, *New England Journal of Medicine*, Feb. 2009. [5] P. Kumar *et al*, *J. Appl. Polym. Sci.*, Jul. 2017. [6] S. Agarwal *et al*, *Polymer,* Dec. 2008. [7] H. Wang *et al, Sci. China Phys. Mech. Astron*, Jul. 2012. [8] M. Stojko *et al.*, *Pharmaceutics*, 9, Sep. 2020. [9] C. Ng, M. Hamzah *et al, JAITA*, Dec. 2020.

Publications: ***G. Guggenbiller,*** A. Al Balushi, A.C. Weems, **"**Poly(β-hydroxythioether)s as Shape Memory Polymer Foams for Oil Sorption in Aquatic Environments." *Journal of Applied Polymer Science.* Accepted, in press

5	Robert E. Latta

Ryan P. Leahy



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

Active Control of Flow and Acoustics in Heated Supersonic Rectangular Twin Jets

Biography: Ryan Leahy is currently a second-year master's student pursuing a degree in Mechanical Engineering, with a focus in Aerospace at The Ohio State University. In May 2021, Ryan graduated *magna cum laude* from Ohio State with a bachelor's degree in Mechanical Engineering and a minor in Spanish. In addition to participating in the Formula and Baja SAE clubs as an undergraduate, Ryan obtained professional engineering internships in both the manufacturing and power industry. Working as a research assistant at the Gas Dynamics and Turbulence Laboratory at Ohio State has enabled Ryan to cultivate a new passion for aeroacoustics. Outside of his studies, Ryan enjoys playing the guitar and working on his vehicles.

Abstract: As the design requirements for future tactical aircraft become increasingly complex, future exhaust systems of these aircraft must adapt to the operational requirements that include thrust vectoring, thrust reversing, lower drag allowances, as well as greater control for mixing and entrainment. Rectangular twin jets offer a way to fulfill these requirements in the integration of aerodynamic and propulsion in the future tactical aircraft (Dusa et al. 1983, Weigand et al. 2018). In addition, due to the nature of closely spaced supersonic twin jets, the formation of feedback loops, coupling and screech, have the potential to increase the unsteady near field pressure fluctuations while also having the effect of elevated far field noise (Shaw 1990, Panickar 2004). The increased near field pressure fluctuations can induce structural damage to nearby components of the aircraft (Berndt 1984), while the elevated far field noise is detrimental for personnel working closely with supersonic jets (Walker 1990).

Localized arc filament plasma actuators (LAFPAs) have been developed at The Ohio State's Gas Dynamics & Turbulence Laboratory and have previously been successfully used for flow control in several high speed and high Reynolds number shear layers (Samimy et al. 2018, Esfahani et al. 2021).
In unheated jet experiments, these actuators have demonstrated the ability to mitigate NF pressure while altering coupling modes (Leahy et al. 2022) as well as advantageously affecting Far-Field acoustics levels. Ongoing work is being carried out to characterize heated rectangular twin jets up to a total temperature ratio of 2 as well as investigate the LAFPAs effect on coupling, near-field pressure, and far-field acoustics.

Publications:

N. Webb, A. Esfahani, S. Yoder, R. Leahy, M. Samimy "Empirical Closure Model for Coupling Mode Prediction in Supersonic Rectangular Twin Jets." AIAA Journal, Nov. 2022

R. Leahy, A. Esfahani, N. Webb, M. Samimy, "The Effects of Active control on Near-Field Pressure Fluctuations in Supersonic Rectangular Twin Jets", AIAA paper 2022-2968, AIAA/CEAS Aeroacoustics 2022, June 2022, Southampton, UK

N. Webb, A. Esfahani, R. Leahy, M. Samimy, "Active Control of Rectangular Supersonic Twin Jets using Perturbations: Effects and Mechanisms", AIAA paper 2022-2401, AIAA SciTech 2022, Jan. 2022, San Diego, Ca

8	Warren Davidson

Lynn Pickering

PhD Candidate, Aerospace Engineering
Advisor(s): Dr. Kelly Cohen

Fuzzy Logic SHAP for interpretability in high input engineering data applications

Biography: Lynn Pickering is in her third year as a PhD candidate at the University of Cincinnati, after graduating with a Bachelors of Science in Aerospace Engineering and minor in German Studies (Summa Cum Laude and Distinguished University Honors Scholar). Without trust in AI, only so much can be achieved, and so she is passionate about Fuzzy Logic as an artificial intelligence method that provides the transparency and explainability to truly advance AI. Explainability in AI is essential to AI built to work in partnerships with Humans, as well as ensure that the AI is being accurate. To this end, she is working on applying Explainable AI methods to AI coupled with game theory. To further promote explainable fuzzy systems, she is on the organizing board of the Explainable Fuzzy AI student competition.

Abstract: This project extends efforts of AI coupled with game theory. SHAP is a novel unified approach for interpreting the predictions of models. It makes use of an explainer model, which is an interpretable approximation of the original model. The novelty of SHAP was unifying six explanation models from the literature: LIME, DeepLIFT, Layer-Wise Relevance Propagation, classic Shapley regression values, Shapley sampling values, and Quantitative Input Influence. The theory behind SHAP is based on the concept of Shapley values from game theory, where Shapley quantifies the contribution of each player to a game.

In this work, SHAP is applied to fuzzy logic to further increase the interpretability of fuzzy logic for large input engineering applications. Interpretability has many aspects, of which understanding the impact of input variables on the final output of a classification task for an engineering application is one. The work here considers the three primary fuzzy systems for analysis : Mamdani, Takagi–Sugeno–Kang and inference fuzzy systems. Furthermore, in a fuzzy logic system, the input variables are partitioned into fuzzy sets, which allows this work to extend the typical work done applying SHAP to a system and analyzing input variables, to analyzing input variable fuzzy partitions on a finer scale.

Publications:

-Pickering, L., and Cohen, K., “Genetic Fuzzy Controller for the Homicidal Chauffeur Differential Game”, 2023 NAFIPS Annual Conference, 31st May – 2nd June, 2022, Saint Mary’s University, Halifax, Canada. To also appear as book chapter in Springer publication.
-Pickering, L., and Cohen, K., “Towards Explainable AI - Genetic Fuzzy Systems - A Use Case”, 2021 NAFIPS Annual Conference, June 7-9, 2021, Purdue University, IN. To also appear as book chapter in Springer publication titled ‘Explainable AI and Other Applications of Fuzzy Technique’s Editors: Julia Rayz, Victor Raskin, Scott Dick, and Vladik Kreinovich.
-Pickering, L., Ernest, N., Arnett, T., Kunkel, B., and Viana Perez, J. (2021, June 7-9). Explainable AI Challenge – Student Competition. 2021 NAFIPS Annual Conference, Purdue University, IN, United States.
-Pickering, L., and Cohen, K., “Genetic Fuzzy based Tetris Player”, 2020 NAFIPS Annual Conference, August 20-22, 2020 - Redmond, Washington, USA.
-Pickering, L., Viana Perez, J., Li, X., Chhabra, A., Patel, D., and Cohen, K., “Identifying New Inputs in COVID - 19 AI Case Predictions”, Proceedings of 7th International Conference on Soft Computing and Machine Intelligence (ISCMI 2020), November 14-15, 2020, Stockholm, Sweden, pp. 192-196.

2	Brad R. Wenstrup

THE UNIVERSITY OF TOLEDO

Evyn Pohlman

Master's 2, Mechanical Engineering
Advisor(s): Dr. Anju Gupta

Two Phase Flow Boiling in Microgravity

Biography: Growing up on a farm, I developed an affinity and an interest towards building and repairing devices/machines that would enable us to get the job done. So, I went to school to become an engineer. My mechanical engineering career began at the University of Toledo, joining clubs such as the FSAE Motorsports Team and the UT Scuba Club. For the whole 2021 year, I was involved in undergraduate research designing a supersonic wind tunnel and its control system. When I graduated with my Bachelor's of Science in December 2021. I returned the next semester to begin my Masters program. I joined Dr. Anju Gupta's Interfacial and Thermal Transport Lab the start of that semester and began my masters research as her student.

Abstract: One of the main differences of flow boiling in microgravity as compared to gravity is obviously the lack of gravity. This creates several differences, for example the lack of pressure associated with height and buoyancy effects from gravitational body forces. There is no thermally induced convection either, or automatic bubble detachment due to convection or buoyant effects like in terrestrial pool boiling. This makes the properties of the fluid itself much more pronounced, specifically surface tension effects, and creates several problems that traditional boiling methods are not well suited for. Thus, new methods must be engineered to provide cooling throughout ranges of gravity magnitudes, from zero gravity to earth's gravity. Without improvements, the current methods are ineffective at providing the necessary cooling requirements, and in fact are not even close, and the space industry as whole is greatly limited.

Since there is no automatic bubble departure due the lack of aforementioned effects, surface engineering of the heater and channel geometry is vital to the performance. Because the bubbles do not detach, shear forces created by forced fluid convection across the heater surface take the place of the thermally induced convection as well as buoyant effects. This is called two-phase flow boiling. The proposed research aims to utilize numerical simulation, via Ansys to study and improve the phase change heat transfer properties such as critical heat flux, wall superheat, and heat transfer coefficient using surface and channel geometry modification with water at first while under multiple gravity regimes.

Publications: None yet.

5	Robert E. Latta

Natalie Reed

Master's 2, Aerospace Engineering
Advisor(s): Dr. Joseph Corcoran

Structural Health Monitoring of Aerospace Structures Using a Passive Guided Wave Approach

Biography: Natalie Reed is a graduate student at the University of Cincinnati working in the Center for Non-Destructive Evaluation. She graduated from the University of Cincinnati in 2022 with a Bachelor of Science in Mechanical Engineering before continuing on to finish her Master's degree in Aerospace Engineering. During her undergraduate career, Natalie was involved in a wide variety of research projects focusing on everything from Electrochemical Additive Manufacturing to Aeroacoustics in UAM vehicles. She has presented her work at multiple international conferences. Outside of research, Natalie worked as a co-op at Emerson in Sidney, Ohio performing destructive testing on compressors for refrigeration and HVAC applications. It was through these experiences that she came to find her current research which combines some of the theory she learned working in industry with the wealth of complex applications offered by the field of Aerospace engineering. After completion of her graduate degree, Natalie hopes to return to industry as a reliability or test engineer and use her knowledge to provide companies with the technical expertise to predict and monitor the life of their products and components.

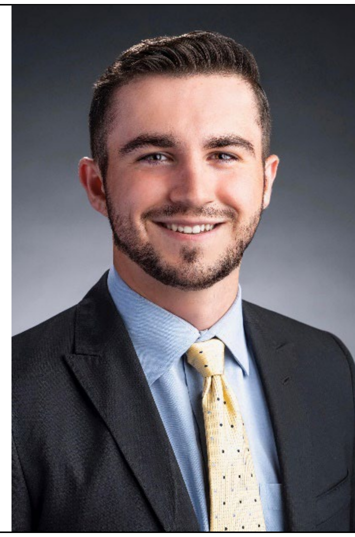
Abstract: The uptake of structural health monitoring in aerospace has been limited by the practicality of piezoelectric transducers and the lengths of their associated cables. The use of fiberoptic strain sensors that can be integrated into or onto aerospace assets such as fuselages, wing structures, or pressure vessels presents a potential solution. However, a conventional structural health monitoring approach is to use guided waves sent and received between an array of transducers. This presents an issue for the use of fiberoptic sensors which are not capable of excitations and only detection. To solve this problem it is proposed that existing ambient vibrations (the 'noise') are used as a preexisting source of ultrasound. This provides a passive modality, where the desired signal can be created though advanced signal processing on data harvested simply by the fiberoptic sensors. The aim if this research is to produce a proof-of-concept prototype monitoring system. This system would allow for the construction of a close approximation of a traditional active signal (with ultrasonic excitation) through advanced processing on a passive signal (without ultrasonic excitation). In order to construct this system, this work will focus on creating a better understanding of the means by which an active signal can be reconstructed. This understanding will then be used to better define hardware limitations and data processing techniques required to build a reliable prototype.

Publications:

Reed, N., and Cuppoletti, D. R., "Implications of Rotor-Rotor Interaction in Noise Generation of UAM Vehicles with Counter-Rotating Configurations," AIAA SciTech 2022 Forum, San Diego, CA, January 2022.
Kamaraj, A., Reed, N., and Sundaram, M., "Effect of Ultra-High Pulse Frequency on the resolution in the Electrochemical Deposition of Nickel," 49th SME North American Manufacturing Research Conference, Cincinnati, OH, June 2021.

1	Greg Landsman

Hunter Reeling



Graduate Student (M.S.), Mechanical Engineering
Advisor(s): Dr. Jinjuan She

Aligning Functional Analysis Processes to Designers' Natural Cognitive Flow
to Improve Creativity and Reduce Effort

Biography: Graduate student studying Mechanical Engineering at Miami University, in a 4+1 degree program, expected to complete research and M.S. degree in May of 2023. Prior to joining this degree program, Hunter was a student-athlete in baseball through the first three college semesters before transferring to Miami in the Spring of 2020 and putting down baseball during the COVID-19 pandemic. Once at Miami, Hunter joined the Honors college and enjoyed the engineering coursework. Outside of the classroom, undergraduate research with Dr. Andrew Sommers studying micro-milling to influence fluidic behavior on metal surfaces led to a desire to pursue an advanced degree. This desire led to the joining of the Human Centered Design lab, at Miami University, beginning the master's research covered in the abstract below, and obtaining this fellowship honor. Last summer, Hunter completed an internship in the Mechanical group of the Space Exploration Sector at John's Hopkins Applied Physics Laboratory, currently maintains a part-time on-call status with the group. No concrete plans have been established after graduation, such as entering industry or pursuing a Ph.D.

Abstract: Engineering design in new product development is a constant battle between creativity and strict structure. As researchers look to optimize the process, each stage is placed under a microscope to put designers in the best position to develop better products for companies in a cost-effective manner. One idea in improving product development is the concept of incorporating human-centered design into functional analysis. However, critiques of these functional analysis methods cite an unnecessary number of resources needed to invest in these steps, a restriction in creativity, and a high necessary level of effort from the design teams. The goal of this research will be to address these critiques by incorporating theories from cognitive research and Human-centered Design into the functional analysis process. This work will propose and test a new method aimed to increase creativity, improve the quality of the function model of the design space, and be accessible to engineering students and industry engineers alike.

Publications: She, J., Belanger, E., Bartels, C., and Reeling, H. (July 22, 2022). "Improve Syntax Correctness and Breadth of Design Space Exploration in Functional Analysis." ASME. *J. Mech. Des*. November 2022; 144(11): 111402. https://doi.org/10.1115/1.4054875

8	Warren Davidson

KENT STATE
UNIVERSITY

Alyssa Reinhardt

Master's Student, Geology
Advisor: Dr. Timothy Gallagher

Using Remote Sensing to Predict Seasonal Controls on Soil Respiration and Weathering Across a Watershed

Biography: Alyssa attended Bowling Green State University and earned a degree in Geology, where she also did research on the effect of boat washing on Lake Erie water chemistry. She is currently attending Kent State University and working on a Master of Science degree in Geology and plans to continue with a PhD in Applied Geology. She is passionate about environmental protection, science communication, and STEM outreach, particularly for underrepresented groups. Alyssa lives in Cuyahoga Falls with her cat, Kermit.

Abstract: This research project assesses the potential of using remote sensing of soil moisture to predict variations in soil respiration and chemical weathering. It utilizes a combination of remote sensing technology, manual soil gas sampling, and laboratory soil incubations to upscale predictions of soil respiration across the Huff Run Watershed in southeastern Ohio. This watershed was once the site of coal mining throughout the late nineteenth and early twentieth centuries. The mining stopped in the 1940s and the mines, along with their overburden or spoils, were abandoned. Consequently, the Huff Run Watershed is affected by Abandoned Mine Drainage (AMD), which occurs when the leftover mine spoils that are rich in sulfide minerals interact with water and oxygen and release acidity into soils and streams. One of the main minerals responsible for AMD is pyrite, a sulfide mineral that breaks down by consuming oxygen.

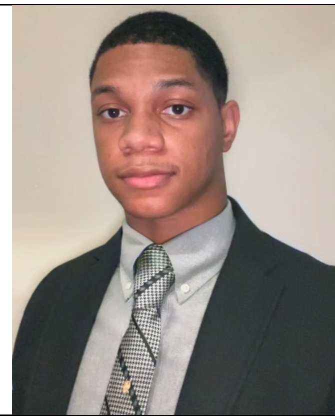
It is hypothesized that the presence of pyrite in abandoned mine spoils will be detectable by soil gas measurements. Additionally, the rate of mineral weathering as well as soil respiration should be controlled seasonally. Since pyrite oxidation and soil respiration occur simultaneously in mine spoils throughout the Huff Run Watershed, the soil gas signals of these two processes must be detangled in order to understand how they are each affected by soil moisture and how they affect each other. This research has two main goals: to understand the ability of remote sensing to predict soil processes on a regional scale and to better understand how carbon fluxes between soil and the atmosphere are controlled by seasonality and the presence of reduced iron.

Publications: None yet.

13	Emelia Sykes

Cleveland State University

Dawud H. Sharrieff



Master's 1, Biomedical Engineering
Advisor(s): Antonie van den Bogert

Wearable Sensing for Analysis of Musculoskeletal Function During Zero-G Exercise

Biography: My name is Dawud H. Sharrieff. My personal experiences inspired me to currently pursue a Biomedical Engineering degree at Cleveland State University, after achieving my Bachelor's in Mechanical Engineering: For as long as I could remember, I knew I wanted to bring or restore ability to those who have limited physical ability. You could say I have somewhat of a personal investment in this mission, having been born with cerebral palsy. My spark and motivation: To give people, and especially kids, a better quality of life through research and development of advanced technology/devices.

Abstract: Loss of muscle and bone tissue is a well-known problem for astronauts in long-duration missions. This problem can only be solved by regular physical exercise, designed to deliver sufficient dose of mechanical load to muscles and bones. To this end, compact and light-weight exercise machines with electromechanical resistance, such as ATLAS from NASA GRC, will likely be deployed in Mars exploration missions. It would be desirable if the exercise device came with sensors and software to estimate the forces in muscles and bones, to inform the astronaut and the medical team, and help ensure that a sufficient daily dose of mechanical loading has been achieved. This project will contribute to that goal. The specific aims are to develop and evaluate a novel approach to estimate forces in the human body.

This past Fall 22 semester, using OpenSim's Matlab API, a musculoskeletal model was successfully completed to complete a geometrically realistic arm musculoskeletal model and basic simulation for a biceps curl. The simulation was tested to ensure that it works as expected, providing the data and plots for; *Elbow Angle, Biceps Muscle Activation, Biceps Force, Biceps Fiber Length, Biceps Tendon Length, and Biceps Muscle-Tendon Length.* I worked throughout the semester to continue learning the OpenSim Moco API and how to correctly express commands to build a more complex simulation which we want to use later for trajectory optimization. Trajectory optimization will be used to find trajectories that track data from inertial measurement units (IMUs) and electromyography (EMG) sensors. Experiments will then be done to evaluate the method for a biceps curl exercise. The collected data and model will be altered to evaluate the accuracy in both Earth gravity and in zero gravity, where inertial sensing cannot benefit from drift correction by the gravitational effect on accelerometer signals. In year two (given separate funding) the work could be extended towards full body exercise.

We expect considerable indirect impact by enabling further developments:

- When musculoskeletal forces are estimated during exercise, adaptive control of the electromechanical exercise device becomes possible, altering the resistance automatically to optimize the delivery of appropriate levels of loading to all relevant tissues.
- With the same models and software, trajectory optimization can be done in a predictive manner, without human experiments or data, to develop and optimize the design of exercise machines prior to prototyping or human testing.
- The developed technologies can be adapted for applications outside NASA, in rehabilitation, ergonomics, and fitness.

Publications: None yet.

4	Jim Jordan

Scholars

Bella Allen

Senior, Chemistry and Biology
Advisor(s): Dr. Michael Kovach

Are nasal cannula prongs an under recognized vector of the transmission of pathogens?

Biography: Bella is a senior studying Chemistry and Biology at Baldwin Wallace University. During her time as an undergraduate, not only has she has taken up research projects for each of her majors, but she also works outside of school at the Cleveland Clinic. During the past summer, she worked in the Chemistry department at Northeastern University in Boston, MA through a 10-week REU program. After graduation, she hopes to pursue her doctoral degree and enter the industry conducting research.

Abstract: Nasal cannulas are frequently used in healthcare and recently have been investigated as vectors for the transmission of pathogens. These cannulas are frequently removed by healthcare works to care for patients. Currently it is unknown just how many pathogens these cannulas are exposed to when removed from the patient. Via a series of experiments utilizing bacterial cultures, the survival of bacteria on the cannula over a specified length of time can be assessed. We theorize that it is unlikely that the viral load increases, as viruses require living cells to replicate. However, the bacterial load may persist for a short time, long enough to be introduced into the host for possible infection. Our principal investigation is to determine if the bacteria can survive on the cannula, and if they can, how many remain on the cannula after a specified length of time. This research can provide critical information pertaining to bacterial survival on these cannulas and then subsequently be used to potentially develop a better understanding of the transmission of pathogens on universal vectors.

Publications: None yet.

16	Anthony Gonzalez

Cleveland State University

Luke Anderson

Junior, Electrical Engineering
Advisor(s): Dr. Gao

Research and Design of Controls for Multi-rotor Unmanned Aerial Vehicles (MUAV)

Biography: My name is Luke Anderson; I am currently a Junior Electrical Engineering student and Cleveland State University's Washkewicz College of Engineering. I have lived in the Cleveland area my whole life. I come from a family of four, my parents and older brother. I enjoy constructing my own custom circuits with friends on campus to supplement my course work. In my spare time I cycle and have been pushing to the goal of riding fifty miles.

Abstract: The purpose of this research is to investigate the feasibility of Multi-Rotor Unmanned Aerial Vehicles (MUAVs) for the application of weather data acquisition. That is, the use of MUAVs, or drones, in heavy winds / severe weather conditions. The initial concept of using drones over other methods is the freeness that comes with drones. Drones are not bound to a single spot in the sky and can be deployed nearly anywhere. The main struggle of using a drone is the stability of the drone. It is desired that the drone would be able to fly itself to a specified location and maintain that position, even in the face of strong wings and other disturbances.

This research has been divided into two separate areas. First being the study of how to make a drone. Dr. Gao thought it in the student's best interest to learn the complete workings of a drone for this research. That is, the drone itself should be a uniquely developed entity, used as a learning bed. This decision was made due to the fact that advanced controls that would be required for such a project are of the graduate level and thus a good foundation should be made first. The second area is the analysis of the physical setup of the drone. How many rotors is best, how far apart should they be as to not interfere with the sensors on board? These questions will be looked at and used in the design of a final version of a drone.

Publications: None yet.

9	Marcy Kaptur

KENT STATE
UNIVERSITY

Ethan Armstrong

Senior, Actuarial Mathematics
Advisor(s): Dr. Aloysius Bathi Kasturiarachi

Predicting Gravitational Collapse with Einstein's Field Equations

Biography: My name is Ethan Armstrong. I live in New Philadelphia, Ohio. I'm studying actuarial mathematics at Kent State University. I love mathematics and I believe it will be a versatile degree to have for my career. I'm also interested in physics and astronomy, and I'm excited to be taking part in research through the OSGC. I believe that the work NASA does is important for the future of humanity and I'm happy to be supporting that through my research.

Abstract: Our goal is to use Einstein's Gravitational Field Equations to predict whether certain stars will collapse into black holes at the end of their lives. Specifically, we will be using the bounds on neutron star mass given by the Tolman-Oppenheimer-Volkoff (TOV) equation, which describes a spherically symmetric body of isotropic material in gravitational equilibrium. We will apply it to several relatively nearby stars, taking into account their mass, radius, and angular momentum.

Publications: None yet.

7	Max Miller

OHIO UNIVERSITY

Wafa Aziz

Senior, Biochemistry
Dr. Sarah Wyatt

Phenotypic Characterization of Gravity Related Transcription Factors Using Clinorotation

Biography: I am a senior at Ohio University studying biochemistry and with a focus in plant biology. At the Wyatt Lab, I research transcription factors that are differentially expressed in microgravity to understand more about the plant gravity response. In addition to research, I have worked as a college math tutor and a microbiology lab assistant. I enjoy attending professional academic conferences to further understand the many facets of biological research and network with my peers studying in diverse fields. I hope to learn more about, and one day study, space science and exobiology.

Abstract: How does gravity affect plant growth? Or rather the absence of it? To help answer these questions, some of the National Aeronautics and Space Administration's (NASA) space flights allow for plant experimentation in the microgravity environment of the International Space Station (ISS). One such experiment, Biological Research in Canisters (BRIC) 20 flown in 2015 by the Wyatt lab at Ohio University, led to the discovery of three transcription factors that had altered expression in spaceflight as compared to ground controls. Transcription factors control downstream gene expression and are often a control point for physiological responses. These three transcription factors, Ethylene-responsive transcription factor 104 (ERF104), IQ-domain 21 (IQD21), and Cryptochrome-interacting basic-helix-loop-helix 1 (CIB1), were selected for further study via chromatin immunoprecipitation sequencing (ChIP-seq) to identify the DNA binding sites of the transcription factors and subsequent genes they regulate.

Homozygous ChIP insertions for each gene in its mutant background, along with null mutants for each gene and Col-0 Arabidopsis seedlings will be phenotyped to determine whether the constructs, inserted into the respective mutant background, will yield wild-type responses to a change in the gravity vector (effectively "rescuing" the phenotype). These will be exposed to simulates microgravity using a novel approach, clinorotation. A clinostat allows for plant growth while rotating the plants in three dimensions, and it also has the ability to capture images of the growing seedlings. Although this is not the true microgravity environment a spaceflight allows for, industry and the academic community utilizes the mimicked environment provided by clinorotation to study plant responses to microgravity.

Publications: None yet.

15	Michael Carey

Tyreese Bernard

Junior, Electrical Engineering
Advisor(s): Ingrid Daubar, Ph.D , Deok Nam, Ph.D
& Melissa Meyer

Temporal variations in the relative Albedo of Martian Dust Devil Tracks

Biography: Hi, I'm Tyreese from Indianapolis, Indiana, an undergraduate majoring in Electrical Engineering at Wilberforce university. Since I was a small child around the age of 8, I've had my eyes glued to the television every time I visit my grandparents. Watching a show called Phineas & Ferb where they would build and invent everything from Rockets, Time Machines & Roller Coasters. Watching this intrigued me and gave me a creative spark. As a child I would take things apart like ball point pens, remotes, bicycles, phones etc. taking apart the ball point pens and building cannons that would need to be lit and could puncture a hole through a tin can. Taking apart remotes and creating a robotic bug that would bounce off obstacles and keep going and taking apart old bicycles and revamping them into new ones. Little did I know years later that my interest in engineering would start. My plan is to work with rockets & missiles for companies such as NASA, Boeing, Lockheed Martin, Blue Ogrin & Space X. After completing my degree and working in my field for several years I would love to become an astronaut.

Abstract: The characterization of the modern Martian climate and atmosphere is an important step toward evaluating the potential for habitability and human exploration of Mars. An important component of the red planet’s climate is the ubiquitous Martian dust. Dust devils are a common part of the dynamic climate of Mars, forming when the warm air closest to the ground meets cooler air from, causing mixing and the rise of dust off the Martian surface, and leaving a dust devil track. The fading of dust devil tracks, some of which are visible from orbital HiRISE (High Resolution Imaging Science Experiment) imagery, can be analyzed over time to understand how much dust settles over time to erase their tracks. This information can be used to infer how much dust devils contribute to the overall dust cycle on Mars. Here we calculate changes in relative albedo for [X number of dust devil tracks] using [X number of repeat HIRISE Images] at the Insight Lander location in the Elysium Planitia region of Mars in order to quantify the fade rate of these climatic indicators. Results show that dust devils fade after [X number of days] and follow an [X linear, exponential] albedo decline trend. This is [X similar or different to results elsewhere on Mars] which shows [X dust settling rates are either similar or different to these elsewhere].

Publications: None yet.

10	Michael R. Turner

NORTHERN

Grant Brautigam

Junior, Mechanical Engineering
Advisor(s): Jed Marquart

Welding's Practicality in the Space Environment

Biography: Grant Brautigam studies Mechanical engineering at Ohio Northern University. He is from the small town of New Bremen Ohio. Grant has been an active member of Ohio Norther's chapter of AIAA since his freshman year and currently serves as Vice President. He also recently became a member of the Ohio Lota Chapter of Tau Beta Pi. Over the course of Grant's studies, he has become interested in robotics and aerospace topics and he hopes to further explore these areas in a graduate degree.

Abstract: With the accessibility of space increasing, manufacturing in the space environment will eventually be necessary for repairs and construction of bigger structures. Welding is a fundamental aspect of any large scale project thus knowing what kinds of welding are practical in the harsh environment of space is key for a safe a successful execution. Traditional arc welding poses different hazards that lass common types of welding such as friction, laser, and cold welding my be able to combat. In-space manufacturing can increase the scale and limit on what kinds of structures can be put into orbit.

Publications: None yet.

4	Jim Jordan

Marek Brodke

Junior, Aerospace Engineering and Mathematics
Advisor(s): Dr. Prashant Khare

Simulating Fluid Flows through Quantum Computing

Biography: My name is Marek Brodke and I am a 3rd year Aerospace Engineering and Mathematics student at the University of Cincinnati. I developed my interest in these topics at a young age while working on a cattle farm. There I was exposed to large machines that I was soon fascinated by; I was particularly fascinated by how a diesel engine operates (I am still fascinated by it). This fascination led me down a path of studying engines and other forms of extracting energy and along the way I became a member of a FIRST robotics team. As a member and mentor of that team, I gained the skills to further explore my passion as well as giving me valuable connections for the future. Currently, I am exploring more advanced topics in math, specific analysis, and I am looking forward to continuing to share my passions with others.

Abstract: Recent advances in quantum computing hardware and its increased availability has made it possible for researchers to explore its potential. While this emerging area has been investigated by researchers in several different fields of inquiry, there is a lack of literature demonstrating its viability in simulating classical fluid flows. My research builds on previous work that showed the viability of solving the Navier-Stokes equations using classical-quantum algorithms. Specifically, my colleagues and I implemented a quantum amplitude amplification and estimation circuit and successfully demonstrated that it can be combined with classical algorithms to simulate fluid dynamic flows. This hybrid quantum-classical algorithm was then applied to investigate one-dimensional flow through a converging-diverging nozzle. Our results agree with the theoretical calculations for the flow through the nozzle. This evidence-based assessment is a very important step to demonstrate the viability of applications of quantum computers to classical simulations of fluids. A manuscript regarding this work is currently under review and will be published by mid-summer 2023.

Publications: None yet.

9	Marcy Kaptur

Mye’sha Burnett

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

Atmospheric Model Validation through a BalloonSat Mission: Balloon Launch, Tracking, and Recovery

Biography: Mye'sha Burnett is an undergraduate student at Central State University, currently in her third year pursuing a bachelor's degree in manufacturing engineering. She has a strong passion for leadership and helping others achieve their goals, as demonstrated by her election as President of the National Society of Black Engineers at Central State University for the 2022-2023 academic year. In the summer of 2022, she interned at Materion Corporation as an environmental, health, and safety intern in Brewster, NY, where she gained experience in inspections, CNC machines, and Solid Edge software. Mye'sha also worked as an environmental, health, and safety intern at the National Museum of the American Indian in Washington DC during the summer of 2019, where she learned about safety data sheets and chemicals. Alongside her academic and professional pursuits, Mye'sha is a member of the Central State University Volleyball team, conducts research projects with professors, and enjoys photography. After completing her undergraduate degree, Mye'sha plans to pursue a master's degree.

Abstract: Instrumentation will be constructed and packaged to collect atmospheric data to near space altitudes for the purpose of validating the temperature and pressure profiles of the U.S. Atmospheric Model. A helium filled latex balloon, parachute, and associated payloads make up the “space vehicle” that will house the instrumentation. GPS and radio technology are needed for the successful tracking and recovery of the balloon in flight. This project centers on the balloon launch operations, tracking during the flight, and recovery after landing.

Publications: None yet.

10	Michael R. Turner

Cray A. Burton	

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

Atmospheric Model Validation through a BallonSat Mission: Ballon Launch, Tracking, and Recovery

Biography: Cray Burton is an undergraduate student attending Central State University (CSU) currently in his junior year. Cray grew up in grew up in Gurnee, Illinois as the son of a District attorney and Loan officer. Growing up, Cray has always been curious about how machinery and tools we're designed and created. Cray has interned at Ardagh Group as a production intern as well as a quality intern for the past two years and is now looking forward to being a Sales Engineer intern at Timken for this upcoming summer. At school he is currently working closely with Dr. Morris and a few other students working on figuring out the buoyancy force displacement in a hot air balloon.

Abstract: Data will be constructed, packaged, and implemented to be collected atmospherically from near space altitudes for the basis of validating pressure and temperature profiles of the U.S Atmospheric Model. A Latex balloon filled with helium gas, parachute, and payload makes up the construct of the "Ballon" that will carry the instruments. GPS and radio technology are needed as well, for successful data collection, tracking, and recovery of the whereabouts of the balloon in high altitude. This project orbits around the balloon launch operations, tracking during the flight, and recovery after landing.

Publications: None yet.

10	Michael Turner

Collin Butler

Senior, Mechanical Engineering
Advisor(s): Dr. Muhammad Jahan

Micro Electrical Discharge Machining of Aerospace Materials

Biography: Collin is a senior Mechanical Engineering student at Miami University. Being from Chicago meant he grew up surrounded by a robust built environment and heavy industry, which sparked his passion for engineering from a young age. Collin enjoys all things manufacturing, and has loved his work with Miami's Laboratory for Advanced Manufacturing Processes because it gives him access to cutting-edge manufacturing disciplines and tools. Outside of school, Collin likes woodworking, biking, and exercising. He is considering pursuing higher education, but will spend at least a few years in industry post-graduation.

Abstract: Electrical-Discharge Machining (EDM) is a non-contact machining technique that harnesses the electrical arc between a tool and workpiece in dielectric fluid to produce a spark, which removes material. The non-contact nature of EDM has many advantages, such as creating more options for machining materials that are very small or notoriously difficult to conventionally machine. This project investigates techniques of creating micro-scale electrodes that can create very small features and the practical limits of microscale machining. Different electrode materials and machining parameters were tested, and finished electrodes were measured. This research aims to explore more options for creating micro-scale features on products and parts in a world where miniature, lightweight components are a key goal in manufacturing and design.

Publications: None yet.

8	Warren Davidson

Ethan Cartwright

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

Active Flow Control for Manipulation of Flow Aerodynamics in Jets

Biography: Ethan is a 3rd year undergraduate aerospace engineering student at the Ohio State University. His research interests include aerodynamic and propulsion applications wherein he plans to pursue a PhD in aerospace engineering. Additionally, he has passions for teaching, humanitarian engineering and engineering education.

Abstract: Thrust vectoring, the action of altering the direction of jet flow, has been used in aerospace applications to enable more aggressive maneuvers and allow for a shorter take off distance. It accomplishes this by effectively generating additional lift in a particular direction. Past works have successfully achieved significant thrust vectoring accompanied by drawbacks such as increased mechanical complexity and weight, or reduction in thrust output. This study seeks to use Localized Arc Filament Plasma Actuators (LAFPAs) to achieve thrust vectoring. This strategy for thrust vectoring leverages instabilities inherent in turbulent flow to establish authority over vortex formation in the exhaust nozzle boundary layer. LAFPAs are embedded just upstream of the reaction surface and pulsed at discrete intervals which form plasma arcs at a constant pulse-repetition frequency. The plasma arcs impart high-temperature disturbances in the flow, causing it to trigger vortex formation which entrain fluid as they propagate downstream. Alteration in excitation frequency is expected to impact vortex growth and development which results in entrainment of differing amounts of fluid. This causes the jet to attach to the reaction surface by varying amounts and in varying directions, thus deflecting it and the thrust vector.

This study looks to explore the thrust vectoring capability of these LAFPA plasma actuators. In particular, a curved nozzle extension embedded with 8 LAPFA electrodes just upstream of the reaction surface—symmetrically spaced by 45 degrees azimuthally— is secured to a jet nozzle housed in an anechoic chamber. The jet opens to a backward facing step within the nozzle extension containing the curved reaction surface which flares to a 15-degree termination angle. LAFPA capability in altering the thrust vector by deflecting the jet is assessed across actuation frequencies and number of active LAFPAs. Their effects are documented using an azimuthally static pressure tap array, time-resolved schlieren imaging, and PIV. At present, an initial sweep of tests has been conducted showing asymmetric pressure profiles along the reaction surface. An expected trend of increased suction at low actuation frequencies and decreased suction at higher frequencies is found. To verify and quantify the connection between these pressure profiles and thrust vectoring of the jet, data collection will be expanded to include schlieren imaging and PIV to capture a fuller picture of flow behavior. Additional next steps include addressing limitations with experimental repeatability and setup.

Publications: None yet.

3	Joyce Beatty

Marietta College

Kennedy Couch

Junior, Biochemistry
Advisor(s): Dr. Suzanne Parsons

How Parabens on Melanoma Cells Affect Cholesterol Content

Biography: I am a junior at Marietta College majoring in Biochemistry and minoring in Leadership. My end career goal is to attend medical school and become a physician. I am involved with many organizations on my campus and community. I have founded Women in STEM at Marietta College which was established in 2022. I am also vice president of biology club, a hospital volunteer at Marietta Memorial, and a resident assistant at my campus. This summer I participated in the summer investigative studies research fellowship at Marietta College where I was able to cultivate skills in laboratory research. Outside of the lab you can find me running, playing the violin, or enjoying time with friends and family!

Abstract: Parabens are chemical compounds found in many everyday cosmetic products and are used in this research project to treat melanoma cells. This project was completed in order to determine if there is a correlation between the treatment of melanoma cells with paraben and cell cholesterol content. Heptylparaben and mononitroparaben, novel parabens used in different concentrations, were used and have the potential to be a preliminary treatment for melanoma, the deadliest form of skin cancer. Experiments were preformed to identify if cholesterol levels, which are critical to cell life, were affected by the treatment of such chemical compounds. Cell culture, paraben treatment, cell lysis, Bradford assay, and cholesterol assay were important methods utilized to collect viable data.

Results indicated that cholesterol levels standardized to protein content did not change upon paraben treatment. Further studies will investigate the effects of paraben on other cellular lipids.

Publications: None yet.

15	Michael Carey

Marietta College

Lillian Daneshmand

Senior, Physics
Advisor(s): Joseph Smith

Dimensionality Effects on Laser-Accelerated Ions in 1D, 2D, and 3D Particle-In-Cell Simulations

Biography: Lillian Daneshmand is a senior physics major at Marietta College in Marietta, OH. She has long held a passion for science and thanks OSGC as well as the faculty of Marietta College for allowing her to pursue that passion. She is a founding member of the Women in STEM Club and, this year, served as Chapter President of the Beta Theta Chapter of Sigma Kappa. Lillian began research on computational simulations of laser-matter interactions with Dr. Joseph Smith as a junior. After graduating from Marietta College, she hopes to attend graduate school to obtain a doctorate in physics.

Abstract: Due to the high computational cost of 3D particle-in-cell (PIC) simulations, lower dimensional 2D or 1D simulations are commonly used instead to model ultra-intense laser-matter interactions. However, lower dimensional simulations do alter interactions in non-trivial ways due to various simplifications. This work studies the effects of dimensionality in PIC simulations on laser-accelerated ions with a series of 1D, 2D, and 3D simulations over a wide range of laser intensities (10^{17}-10^{21} W/cm^2). We compare multiple observables from the interaction, including maximum proton energy, laser-proton energy conversion efficiency, and accelerating field strength for these simulations. This work aims to isolate patterns across these variables and intensities between different dimensionalities.

Publications: None yet.

14	David P. Joyce

Justin Dannemiller

Senior, Computer Science
Advisor(s): Dr. Jong-Hoon Kim

eXtended Reality Smart Guidance Interface (XRSGI) in AARON System for xEMU

Biography: Justin Dannemiller was born and raised in Akron, Ohio and attended Green High School before earning a Bachelor of Science in Biomedical Engineering at The Ohio State University. Among his engineering experiences at OSU, Justin was introduced to programming, electronics, and robotics: domains with which he developed a deep passion. After graduating from OSU, Justin began pursuing these newly found passions at Kent State University in the Computer Science program. Now a senior in this program, Justin has conducted several research projects in robotics and artificial intelligence (AI) through the Advanced Telerobotics Research (ATR) laboratory. These projects include (1) developing an affordable drone for the education of computer science and robotics concepts to students of a wide variety of backgrounds and (2) developing a computer vision-based autonomous gauge detection system for prevention of disaster scenarios. Upon graduation, Justin plans to pursue a master's degree in Computer Science where he will continue his research in AI and robotics.

Abstract: Contemporary space missions rely on a simple communication approach wherein ground crew personnel relay task-pertinent information to astronauts to assist them in the completion of their missions. Such an approach, however, will not be feasible in future explorations of the Moon, Mars, and beyond. In such missions, the substantial distances between astronauts and their supporting personnel would result in temporally prohibitive communication delays. Future systems envision addressing this issue by incorporating intelligent support into spacesuits and nearby robotic agents.

This paper presents one such module, the eXtended Reality Smart Guidance Interface (XRSGI). The XRSGI is designed for potential incorporation in NASA's xEMU for the assisting of astronaut missions by recognizing and highlighting task-pertinent objects with which the astronaut must interact. The XRSGI achieves recognition through the deployment of the YOLOv5 object detection algorithm to recognize objects of interest. Furthermore, highlight visualization is achieved through a custom-designed Unity application running on a MagicLeap augmented reality headset. Through the real-time recognition and highlighting of objects related to the astronaut's mission, the XRSGI affords greater autonomy to the astronaut in the completion of their mission, an imperative capability for the distant space missions of the future.

Publications:

1) Bailey Wimer, Justin Dannemiller, Saifuddin Mahmud, and Jong-Hoon Kim, "Low-cost Entry-level Educational Drone with Associated K-12 Education Strategy", The 14th International Conference on Intelligent Human-Computer Interaction, Tashkent, Uzbekistan, Oct. 20 – 22, 2022.
2) Saifuddin Mahmud, Justin Dannemiller, Redwanul Sourave, Xiangxu Lin, and Jong-Hoon Kim, "Smart Robot Vision System for Plant Inspection for Disaster Prevention", 2022 IEEE International Conference on Robotic Computing, Naples, Italy, Dec. 5 – 7, 2022.

16	Anthony Gonzalez

Alex Demagall

Senior, Aerospace Engineering
Advisor: Dr. Igor Adamovich

Plasma Assisted Combustion of Hydrocarbon Fuels in Extreme Fuel Lean Conditions for the Study of Combustion Kinetics and Intermediate Chemical Reactions

Biography: Alex Demagall is a senior at The Ohio State University majoring in Aerospace Engineering. During his undergraduate experience he was in the STEM Scholars Group, Buckeye Space Launch Initiative, and has been a teaching assistant. The past summer he interned at Johns Hopkins Applied Physics Laboratory, where he worked on the DART mission. He is the vice president of the Sigma Gamma Tau honor society. He currently works at the Non-Equilibrium Thermodynamics Laboratory where he studies various plasma flows. He plans to continue his education with a graduate degree in Aerospace Engineering after his bachelors.

Abstract: There is limited knowledge on the kinetics of radicals and intermediate species formed during combustion of hydrocarbon fuels. Understanding these phenomena can lead to better performance of jet engines and supersonic combustors. In addition, the techniques enacted to study these phenomena are leading to the development of efficient plasma-assisted combustion methods. Plasma-assisted combustion methods do not require large or hazardous facilities to study combustion. A reacting flow wind tunnel was designed and built in 2021, partially supported by the Ohio Space Grant Consortium. The wind tunnel is coupled with a heated flow reactor and will be used to study chemical reactions during the oxidation of hydrocarbon fuels at “fuel-lean” conditions, for high-speed propulsion applications. In the reactor, which serves as the wind tunnel plenum, the fuel-air flow diluted in argon will be heated by passing through a thermal energy storage (a container filled with ceramic beads and placed in an oven), and then expanded through a converging-diverging nozzle into a supersonic test section. Between the thermal storage and the nozzle, there is an electric discharge section, which will generate reactive atoms and radicals in the fuel-air mixture. This needs to be done since the reactant mixture is non-reactive below the ignition temperature. The heated and plasma-processed reacting flow will expand through the nozzle into the supersonic test section. The rapid supersonic expansion to low pressure and temperature will stop the chemical reactions, such that the reaction products in the flow can be analyzed. This wind tunnel / heated flow reactor will be used by for the measurements of the reaction products in the test section, specifically CO_2, CO, and H_2O.The reaction products will be measured by infrared absorption spectroscopy, already fully operational, using a tunable Quantum Cascade Laser (QCL).

Publications: None yet.

7	Max Miller

Braddon Dennison

Junior, Engineering
Advisor(s): Dr. Paul Penko

Development of a Microbial Fuel Cell

Biography: Braddon Dennison is a junior engineering major at Baldwin Wallace University. He has a B.A. in Spanish from Drake University and a master's degree in Hispanic Linguistics from the University of Minnesota. Braddon has always been interested in how things work and building things, but his path towards the study of engineering has been far from traditional. He is passionate about protecting environment and green technology, and it is that passion that has driven him to return to school in order to pursue a degree in General Engineering. Following the completion of his undergraduate degree, Braddon hopes to work as an engineer helping to develop and implement renewable energy technologies.

Abstract: Electrical energy is a central aspect of today's society. It is necessary for communication, work/school, and food production/storage to name a few examples. Global energy consumption has increased dramatically over the last seven decades. Many traditional energy solutions involve obtaining energy from non-renewable energy sources such as nuclear power and fossil fuels like gas, oil, and coal. The use of fossil fuels as a source of energy is particularly detrimental to the environment due to the emission of carbon dioxide and other gases, which contributes to global climate change that endangers all of humanity. Thus, there is a clear need for sustainable power sources. The primary focus of this project was to design, fabricate, test, and optimize a microbial fuel cell as a means of producing renewable energy. Microbial fuel cells utilize naturally occurring bacteria that decompose and oxidize organic material to generate electricity and could be potentially employed as a power source in a latrine or waste treatment plant, or even on a space mission. Throughout this project a laboratory prototype was repeatedly tested and modified with the intent of increasing the power production of the fuel cell. Additionally, a theoretical design was created that could be implemented outside of the laboratory in such places as composting latrines in developing countries. The research showed that although the power generation of the prototype was limited, the microbial fuel cell reliably produced a small amount of power for more than a week. The power output may be improved in several ways such as by increasing the surface area of the electrode and the proton exchange membrane or by using a different bacteria or substrate. The results demonstrate a clear need for further interdisciplinary investigation of the fuel cell. Provided that the problem regarding the limited power output is solved, the proposed design would be a practical and convenient way to provide electricity to people in remote locations that lack reliable access to electricity.

Publications: None yet.

9	Marcy Kaptur

Cleveland State University

Lucas Devole

Senior, Pharmaceutical Sciences
Advisor(s): Dr. Bin Su, Cleveland State University

Optimization of FAZ1 inhibitors for Trypanosomiasis

Biography: My name is Lucas Devole. I am a student at Cleveland State University studying pharmaceutical sciences. I am from Lexington KY and have wanted to do medicinal chemistry my entire life. I'm graduating with my BS this May and I start on my Ph.D. in the fall. When I'm not in the lab (which isn't often) I am usually playing the piano or training for triathlon. Outside of that, I tutor organic chemistry for the university.

Abstract: African Trypanosomiasis, or African Sleeping Sickness, is an orphan disease found in Sub-Saharan Africa. It is caused by a protozoan in the genus Trypanosoma and is spread by the tsetse fly. The current treatments are experiencing resistance and possess harsh side effects. In earlier research, our lab discovered 2-piperazine-4-amino-6,7-dimethoxyquinazoline derivatives that showed high potency towards Trypanosoma Brucei by inhibiting FAZ1. To continue exploring this pharmacophore, we synthesized derivatives containing a triazine ring bonded to the open amine of the piperazine ring. We then tested the IC50 values and identified drugs, like compound 12 and 9, that showed high potency and selectivity for the Trypanosome.

Publications: paper under review.

11	Shontel M. Brown

Ryan Dippolito

Junior, Mechanical Engineering
Advisor(s): Manigandan Kannan, PhD

Powder Bed EDM, 3D Printed Titanium (TI-6AL-4V) Property and Surface Treatment Analysis

Biography: My career goal is to make a lasting impact on human space exploration. I have had the privilege of doing three internship rotations with Johnson Space Center in Houston, Texas. First, I worked in flight operations for the ISS and Artemis programs. Secondly, I worked in liquid propulsion for CubeSat-sized spacecraft, specifically on the Seeker program. Most recently, I worked in Active Thermal Control for human spacecraft, specifically doing R&D on electrochromic radiators and gas trap concepts for the Gateway program. In 2023, I'll be completing another rotation with Life Support Systems on crew capsules. My long-term goal is to become a PhD student and conduct research on a technology gap that brings humans closer to living on Mars. At the University of Akron, I have worked as an undergraduate research assistant for Dr. Kannan for close to one year. Dr. Kannan has taught me so much about the world of research, specifically in Additive Manufactured metals. I've gotten to conduct research on different surface grinding techniques to help improve fatigue life of specimens, while also conducting impact and erosion testing to evaluate its performance in a jet-engine application. I also have the privilege of being the Chief Mechanical Engineer for UA's Rocket Design Team, The Akronauts. Recently, we sent our newest rocket, Emergence 3, to 38,005 ft. Our eventual goal is to put a rocket past the Karman Line.

Abstract: The goal of my research for Dr. Kannan is to further characterize additively manufactured, Ti-6Al-4V and improve its fatigue life for aerospace applications through surface modification. Additively manufactured titanium has a very rough surface finish when coming off the printer, so a post-processing method is needed to remove the top layer. We are working with M.K. Morse in Canton, Ohio to evaluate different surface grinding techniques that remove this top layer and impart a compressive residual stress at the same time. This will improve fatigue life and limit crack formation/propagation. Our goal is to make our grinding technique a permanent secondary process for additive manufactured metals. In our research, we are evaluating the imparted residual stresses of different grinding methods, while also conducting a high-cycle fatigue study on the same grinding techniques to hopefully see an improvement in overall specimen lifespan. In addition, we are collecting and analyzing surface roughness, micro-hardness, macro-hardness, and microstructure data on the same grinding techniques.

Additionally, we are doing erosion and impact studies on the same material, with the only surface modification being a conventional face-milling process. At the University of Akron's Gas Turbine Test facility, we are taking 1" x 0.75" specimens and shooting them with an erosion gravel gun at different velocities while they are under thermal load and measuring the specimen's mass loss after the test. For impact testing, at the same facility, we are using an impact testing cannon to shoot 1/16" diameter steel balls at Mach 1 into the center of the gauge section of an ASTM dog-bone sample. After this, we are running the samples under a high-cycle fatigue test and comparing to un-modified samples to see the loss in lifespan.

Publications: None yet.

11	Shontel M. Brown

Lemuel Duncan

Senior, Mechanical Engineering
Advisor(s): Dr. Ahsan Mian

Compression Testing of Functionally Graded Triply Periodic Minimal Surface Lattices

Biography: Lemuel Duncan is a senior in the College of Engineering and Computer Science at Wright State University pursuing a master's degree in mechanical engineering. At a young age, he decided to pursue a career in engineering and was draw to the mechanical field because of its basis in the practical applications of everyday life. After completing most of high school as a home school student, he enrolled at Sinclair Community College at the age of Sixteen to earn CCP credit toward his future degree. In 2021, he graduated from Sinclair with High Honors and an associate degree before transferring to Wright State University. At Wright State, he has continued his outstanding academic performance and maintained a perfect 4.00 GPA. At the end of the 2023 spring semester, Lemuel will graduate with his bachelor's degree in mechanical engineering. However, this is not at all where he intends to conclude his journey as he is currently enrolled in the 4+1 program at his university. As a pre-graduate student, Mr. Duncan has greatly accelerated his learning and formed invaluable relationships with his professors. Once, he enrolls as a full-time graduate student, he will continue working with the engineering faculty at Wright State along with a team of researchers at AFRL to conduct thesis research in the realm of electronic packaging and reliability.

Abstract: Research is conducted on additively manufactured gradient triply periodic minimal surface (TPMS) lattices. Interest in the field of lattice design has recently seen a large increase due to advancements in additive manufacturing technology and a high demand in the scientific community for materials possessing high strength-to-weight ratios. To better understand the properties and applications of TPMS lattices, Experiments are conducted on lattices designed using two distinct gradient methods. The lattice gradients are created by either changing the wall thickness or cell size of the lattices through their height. Application of gradients to the lattices is expected to increase their energy absorption capabilities substantially as compared to non-gradient or otherwise uniform lattices which are constructed using the same amount of material.

Under normal circumstances, a uniform TPMS lattice will exhibit behavior similar to that expressed by many metallic foams when under compression. The compression process is generally defined by three stages. The first stage of deformation is linear and elastic followed by a relatively constant stress plateau. The third and final stage is termed the densification stage which is the point where the cells of the foam have collapsed on each other and stress increases rapidly. Stage two of the compression is generally where the majority of energy absorption occurs. By applying gradients to lattices, the compression results should yield a stress strain curve that is characterized by a series of ascending constant stress plateaus therefore increasing the material's ability to absorb energy.

Publications: None yet.

4	Jim Jordan

Miranda L. Eaton

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

Application of Magneto-Rheological Fluids for Replicating a Range of Radial Pulses

Biography: Miranda Eaton is a senior Mechanical Engineering student at Miami University in the combined BS/MS program. She was first introduced to engineering at a STEM summer camp in seventh grade. From then, her passion for engineering and problem solving developed through high school where she enjoyed her math and science classes. At Miami University, Miranda has served as Local Outreach Chair for Engineers Without Borders, a tutor in math, physics, and engineering courses, and a research assistant in the Mechanical and Manufacturing Engineering department. In addition to her academics, Miranda enjoys reading, playing piano and guitar, and spending time with her family. Miranda will graduate in May and is excited to start her career as a product development engineer at the Goodyear Tire & Rubber Company.

Abstract: This study presents the design and test of a new pulse simulator capable of reproducing a wide range of radial pulses. It proposes to use a Magneto-Rheological (MR) fluid technology to shape radial pulse waveforms. The primary objective of this study is to demonstrate its feasibility of regenerating age-related human radial pulse waveforms using the proposed MR pulse simulator. The overall experimental set up includes a cam system, an MR device, an electromagnet, and sensors (laser displacement and pressure transducer). The cam system generates a base pulse waveform. This base pulse waveform is sent to an MR device which consists of a silicone tube (representing the radial artery) submerged in MR fluid. An electromagnet is placed beneath the MR fluid chamber which applies a specified magnetic field to control the MR fluid. This, in turn, enables the MR fluid to reshape the base pulse waveform to the desired pulse waveform. The mounted sensors collect data and measure the outputs for further analysis. Using this setup, a series of testing will be conducted by varying the input magnetic field with the pulse width modulation (PWM) control. PWM signals can be altered by changing the duty cycle and delay input to the electromagnet. These factors will affect the magnetic field, thus changing the MR fluid surrounding the silicone tube, and shaping the base pulse generated by the cam system. This study will then examine the pulse shaping performance of the MR device by comparing the reproduced radial pulses with those of in vivo radial pulses.

Publications: 1. Eaton, M, Koo, J, Yang, T, & Kim, Y. "Simulating Age Related Radial Pulses Using Magneto-Rheological Fluids." *Proceedings of the ASME 2022 Conference on Smart Materials, Adaptive Structures and Intelligent Systems. ASME 2022 Conference on Smart Materials, Adaptive Structures and Intelligent Systems.* Dearborn, Michigan, USA. September 12–14, 2022. V001T03A007. ASME. https://doi.org/10.1115/SMASIS2022-90793

5	Robert E. Latta

The University of Dayton

Molly Fenik

Junior, Mechanical Engineering
Advisor: Dr. Megan Reissman

Simulator Based Study of Vehicle Control Performance

Biography: Molly Fenik is a junior Mechanical Engineering student with a minor in Biomechanics at the University of Dayton. She has participated in research combining her multidisciplinary interests and skill sets in the areas of mechanical engineering, biomechanics, and robotics. She is personally motivated to apply her engineering knowledge to human subject research. Molly’s research began her sophomore year when she worked with an OSGC Fellow. One of Molly’s strengths is her ability to adapt to new things. She also enjoys teaching and sharing her engineering knowledge with others. This was demonstrated during her time spent as a teaching assistant for a Mechatronics course. She is looking forward to applying her personal experiences to human subject research.

Abstract: The ability of humans to consistently perform precise motor control tasks is one of the most missions critical aspects of human space exploration and falls under the Human Exploration and Operation Directorate. Under aerospace conditions humans must frequently perform these tasks with limited visual information and under conditions where vestibular sensory function is compromised. This work continues an OSGC Fellow project which looks at the effect of hypoxia on motor control performance during roll tilt tasks. Trials included tasks matching their visual roll-tilt while experiencing matched motion simulator roll-tilt and visual roll-tilt with no motion simulator roll-tilt. Visual roll-tilt matching tasks were presented with both continuous and disappearing targets. Additional collections (n=7) were performed under hypoxic (10% O_2) and normoxic (21% O_2) conditions. This completes the study group (n=12) and will help to draw a better conclusion from the processed results.

To extend this study of human-vehicle interactions, I have developed a new motor control task using a virtual Starfield environment and motion simulation movement. To simulate the impact of zero gravity on the vestibular system, participants (target n=5) will complete vehicle control movement tasks where vehicle roll and yaw dynamics are coupled. Participants will be asked to perform vehicle roll tilt tasks (align with visual target) that generate a coupled yaw rotation. The participants will then be presented with a heading target (vertical bar) requiring them to counter the tilt input to halt yaw rotation and align with the vertical bar location. I will examine factors of vestibular information (motion vs. no motion) and visual information (visual rotation rate different from physical rate). Results will allow for the characterization of human vehicle control inputs when coupled dynamics are present and the impact of visual and vestibular factors on performance.

Publications: None yet.

4	Jim Jordan

NORTHERN

Olivia F. Galigher

Senior, Mechanical Engineering and
Applied Mathematics
Advisor(s): Jed E. Marquart, Ph.D., P.E.

Comparing Flow Over a Surface Numerically vs Experimentally

Biography: Olivia Galigher is a senior pursuing a Bachelor's degree in Mechanical Engineering with a concentration in Aerospace and a second major in Applied Mathematics. She is originally from Bolivar, Ohio and was drawn to Ohio Northern University for an engineering education with a small school feel and big-time opportunities. During her time at Ohio Northern, Olivia has served as a representative of the College of Engineering on ONU's Student Senate, served as a representative on the Joint Engineering Council, and is currently serving as the Student Branch Chair and President of Ohio Northern's chapter of AIAA for the second year. She is also a member of the Varsity Women's Golf Team. Olivia enjoys spending her free time outdoors on the golf course, the lake in the summer, and the ski slopes in the winter. Upon graduation in May of 2023, Olivia will be starting her professional career at GE Aerospace as a part of their Edison Engineering Development Program, where she will work full-time and begin working on her Master's degree in Aerospace Engineering.

Abstract: Understanding how flow over a specific surface happens is really valuable information, however it is not always feasible to construct a full-scale model of something and test it. Numerical software like Computational Fluid Dynamics (CFD) allows you to take a 2D or 3D model and simulate flow under various conditions. Another option is testing it experimentally, using a small-scale model in a wind tunnel. In order to better understand the benefits of both methods and determine which contains more accuracy, a comparison of the flow results over a sphere from both numerical and experimental techniques can be completed and conclusions drawn.

Publications: None yet.

7	Max Miller

Julia Gersey

Junior, Computer Science & Applied Mathematics
Advisor(s): Dr. Brian Krupp

Fine-Grained Air Quality Sensing with IoT

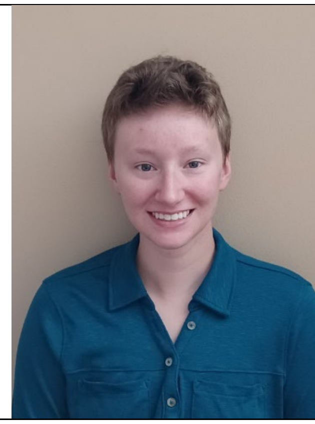
Biography: Julia Gersey is a Junior at Baldwin Wallace University, majoring in both Computer Science and Applied Mathematics. She grew up in Solon, Ohio, and attended Solon High School, where her interests in Computing and Mathematics grew after taking AP Computer Science and Algebra/Calculus classes. At Baldwin Wallace, she is a member of the MOPS (Mobile and IoT for Planet and Society) Research Group, plays Varsity Softball, and leads multiple student clubs focusing on environmental action (SEA), women in computing (ACM-W), and hosting computing camps for kids (CS+). Her research interests focus on using computing to help her community and the environment through IoT and mobile platforms. Upon graduating in May of 2024, she plans to pursue a PhD in Computer Science.

Abstract: The World Health Organization states there are “4.2 million deaths every year as a result of exposure to ambient (outdoor) air pollution”. Additionally, they report that “9 out of 10 people worldwide live in places where air quality exceeds WHO guideline limits”. For Northeast Ohio, there are only a few sparsely deployed EPA air quality sensors monitoring particulate matter 2.5 (PM 2.5) levels; the PM type that poses the most significant health risk for humans. We built and deployed low-cost, low-power Internet-of-Things (IoT) monitors to provide more fine-grained data. We partnered with PCs for People, a company that offers both refurbished computers and internet access to the community at low to zero cost, allowing our sensors to be placed in their existing wifi hotspot towers, giving power and connectivity. From this deployment, we could determine a significant difference between two locations less than 4 miles apart where the average particulate matter reading was more than double. These findings show that fine-grained air quality monitoring can provide the community with more meaningful data about the air they breathe. We have publicly made this air quality data available on our website (https://mops.bw.edu/). Our upcoming work includes deploying more sensors and building a computer science curriculum so local schools can make the air quality monitors, providing an opportunity for students to learn computer science topics.

Publications:

1. Brian Krupp, Julia Gersey, Franklin Lebo. "Campus Plate: Connecting Students on College Campuses to Reduce Food Waste and Food Insecurity". 2022 International Conference on Research in Adaptive and Convergent Systems (ACM RACS 2022). (Accepted)
2. Brian Krupp, Julia Gersey, Jonathon Fagert, Tony Mlady. "Towards Fine-Grained Air Quality Sensing in Urban Environments". 2022 ACM Conference on Embedded Networked Sensor Systems (ACM SenSys 2022). (Accepted) (Poster)

Rebecca N. Gilligan



Senior, Mechanical Engineering
Advisor(s): Dr. Kelly Cohen

Testing Approach and Precision Landing for All-Terrain Aerial Robotic Interface (ATARI)

Biography: Rebecca Gilligan is a senior in Mechanical Engineering at the University of Cincinnati. She has been researching collaborative aerial and robotic systems since 2020, supported by OSGC. Collaboration between different types of vehicles creates the potential to complete more complex missions than the autonomous vehicles could complete on their own. Rebecca presented some of this work at AIAA's Region III conference, winning first place in the undergraduate category and moving on to present at the International Student Competition at SciTech. Rebecca is passionate about space applications of robotics and UAV research and plans to continue her studies by pursuing a PhD at the University of Cincinnati after graduation.

Abstract: Combining the strengths of different autonomous vehicles in a multi-modal system creates opportunity to complete more complex missions through collaborative interaction. The development and testing of All-Terrain Aerial Robotic Interface (ATARI) builds on a previously funded OSGC project titled *Integrating Unmanned Aerial Vehicle and Unmanned Ground Vehicle Collaborative Systems*. ATARI consists of a collaborative unmanned aerial vehicle (UAV) and unmanned ground vehicle (UAV). The UAV features a precision landing system which is utilized to land on the levelling platform attached to the UGV. This allows the UGV to serve as a mobile landing platform for the UAV which can provide improved landing sites and enhance the flight time of the UAV. This phase of work focuses on the flight testing approach, precision landing system, and preliminary flight test results.

Publications:

Gilligan, R., Cohen, K., "Design of an All-Terrain Aerial Robotic Interface (ATARI) as a Collaborative Platform for UAVs", presented at AIAA's 2022 Region III Student Conference, March 26, 2022, West-Lafayette, IN. *[PENDING PUBLICATION IN SCITECH CONFERENCE PROCEEDINGS]*

Yasin, A., **Gilligan, R.**, Heitmeyer, D., Cohen, K., "University of Cincinnati Aerial Vehicles (UCAV) Team's Solution to the 2022 AUVSI Student Unmanned Aerial Systems Competition", presented at AIAA's 2022 Region III Student Conference, March 26, 2022, West-Lafayette, IN.

Gilligan, R., Heitmeyer, D., Yasin, A., Palmer, H., Poplin, I., Chidambaram, N., Vesselovec, X., Driscoll, D., Assd, O., Smiley, D., Jugade, S., "University of Cincinnati UCAV 2022 AUVSI SUAS Competition Technical Design", 20th Annual Student Unmanned Aerial Systems Competition (SUAS) by the Association for Unmanned Vehicle Systems International (AUVSI) Seafarer Chapter. February 15, 2022.

Gilligan, R., "Integrating Unmanned Aerial Vehicle and Unmanned Ground Vehicle Collaborative Systems", NASA/ Ohio Space Grant Consortium 2020-2021 Annual Student Research Symposium Proceedings XXIX, March 26, 2021, Virtual. http://osgc.org/wp-content/uploads/2021/09/2-Proceedings-PDF.pdf

Delonte Goodman

Senior, Mechatronics Engineering
Minor: Physics
Advisor(s): Dr. Antal Jakli, Arwa Ayami

Liquid Electrolytes as Organic Electrochemical Transistors (OECTs)

Biography: Delonte Goodman is from Cleveland Ohio and was born in a single parent low-income household. Aiming to better himself worked on a variety of STEM related projects. He has interned at the NASA Glenn Research Center twice during his sophomore and junior years of high school. During those summer internships he worked on the Periodic Table of Life (PeTaL), which serves as a citizen science that assists researchers in their work for biomimicry. While assisting with the creation of the app, he helped program and research topics related to biomimicry. Delonte has also volunteered for different programs such as Minority University Research and Education Project (MUREP). During this program he helped teach students how to pilot and operate the flying simulator.

In his years at Kent State University Delonte has conducted research in the field of soft matter applications such as Organic field transistors and Organic electrochemical transistors. This research was conducted for the McNair Program during both the academic year and summer. Delonte has worked with researchers and professors such Dr. Bjorn Lussem and Dr. Jakli for over two years in several research projects. Outside of his research Delonte serves as an Resident Assistant (RA), K/T mentor, president of multiple clubs such as Organization of Black Aerospace Professionals (OBAP), American Foundry Society (AFS), Kent State Combat Robotics, and Kent State Pokemon League. He is also a DI fellow and serves as a professor for the PTCG Program. Finally Delonte hopes to achieve his goals and ambitions in becoming a scientist and engineer at NASA working in long distance space exploration.

Abstract: The research will be studying the electrical response of changing the cationic size and valency in liquid electrolytes as organic electrochemical transistors (OECTs). This will involve using metal salts as gate electrolyte, water and other organic solvents, and measuring at different temperatures. The following metals salts include Li(tsfi), AL(tsfi), and Mg(tsfi). During the study the transient measurements and transfer curves for each sample will be collected. A comparison of the On and Off Ratio and Switching Times will also be evaluated for each sample.

Publications: None yet.

11	Shontel M. Brown

UNIVERSITY OF Cincinnati

Catherine Gottsacker

Junior, Chemical Engineering
Advisor(s): Dongmei Feng

Integrating UAV with sensors to monitor the Harmful Algal Blooms in the Ohio River

Biography: Catherine is a junior at the University of Cincinnati studying chemical engineering with minors in chemistry and environmental analysis & policy. In addition to research throughout her studies, she has completed two co-op rotations with Sherwin-Williams working in environmental health and safety and process chemistry, and a third rotation with Superior Fresh focusing on recirculating aquaculture design. At school, Catherine is the president of Engineers Without Borders and treasurer of the UC Symphony Orchestra. She is also pursuing her master's degree in environmental engineering through UC's accelerated engineering degree program, and hopes to focus her future research and career on removing barriers to equitable access of clean water.

Abstract: Harmful algae blooms (HAB) in surface waters are a global environmental concern, threatening both human and environmental health. To control their impact, HABs must be monitored in a timely manner. While continuous monitoring of surface water is possible using monitoring stations equipped to measure chlorophyll concentration, establishing and maintaining the stations is a costly and labor-intensive endeavor. Chlorophyll data can also be detected in the field using sensors or by collecting water samples, but these methods are time consuming and require direct access to the water. The methods become dangerous and impractical in areas surrounded by cliffs or wetlands.

In this project, a flexible, efficient, and cost-effective approach for monitoring surface water quality is developed using Unmanned Aerial Vehicles (UAV) and multispectral sensors. A UAV platform is created to allow direct monitoring of chlorophyll concentration using a sonde carried through the water, allowing monitoring of otherwise inaccessible water bodies. In future research, this platform will be deployed in tandem with a second UAV carrying a multispectral camera, to develop a concentration-reflectance rating curve for Chlorophyll as an indicator of HABs. The reflectance readings from the multispectral-carrying UAV alone can then be used to remotely collect water quality data on any surface water with high spatial and temporal resolution.

Publications: None yet.

2	Brad R. Wenstrup

KENT STATE UNIVERSITY

Katie Horn

Junior, Aeronautics: Professional Pilot Concentration
Advisor(s): Dr. Syed A.M. Shihab

Motion Prediction of Birds to Prevent Bird Strikes with Lower Altitude Aircraft

Biography: Katie Horn is a Sophomore at Kent State University from Louisville, Ohio. Throughout high school, she found her interest in science and math, which led to her becoming Vice President of the LHS Stem Club. Katie earned the Girl Scout Gold Award in her local Girl Scout Troop. After taking a discovery flight at Kent State University and attending many airshows, Katie developed a passion for flight. Katie is pursuing aeronautics with a professional pilot concentration at Kent State University, where she recently earned her Private Pilot License. In the summer of 2022, Katie participated in Kent State's Summer Undergraduate Research Experience (SURE). In December 2022, she was 1 of 5 nominated by Kent State to apply for the prestigious Barry Goldwater Scholarship. After graduation, Katie plans to become an officer and pilot in the USMC.

Abstract: Recent technological advancements in emerging electric aircraft, such uncrewed aerial vehicles or drones, is expected to enable the use of such aircraft for package delivery and passenger transportation below 400 feet at the lower altitudes of the National Airspace System (NAS). Bird strike risk with aircraft is highest at these low altitudes, with most bird strikes happening below 400 feet and in the low altitude aircraft flight phases of take-off, initial climb, landing, and approach. So, bird strike risk with UAS needs to be minimized and considered during flight planning to ensure safe collision-free UAS operations in the NAS. This research project aims to address this critical research need by modeling bird movement and predicting its future track using linear and nonlinear regression models to ensure safe separation between birds and the lower altitude aircraft. Bird movement data from GPS-based surveillance sensors have been used to train and test the models. The bird tracking data collected includes the following features: time, latitude, longitude, and type of bird.

The performance of our models was evaluated using the mean squared error metric. The results show that the nonlinear regression model has lower mean squared error or higher prediction accuracy in training than the linear regression model. However, the mean squared error for the linear regression model in testing is less than the nonlinear regression model, which indicates that the linear regression performs better than the nonlinear regression for both latitude and longitude prediction. The latitude and longitude predictions can be used to determine the velocity and heading predictions of the birds as well. All these predictions can be used in flight planning to reduce the risk of bird strikes with aircraft to improve safety of both air travelers and birds. Flight planning will utilize a strategic deconfliction algorithm to assign departure delays and adjustments to aircraft based on the bird movement forecasts from the regression models to ensure collision-free flights.

Publications: None yet.

7	Max Miller

Cleveland State University

Scott Ibold

Junior, Mechanical Engineering and Physics
Advisor(s): Dr Wei Zhang

Investigation of Repeated Structures in Nature and Resistance to Wind Damage

Biography: I am currently a junior at Cleveland State University pursing a double major in mechanical engineering and physics. Additionally, I am a 10-year veteran of the United States Air Force, during which time I served as an aerospace propulsion technician, specializing in aircraft turbine engine repair; a specialty in which I earned an associate of applied science (AAS). My studies at Cleveland State are to facilitate my career transition from military service to engineering. I am most interested in air and space travel and increasing the reach and efficiencies of aerospace travel.

Abstract: High winds, including those occurring during tornadoes and hurricanes, are one of the largest naturally occurring causes of loss of life and economic damage in the United States. Residential structures, such as homes and low-rise apartment buildings, and shorter commercial buildings have been discovered to be particularly vulnerable when subjected to extreme wind conditions. To reduce the risk associated with building these common structures, it may be useful to observe large naturally occurring formations and organic lifeforms that occur in the same geographies that are potential sites for developments of low-rise structures.

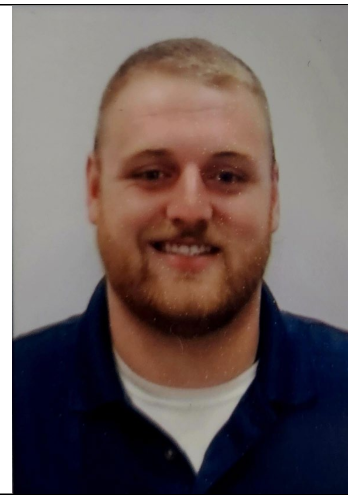
In nature, large organic lifeforms and naturally occurring structures can be found to grow or occur and survive for long periods in areas where strong winds are frequently experienced. Some examples of large lifeforms that exist in high wind areas are Coastal Redwoods on the United States' Western Seaboard. Additionally, study of inorganic structures such as sand dunes which are highly susceptible to deformation and migration due to wind could provide insight to vulnerabilities in man-made structures.

Publications: None yet.

11	Shontel M. Brown

WRIGHT STATE UNIVERSITY

Benjamin Jackson



Junior, Mechanical Engineering
Advisor(s): Mitch Wolff, Craig Baudendistel

Analysis and Tuning of SAE Baja CVT Clutch

Biography: My name is Benjamin Jackson and currently reside in Huber Heights, Ohio. I am a junior at Wright State University where I major in Mechanical Engineering. I recently graduated from Georgetown College with a degree in Physics. I played football and participated in track and field while attending Georgetown. I enjoy spending time at the lake riding PWCs and boating. I am passionate about racing and hope to take it up as a hobby one day.

Abstract: The main objective of a continuously variable transmission (CVT) is to provide an optimal gear ratio that will allow the engine to remain in a peak power output zone for any variable wheel speed. Due to the new implication of a fifteen horsepower engine for the SAE Baja Team, the clutch design and tuning is different from the previous years of only ten horsepower. A CVT clutch consists of many different internal components that affect the gear ratios it puts out. Different forms of testing will be conducted as well as calculations to maximize the efficiency of the clutch. The first test will consist of how the clutch will react to the RPM(Revolutions Per Minute) of the engine to get a baseline of how different the engine is from the past. The clutch will be installed as the engine will be run at various RPMs. To complete this a tachometer will monitor RPM while a video recorder will monitor the primary clutch sheave opening distance. The main variables that will decide this ratio will be the weights on the outer basket which apply the centrifugal force and the center spring which slowly resists that force creating a smooth gear ratio transition.

After a baseline is met, calibration of weights and a spring will allow for changes to occur making the clutch more efficient for the new engine. Testing for belt strength is another key factor to limit slip in the drivetrain. Different lengths and width belts will be tested on the engine to see which size provides the least slip and allow the car to accelerate quicker when the throttle is hit. After all the tests and calculations are completed, the CVT clutch will be tuned to maximize efficiency and limit power loss. The ultimate goal is to supply a transmission setup that will allow the team to compete with an efficient CVT clutch setup.

Publications: None yet.

10	Michael R. Turner

CEDARVILLE UNIVERSITY

Tara Keller

Junior, Molecular Biology
Advisor(s):

Tetrahymena thermophila as an indicator species for climate change

Biography: Tara Keller is an honors student on the pre-PA track of Cedarville University's molecular biology program, with a minor in Bible. She grew up in the Christmas town of Frankenmuth, MI, where her parents fostered her love for learning. On Cedarville's campus, Tara stays involved in several service roles; she serves as a certified volunteer EMT, leads a weekly women's bible study, and tutors fellow college students in biology. These opportunities have grown her confidence in servant leadership positions, and she plans to continue to practice those skills in her pursuit of a Master's of Physician Assistant Studies. This is her first long-term research project, and has incited a further interest into future research opportunities within the healthcare field.

Abstract: *Tetrahymena thermophila* are free-living, nonparasitic unicellular eukaryotic organisms that are generally representative of other microorganisms. For this experiment, we were interested in measuring the change in gene expression caused by stressing *Tetrahymena*, specifically by increasing the culture temperature. Gene expression refers to a cell's activity of protein production. In our studies, gene expression was observed by measuring mitotic rates, acetylation and methylation of histones, and mitochondrial biogenesis in response to heat shock. We used a variety of techniques to accomplish this, including cell counting by a hemocytometer, immunofluorescence visualization and quantitation, and staining with MitoTracker™.

By studying the response of *Tetrahymena* to the increase in environmental temperatures, we could gain some insight into the effects of climate change on other unicellular organisms. Increasing temperature is a known stressor of microorganisms, because they are unable to thermoregulate as well as multicellular organisms. Future research could be done to study which genes or histones are most activated or deactivated when temperature increases, as it would give insight into which proteins are produced or conserved in the stress response of *Tetrahymena*.

Publications: None yet.

10	Michael Turner

Anthony Krcik

Junior, Mechanical Engineering & Economics
Advisor(s): Mark Sidebottom

Tribological Analysis of 3D Printed PEEK

Biography: Anthony is a third year Mechanical Engineering and Economics dual degree student at Miami university. He started working in the materials tribology lab in the second semester of his first year. His first project was building a tribometer for Dupont Specialty Products Inc. that was capable of simulating jet engine conditions to evaluate bearing materials. Later he helped re-design two other tribometers one for automotive transmissions and another built for current research of polymer composites.

Abstract: Today, increased service intervals for air and spacecraft engines are desired to enable improved reliability. One major limitation for air and spacecraft engines are the extreme conditions they operate under (high temperature). This limits the application of liquid lubricants as they either need to be replaced too frequently or they cannot perform consistently under a wide range of conditions. High performance polymers can be used as solid lubricants for bearing joints and other parts of aircraft/spacecraft. High performance polymers have great thermal properties and low wear rates making them ideal for jet engine applications. We will conduct wear tests of these high-performance polymers on a flat-on-flat tribometer in a humidity-controlled environment. Tests will be run at high temperatures (>200°C) to emulate the temperatures experienced within a turbofan engine. Mass measurements will be taken to determine wear rate of these materials under the different temperatures and loading profiles. Friction coefficients will also be determined in situ. The goal of this research is to expand the understanding and establish the practical limits of high-performance-polymers.

Publications: None yet.

8	Warren Davidson

Jacob Kulig

Senior, Mechanical Engineering
Advisor: Dr. Carson Running

Application of Pressure Sensitive Paint at the University of Dayton: Small Rotorcraft Applications

Biography: Jacob Kulig is a senior undergraduate student studying mechanical engineering at the University of Dayton with a concentration in aerospace engineering. In Fall 2022, he joined Dr. Carson Running's research group and began work on the applications of Pressure Sensitive Paint (PSP) under his mentorship; this research is progressing into Jacob's undergraduate honors thesis. He is also the treasurer of the University of Dayton Aero Design Team and president of the university's Astronautics Club. Throughout his undergraduate career, he has spent time exploring the aerospace industry through internships in spacecraft design, systems engineering, and manufacturing. Outside of school, Jacob can be found camping, skiing, and volunteering at local natural areas. After graduation, he plans to pursue a graduate degree in astronautics engineering.

Abstract: Traditional measurement of pressure on wind tunnel models requires individual pressure transducers or other discreet sensors. To provide advantageous data over an area or complex geometry, placing an adequate number of sensors can be cost prohibitive and physically challenging. Computational fluid dynamics (CFD) provides an alternate approach to such experiments, but often needs experimental verification. Pressure-sensitive paint (PSP) is a distinctive, appealing measurement technique for providing pressure measurements in these cases. By measuring the intensity of a specialized paint's luminescence, the pressure at almost all visible points on a test object can be found. In some unsteady aerodynamic cases, the paint mixture is altered to provide faster response times, thus allowing rapidly changing phenomena to be analyzed. This technique has been utilized for several decades; however, it has been heretofore unused at the University of Dayton. This research provides the groundwork for the use of PSP in various applications at this university. The technique is then applied to analyze the ground effects of small rotorcraft blades. This will assist in revealing the underlying characteristics of the unsteady flow that occurs between a small and the ground, as may occur in unmanned arial vehicles.

Publications: None yet.

13	Emelia Sykes

Suraju Lawal

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

An Investigation of Winglet Design with Limited Computational Cost, Using an Efficient Optimization Method and Calculations.

Biography: I was born and raised in West Africa (Nigeria). I moved to United State of America over a decay ago. I attended Sinclair Community College where I obtained an Associate Degree in Aviation Maintenance Technology, then transfer to Central State University where I am currently a sophomore pursuing a Degree in Manufacturing Engineering and a Minor in Nuclear Engineering. I am the President of National Society of Black Engineers (NSBE), Financial Secretary for Society of Manufacturing Engineers (SME) Central State University Chapter. I am currently working for PSA Airlines a subsidiary of American Airlines as an Aircraft Mechanic.

Abstract: Aerodynamic drag can be decreased with respect to a wing's geometry, and wingtip devices, so called winglets, play a vital role in wing design. The focus has been laid on studying the lift and drag forces generated by merging various winglet designs with a constrained aircraft wing. By using computational fluid dynamic (CFD) simulations alongside wind tunnel testing of scaled down 3D-printed models, one can evaluate such forces and determine each respective winglet's contribution to the total lift and drag forces of the wing. At last, the efficiency of the wing was furtherly determined by evaluating its lift-to-drag ratios with the obtained lift and drag forces.

Publications: None yet.

10	Michael R. Turner

OHIO UNIVERSITY

Daniel Lipec

Senior, Computer Science
Advisor(s): Dr. Chad Mourning

A Three-Dimensional Virtual Depiction of the Errors of the Major Global Navigation Satellite System Constellations

Biography: Daniel Lipec is a senior at Ohio University, majoring in Computer Science with a minor in Mathematics. He grew up in Mentor, OH where he developed an early interest in computing. In high school, he began to explore this interest by taking web development and computer science classes which ultimately solidified his decision to pursue higher education in the field of Computer Science.

Abstract: Global Navigation Satellite Systems (GNSS) are vital in the modern world. The most familiar GNSS constellation is the Global Positioning System, or GPS that is used commonly in the United States. However, many other constellations exist, this project will focus on GPS, Galileo (European Union), GLONASS (Russia), and BeiDou (China). Most phones in the US use multiple constellations to determine a more accurate position, but no constellation is 100% percent accurate, nor are constellations created equal.

The goal of this project is to help visualize the scale of the errors of the positions received from each of these four constellations. Data will be gathered from a set of GNSS receivers at Ohio University which record position data from each constellation every second. This data will then be visualized in three-dimensions, so it is easier to understand how far off the received position from the constellation is from the true position of the receiver. This tool will not only be able to show live data, but also archived data since the beginning of the receiver's data collection. This is especially useful to identify and see how anomalies such as solar flares affect our GNSS constellations, as well as which constellations handle these anomalies with less disruption.

Publications: None yet.

14	David P. Joyce

The University of Akron

James Lyons

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

Shape Memory Alloy Adaptive Wing Prototype Model

Biography: From a young age, I have been fascinated by anything that flies. Even before I understood what an aircraft was, I became excited as my mother drove past helicopters on the commute to preschool. Eventually, this interest grew to wish lists of toy planes that I would play with for hours. Touring the National Museum of the USAF at age 12, I was absolutely fascinated, and from that moment I knew I wanted to work in aeronautics. When choosing a university program I landed on the Engineering department at Akron, drawn by the affordability and the Zips Aero Design Team, of which I am an active member. I am also active in Tau Beta Pi, Engineering Student Council, and service programs at my university. These involvements have opened many doors. This summer, I completed an internship with Schaeffler Transmission Systems and in the coming spring I will be a working at Collins Aerospace. I have also recently applied to USMC Officer Candidate School, motivated by a desire to serve the Nation. Upon receiving my degree, I am uncertain if I will enter the armed forces, begin a career in the aerospace industry, or continue my engineering studies in graduate school. What I am certain of, however, is that any of these endeavors will demand tremendous dedication and mental fortitude. The next two years will be crucial as I refine my ambitions and the skillsets necessary to achieve them. I look forward to the challenging path ahead and the bright opportunities in aerospace that lie before me.

Abstract: An adaptive wing improves aircraft fuel efficiency, aerodynamics, and functionality, like a traditional flap system, while additionally maintaining surface integrity and avoiding gaps. Hydraulic adaptive wing systems are heavy and complex, which has historically prevented their implementation. The objective of this research is to develop an alternative adaptive wing technology using a shape memory alloy blended flap. Integrated heating of trained shape memory alloy samples will elicit precise deformations to articulate the flap with savings in weight, maintenance, and complexity, over a hydraulic system. The concept will be researched in three phases. These phases are as follows:

1. Production of a bench prototype to develop familiarity with the material and produce a prototype flap that consistently articulates using temperature controlled SMA.
2. Iterative redesign of the model based on wind tunnel data to achieve the desired flight characteristics developed from concurrent computational simulations.
3. Implementation of an SMA blended flap on a scale RC plane enabling the team to evaluate the functionality of the concept.

Publications: None yet.

16	Anthony Gonzalez

Brandon Malahtaris

Senior, Mechanical Engineering
Advisor: Dr. C. Virgil Solomon

Effectiveness of Vortex Generators on Airfoil Performance

Biography: Brandon is a Senior Mechanical Engineering student at Youngstown State University with a minor in Mathematics. His passion for engineering grew from middle school Lego robots, which continued into more difficult robotics challenges in high school. In total, he has coached or participated in 7 different competitions including most recently NASA Lunabotics and BattleBots. His interest in aerospace was a result of his second and third year research project which evolved into his current project. Along with his robotics experience, he has recent experience in the aerospace field with an internship at a commercial and military helicopter company. Upon graduation, he plans to continue his education in Mechanical Engineering along with pursuing a full time position in the aerospace field.

Abstract: Vortex generators play a critical role when a plane is in takeoff or landing by providing improved control and reduced stall speeds by organizing separated flow near the boundary layer of an airfoil. The goal of the project is to design and test a NACA 2412 used on a Cessna 172 with and without vortex generators to determine their effectiveness in flight at different velocities and angles of attack.

The airfoil is scaled and designed with a 9” chord length for use with the wind tunnel available at Youngstown State University. The airfoil will be made using a Vat Photopolymerization 3D printer in three different pieces. The vortex generators would be cut from carbon fiber sheet and bonded to another airfoil with cut outs for the generators. Data will be gathered using pressure taps in 64 different locations around the airfoil. For collection a 16-port data acquisition unit will be used and repeated 4 time to receive all values. After acquiring the data, the pressure will be plotted on a graph using Excel to examine the surface pressure distribution. A MATLAB program will be created to compute the lift coefficient acting on the airfoil. Data will be collected at 10, 15, and 30 m/s to analyze differences with and without vortex generators.

Publications: None yet.

13	Emelia Sykes

Jacob G. Mansell

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

Roux-en-Y Gastric Bypass Surgery Does Not Increase Preference for Low Concentrations of Ethanol in Cafeteria Diet-Fed Female Rats: How is Ghrelin Involved?

Biography: Jacob Mansell is a Senior at Baldwin Wallace University pursuing a bachelor's degree in neuroscience. Jacob is currently following the pre-med track required to apply to medical school. After suffering from an unexpected life event, it influenced him to study neuroscience and pursue medicine. During high school, he underwent urgent brain surgery that resulted in his absence for most of his senior year. During this scary time, his medical team mentored and motivated him to pursue the ever-changing field of neuroscience. Growing up, he always wanted to go into a profession where he could directly impact society. After persevering through such a terrifying surgery, he wants to inspire children that medicine is never out of reach, no matter what conditions they develop or are born with, just as his Neurosurgery team had done for him. In addition to research at Baldwin Wallace University, Jacob worked as a summer student research intern with the Edward M. Chester, MD, Summer Scholars Program at MetroHealth Medical Center in Cleveland, Ohio. This strengthened his passion and reinforced a strong work ethic to achieve his goals of pursuing a rewarding career as an MD/Ph.D. specializing in pediatric neurosurgery.

Abstract: Even though women are more prone to obesity than men and 80% of patients receiving bariatric surgery are female, most mechanistic studies of the weight-loss surgery feature only male model organisms. Here we sought to characterize the impact of Roux-en-Y gastric bypass (RYGB) surgery on the metabolic and reproductive profiles of female rats fed a high-fat and high-sugar cafeteria diet (CAF). We then assessed if female CAF rats given RYGB would show higher preferences for low ethanol concentrations than female CAF rats given a sham surgery, which is what has been reported in male rats. Additionally, we seek to correlate the profiles of the hormone ghrelin, which is a “hunger” hormone produced by the stomach and reduced following RYGB, to the alcohol preference of the female CAF rats given RYGB or a sham surgery and unoperated chow-fed rats.

Female rats were at weaning provided either with chow only (CHOW, n=12) or with chow and access to high-fat + high-sugar food choices (CAF; n=24). By 20 weeks of age, CAF rats gained more weight and had higher blood glucose levels after a glucose challenge than CHOW rats but did not show altered responsivity to an insulin challenge or estrous cycling profiles. RYGB surgery in CAF rats (n=8) decreased body weight and fasting glucose levels and led to better tolerance of a glucose challenge compared to their sham-operated sisters (SHAM, n=11). RYGB did not independently alter cyclicity, although estrus profiles unexpectedly changed pre- to post-surgery in both surgical groups. The operated rats, as well as unoperated female rats fed chow only (n=8), were then given ad libitum access to ethanol alongside water, and intakes measured daily; 2% ethanol was given for 8 days, followed by 10 days each of 4% then 8%. Ethanol preference for each concentration was calculated by dividing ethanol intake by the total fluid intake, and these values were averaged over the last 3 days of access of each concentration. At all concentrations tested, CAF-fed RYGB- and sham-operated rats showed similar preferences, and, at the two lower ethanol concentrations, unoperated CHOW rats preferred ethanol to a significantly greater extent than did CAF-fed operated rats. This suggests that RYGB does not always increase ethanol preference as previously reported.

The rats were euthanized and their blood was collected transcardially, treated with EDTA and Pefabloc, and plasma collected for ghrelin analysis via enzyme-linked immunosorbent assay (ELISA). The first test came back inconclusive due to out-of-range standard values. We plan to re-run the ELISA and hypothesize that high levels of active ghrelin will correlate to high ethanol preference.

Publications: None yet.

7	Max Miller

AJ Marino

Junior, Biological Sciences
Advisor(s): Stephanie Miller, Nathanial Szewczyk

Examining Biological Changes to Spaceflight in C. elegans

Biography: Hello! My name is AJ Marino and I'm a Junior Studying Biological Sciences at Ohio University. Growing up I've always had a love for science, especially biology and space. This scholarship has finally given me the opportunity to work with both.

Abstract: I will support pre-flight testing for two NASA Space Biology experiments – CBIOMES and iGCE. The anticipated work will include biocompatibility testing and selecting appropriate worm strains for flight. In addition, I will do histologic analysis of muscle for worms flown on the MME-2 mission.

Publications: None yet.

15	Michael Carey

CEDARVILLE UNIVERSITY

Laurin Meisberger

Senior, Mechanical Engineering
Advisor(s): Dr. Tom Ward

Recovery System for a High Powered Rocket

Biography: Laurin Meisberger grew up in the small town of Williamsburg, Ohio. Throughout high school she was a student athlete who played various varsity sports. While managing sports she graduated Summa Cum Laude in her graduating class of 2019. Growing up Laurin and her family visited many amusement parks, this sparked a passion in her for roller coasters. This passion grew tremendously and led her to choose mechanical engineering as her major at Cedarville University as her goal for her engineering career is to ultimately design roller coasters. During her time at Cedarville she has had the pleasure to grow her engineering skills through classes, lab experiences, and two internships while also volunteering as a Young Life leader mentoring high school girls.

Abstract: For Laurin's senior design project, she and nine other engineering team members are participating in NASA's Student Launch competition. Each year the primary payload for the competition changes. This year our team's challenge is to design a high powered rocket that upon a safe landing is able to receive radio frequency commands and perform a series of tasks with an on-board camera system. To ensure that the full-scale rocket model is safe the team has also constructed and launched a sub-scale rocket. A big part of the scoring for this competition is being able to accurately predict the rocket's apogee anywhere from 4,000 to 6,000 feet. To do this all subsystems of the rocket must work together seamlessly. Lastly, the flight vehicle must be returned safely to the ground for the flight to be considered successful. This is done by designing a working recovery system which is critical for the duration of the entire flight.

Since this is a team project each member has different roles, Laurin is acting as the recovery system lead and Cedarville Student Launch's safety officer. As recovery lead Laurin is responsible for fully designing the ejection portion of the recovery system that will safely bring the entirety of the flight vehicle to the ground. To do this Laurin performed ample research on different styles of recovery systems and performed tests to carefully select the necessary electrical and mechanical components to achieve a successful recovery. The dual bay recovery system that Larin designed will be housed in two separate avionics bays and each will utlize a main and redundant altimeter to reduce the risk of failure. Once the rocket reaches the programmed heights, electric matches hooked to black powder charge wells will trigger a contained explosion which will separate the rocket and release one of two parachutes. The drogue and main parachutes will bring the rocket to the ground at a safe velocity defined by NASA Student Launch requirements.

Per NASA Student Launch requirements, each team is to have a safety officer. As mentioned before, Laurin is safety officer for the 2022-2023 Cedarville Student Launch team. By taking on this role, she is responsible for creating and implementing any necessary safety procedures. So far Laurin has created a Safety Data Sheet binder, gave a presentation to her team on the importance of safety in high powered rocketry, created testing documentation, and began to define a set of standard operating procedures for her team and future teams to use.

Publications: None yet.

2	Brad R. Wenstrup

Victoria Messuri

Senior, Chemical Engineering and Biochemistry
Advisor(s): Dr. Byung-Wook Park

Electrochemically Regulated Smart Wound Dressing

Biography: Victoria is currently a fourth-year undergraduate student at Youngstown State University working on dual degrees in both biochemistry and chemical engineering. She is working on applying to graduate schools with hopes of continuing her academic studies in biomedical or biological engineering to later pursue a career in the pharmaceutical research field with a focus on cancer treatment and prevention. Victoria is involved in several organizations and clubs at YSU, including the Honors College, Chem-E-Car, The American Institute of Chemical Engineers, The Society of Women Engineers, Tau Beta Pi, Phi Kappa Phi, and Pi Mu Epsilon. In high school, she was a member of the golf team and played alto saxophone in marching and concert band. Additionally, Victoria is active in her community with volunteer work and enjoys traveling, spending time with friends, and exercising.

Abstract: The skin represents the largest organ of the human body and acts as a barrier to microbial threats. Conventional wound dressings deliver drugs based on passive diffusion, which is relatively easy to incorporate into the dressings. However, the main drawback of passive methods may be a lag time in drug release incurred with negative influences of rapid onset drugs. Investigating a new treatment that would be more effective, we are developing a smart wound dressing that is responsive to an electrochemical stimulus. Controlling the release of therapeutics can minimize side effects and enhance the efficiency of treating the wound sites. The smart wound dressing is a transdermal patch device capable of loading therapeutics and allowing for their controlled release on demand. Hydrogel is integrated into the smart wound dressing to store the drug. Polyelectrolyte complexes (PECs) are a hydrogel formed when a pair of opposite charged polyelectrolytes are mixed in an aqueous solution, with key properties of flexibility, biocompatibility, and potential for high water content – distinguishing it as a good candidate for a smart wound bandage. We have used different ratios of alginate to chitosan polyelectrolytes for our control experiment and have tested its passive diffusion of the model drug FITC-dextran on agarose gel: referred to as phantom skin. Going further, ferrocene (Fc)-containing macromolecules have attracted considerable attention in controlled drug delivery due to its behavior as a redox mediator. In this project, ferrocene was then incorporated into chitosan to modulate the PEC hydrogel stability as redox-responsive units. The finished PEC hydrogel will then be able to serve as an electrochemically regulated smart wound dressing and be integrated in a portable/personal device, which will be potentially applied for future astronauts who may need a wound treatment during their missions.

Publications: None yet.

6	Bill Johnson

Brooke N. Meyer

Senior, Mechanical Engineering
Advisor(s): Jed E. Marquart, Ph.D., P.E.

Analysis of Fuel Combustion

Biography: I am currently a Senior at Ohio Northern University and will graduate in May of 2023 with a B.S. in Mechanical Engineering. I am originally from Ottawa, Ohio. My hobbies include hanging out with friends and family, kayaking, four-wheeling, and doing anything outdoors. So far at Ohio Northern, I have served as treasurer and logistics manager for the AIAA competition team and am a member of the SAE Baja team. I also had the opportunity to travel to Florida with the Aero team and compete with our RC airplane at the 2020 SAE Aero Design East Competition. After graduation, I plan on starting my career and entering the workforce. I hope to work in the chemical/petrochemical or refining industry.

Abstract: The goal of this research is to perform an analysis of fuel combustion. The fuels that will be analyzed are Jet A, Jet A-1, and SAF (Sustainable Aviation Fuel). Sustainable Aviation Fuel is also sometimes referred to as biofuel. Early biofuels used crops such as corn and soybeans but are now being produced using other, non-food sources such as cooking oil or grass. By analyzing the combustion of these fuels through balancing chemical equations and other processes, a conclusion regarding the energy produced from various jet fuels and the future of them can be determined.

Publications: None yet.

5	Robert E. Latta

The University of Dayton

Joshua Michonski

Senior, Mechanical Engineering
Advisor(s): Dr. Robert Lowe

An Investigation of the Mechanics of an Ultra-Stretchable, Self-Healing, DLP 3D-Printed Hydrogel for Damage-Resistant Soft Robots

Biography: Joshua Michonski is a senior undergraduate student at the University of Dayton (UD) pursuing a degree in Mechanical Engineering with a minor in Robotic Systems. Joshua has a passion for automation and innovative design stemming from his experience leading a High School Robotics team. At UD, Joshua has sought opportunities to explore and develop this passion. He joined and eventually became the vice president of the University of Dayton Mars Rover Team and president of the American Society of Mechanical Engineers Club. Joshua has been an engineering intern for Parker-Hannifin Corporation, Graphic Packaging International, and MinVayu (through the UD ETHOS Program). In 2022, he joined the Behavior of Advanced Materials and Structures (BAMS) lab to conduct soft robotics research on a novel self-healing photocurable elastomer. Through a collaborative effort between the BAMS lab, the Polymer and Responsive Materials Team at the Air Force Research Laboratory, and the University of Dayton Research Institute – with support from a NASA/OSGC STEM Scholarship – Joshua has been able to work full time on this project.

Abstract: Inspired by nature, *soft robots* composed of compliant ("soft") materials are well-suited for uncertain, dynamic tasks requiring safe interaction between a robot and its environment. Vat photopolymerization (VP) additive manufacturing (AM) processes such as digital light processing (DLP) have disrupted traditional manufacturing of soft devices, enabling the fabrication of soft robotic components with unprecedented speed, resolution, and complexity. Concurrently, the rapid development of novel *self-healing photo-curable soft materials* for VP-based AM has paved the way for soft robots with embedded healing of damage (e.g., perforations, tears) induced, for instance, by an unintended interaction with a sharp object in their operating environment. At present, however, the mechanical behavior (deformation and fracture) of self-healing photo-curable soft materials (elastomers and hydrogels) used for next-generation soft robots is not well understood. To address this compelling research opportunity, this work focuses on the design and execution of a mechanical testing program to characterize BeckOHflex, a novel self-healing photo-curable hydrogel synthesized using off-the-shelf chemicals. The large-strain elasticity of BeckOHflex is investigated through quasi-static uniaxial tension testing. Both virgin and self-healed mechanical properties are shown to be commensurate or superior to the best-performing self-healing hydrogels in the literature. Further, a suite of demonstration prints produced on a commercial VP 3D printer highlight the material's scalability and the ability to yield prints with complex form factors.

Publications: None yet.

10	Michael R. Turner

Emmanuel Nshimiyimana

Junior, Electrical Engineering
Advisor(s): Dr. Deok Hee Nam

Development of a paradigm of software and systems engineering processes for aerospace engineering

Biography: I was born and grew up in Rwanda and I came here in 2016. I went to Denbigh High school in Newport News, Virginia for three years, and then I graduated from Paul Laurence Dunbar High School class of 2020, after when my family moved. Then I started my engineering study as a freshman at Wilberforce University. Now I am a junior at Wilberforce University, majoring in Electrical Engineering. My future dream after college is to have some experience at a big electrical engineering company and pursue my advanced studies at graduate school.

Abstract: Development of a paradigm of software and systems engineering processes in engineering. The project presents to introduce a paradigm of software and systems engineering processes. The first plan of the system is started by assessing formal current software engineering practices. An action plan is designed and developed for multi-functional working groups, which were tasked to define and facilitate the implementation of software processes. A second plan is initiated to design and define a system engineering process and, integrate into the systems engineering process the software engineering process already in use. Finally, the project discusses how the developed prototype can interact with the current industry systems engineering including various system designs to understand what the phrase "Systems Design" means in the twenty-first century, aerospace system design with the significance and current development of systems engineering, the foundational elements of the aerospace engineering of the entire system, and the common problems and how the aerospace engineering can be related to system engineering in the present-day business environment.

Publications: None yet.

10	Michael R. Turner

Kyle Preusser

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

Electrochemical Detection of Lead Ions using Novel Biohybrid Nanocomposite of Metal Organic Framework and Cellulose Nanocrystals

Biography: I am from Niles, Ohio, and enjoy creating new things whether it be LEGOs or the like. Back in high school, I was one of the outliers who really enjoyed chemistry. By involving myself in chemical engineering, I have been able to blend my passions with a study I can use to improve the world. At YSU I participate in a variety of programs such as ChemE-Car, Choose Ohio First, the Sigma Alpha Epsilon fraternity, and other research projects under Dr. Park. In my future, I want to manufacture medicines.

Abstract: Heavy metal pollution has become a worldwide problem. Particularly, lead ions (Pb^{2+}) have received growing concerns due to their increased discharge and deleterious effects on the environment as well as human health. Extensive studies show that the ingestion of lead ions display a wide range of adverse effects such as memory loss, nerve disorders, muscle paralysis, and irritability in humans. This project places an urgency to develop an effective and practical method for lead ion detection specifically in a water medium. In this research project, a novel hybrid nanocomposite was fabricated through a simple one-pot hybridization method, and the square wave anodic stripping voltammetry (SWASV) was used as the electrochemical technique for the detection of lead ions.

In this study, the developed electrodes using the metal organic framework and cellulose nanocrystals (MOF-CNC) proved to be an effective material to detect leads ions at levels down to sub-ppm in aqueous solutions. Various electrochemical tests such as cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) were performed to characterize the fully modified electrode to compare it with bare glassy carbon electrodes (GCE). The experimental parameters were optimized for detection such as accumulation time and potential range. Selectivity and reproducibility tests determined that the MOF-CNC modified electrode favor the accumulation of lead ions and indicated an excellent anti interference ability of the electrode. Real samples such as Mahoning River and tap water were tested. The MOF-CNC/PEDOT:PSS/GCE modified electrodes offer portable and efficient methods of safely detecting heavy metals in aqueous medium.

Publications: None yet.

13	Emelia Sykes

Jeremy Price

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

Design and Optimization of a Square Twist Inspired Deployable Radiator

Biography: Jeremy is a junior undergraduate mechanical engineering student at the University of Dayton. Jeremy is interested in all things related to aerospace and automotive research and design, and joined the thermal applications lab at UD in the Fall of 2021 to explore the subject of heat transfer, of which he knew little about. Jeremy has learned a lot from a diverse range of engineering experiences in his undergraduate years. He has worked for Carr Lane Manufacturing, Honda, the Air Force Research Lab, and just recently accepted an internship offer with Boeing. Jeremy is also the Vice President and lead design engineer for the SAE Baja team at UD. When he is not working, Jeremy can usually be found working out in the gym. He also enjoys fishing, hiking, and reading in his free time.

Abstract: For a theoretical outpost on the moon, a means of rejecting excess heat produced by power sources is necessary. Since there is a negligible amount of atmosphere on the moon, this heat must be rejected by radiation. An ideal radiator would be able to change its surface area and therefore the amount of heat it emits to adapt to the day and night cycles of the moon. This radiator would also need to be compact for ease of transportation, and it would need to be simple to set up.

For these reasons, a design for this radiator was chosen that is inspired by an origami tessellation called the square twist. This design was chosen for its ability to be repeated, its ability to be rigidly foldable, a large difference in surface area between folded and unfolded form, a stationary center during folding, and because all panels always face outward. Two versions of this design were created, a rigidly foldable model, and a "flexible" model. The rigidly foldable model is constrained to one degree of freedom and consists of rigid panels and hinges. The flexible model requires more actuators to fold, and requires hinges that can twist while they fold, but the flexible model can fold flatter and will likely have more efficient heat transfer. CAD and physical models of each design have been created, and thermal analysis is now being conducted in ANSYS and verified with a Python model.

Publications: N. Debortolli, N. Douglass, D. Warburton, J. Price, J. Cannon, B. Iverson, R. Mulford, "A Novel Dynamic Spacecraft Radiator Design With Annular Geometry and Varied Thickness Profiles for Cubesat Applications" ASME 2022 Heat Transfer Summer Conference

10	Michael R. Turner

Ezra Ramlo

Senior, Chemical Engineering
Advisor(s): Dr. Khabaz

Microscopic dynamics and rheology of ionomers: a molecular simulation study

Biography: Ezra Ramlo, who goes by Gemini, grew up in Hudson, Ohio. There they got their high school diploma and graduated with Summa Cum Laude. They now attend the University of Akron for a Chemical Engineering Bachelor's degree, in which they are on their fourth year in the program. At the university, they are involved in the Akronauts, which is the Akron Rocket Design Team. They have been heavily involved since their freshman year, which earned them the position of a sub team lead on the team. Within the most recent launches in the team's series to get a rocket to space, they have greatly assisted with the motor development and design. Ezra has been involved in undergraduate research since their freshman year. They were originally involved in rheological research done under Dr. Ruel McKenzie of the Polymer Science Department.

Abstract: Ionomers are polymers in which ionized groups create ionic crosslinks in the intermolecular structure. They are composed of both neutral and ionized repeat units covalently bonded to the polymer backbone as pendant group moieties. They have long attracted attention due to the physical properties associated with the ions (e.g., conductivity, glass transition, and dynamic bonding) and their interactions with other chemical species (i.e., solvent, salts, and non-ionic repeat units). The primary effects of ionic functionalization of a polymer are to increase the glass transition temperature, melt viscosity, and characteristic relaxation times. Polymer microstructure is also affected, and it is generally agreed that in most ionomers, microphase-separated, ion-rich aggregates form as a result of strong ion–dipole attractions. The major effect of the ionic aggregate was to increase the relaxation processes. This increases the melt viscosity and is responsible for the network-like behavior of ionomers above the glass transition temperature. Coarse-grained MD simulations will be used to connect their molecular structure to their macroscopic rheology. In this work, we will create ionomer structures with different architectures and study the network formation at different degrees of electrostatic interactions.

Publications: None yet.

14	David P. Joyce

Cleveland State University

Nicholas Ribic

Senior, Mechanical Engineering
Advisor(s): Dr. Andrew Gyekenyesi
and Dr. Saeed Farahani

Rimeco CNC Lathe Automation and industry 4.0 Project

Biography: This is Nicholas Ribic I am a 22-year-old Senior mechanical engineering student at Cleveland State University. I have also worked at a CNC Machine shop for six years as a CNC machinist. After the first few years working that is when I decided I wanted to go to school to become a mechanical engineer, as I wanted to find ways to improve machining and to automate the CNC machine process. This project has helped me take my first steps in doing this as I get my first experience with automation on machines.

Abstract: With my OSGC award I have been able to do some research in the subject of automation. It started from learning that automation is not just robots running machines but any tool that will limit human interaction in the manufacturing process. At Rimeco Products I started by creating a specialized tool database just for Rimeco Products so that they could automate their CNC programming process and get a better idea of what how long each part will take and how long each job will take to be able to better schedule their jobs.

I then started researching more into automating the lathes. One of the ways I found to automate Rimeco products lathes would be to have a probe in the machine that would measure the part being machined and make the according changes to the machine. The probe would also check if the tools are broken in the machine. This would not create a fully automated lathe as you would still have a machine operator loading and unloading parts from the machine but it would lower the human interaction in the whole process as the machine operator would not need to make any changes to the machine just change tools when the probe alerts that a tool is broken. Overall, I believe this is a good first step into learning more about automation in machine shops and as I continue to do more research, I would eventually like to get the point where we have very limited human interaction in machining and be fully automated as I believe this would drastically increase production.

Publications: None yet.

14	David P. Joyce

WILBERFORCE UNIVERSITY

Patrick Rukundo

Junior, Electrical Engineering
Advisor(s): Dr. Deok Hee Nam

Comparative Studies of Satellite Communication Protocols for Mars Sensor Networks

Biography:
I am Patrick Micucu Rukundo, attending Wilberforce University as an Electrical Engineering major. I'll be entering my senior year next semester. My dream is to have a career at NASA or work for a big electrical company

Abstract:
The terraforming of Mars is a hypothetical procedure that would consist of a planetary engineering project by transforming Mars from a planet hostile to terrestrial life to one that can sustainably host humans and other lifeforms free of protection or mediation. The Mars environment poses some challenges for communication that can make terrestrial solutions ineffective. Although not suitable for direct replication, it is valuable to study successful terrestrial approaches and evaluate their ability to support the harsh Mars environment, and to assess how procedures and algorithms can be adapted for efficient Mars communication. In this project, frequently used Medium Access Control (MAC) protocols are reviewed, and discuss the challenges of the classifications and performance assessments of MAC protocols for satellite communications face in the Mars environment. In addition, a group of hybrid and adaptive communication protocols and their performance for Mars will be investigated and compared for a Mars Regional Communication Protocol Model

Publications: None yet.

10	Michael R. Turner

WRIGHT STATE
UNIVERSITY

Dryana Russell

Senior, Material Science and Engineering
Advisor(s): Dr. Henry Young

Nano-Silver Sintering for Microchip Heat Sink

Biography: Dryana Russell is a senior at Wright State University majoring in Material Science and Engineering. She currently maintains a 3.9 GPA and has interned at Wright Patterson Air Force Base and Pacific Northwest National Laboratory throughout her time in college. After graduating she plans on participating in the Peace Corps as a volunteer teacher in Ghana. Further in the future, she is considering pursuing her master's degree in environmental engineering. In her free time, she mostly reads but is also interested in learning how to blade-smith.

Abstract: This project mainly focuses on the compression and sintering of silver nano and micro-particles. Multiple processes have been utilized to maximize the density of the silver samples. One of the initial experiments attempted was heating the sample while simultaneously applying pressure. The previous tests have been conducted by producing a mixture of di-ionized water, silver nitrate, and silver microparticles. This mixture is placed on silicon wafers and heated at 250℃. Consolidation studies are being conducted with varying silver particle sizes and different concentrations of silver nitrate. This study focused on producing a high packing density of silver particles while analyzing sintering processes. Characterization of resulting solids will be done with SEM and possible XRD.

Publications: None yet.

10	Michael R. Turner

NORTHERN

Abigail Schauer

Senior, Mechanical Engineering
Advisor(s): Dr. Jed Marquart

Comparison of Flow Separation on a Wing with and without Vortex Generators

Biography: Abigail Schauer is a Senior at Ohio Northern University studying Mechanical Engineering with a concentration in Aerospace. She is a design lead for ONU's American Institute of Aeronautics and Astronautics (AIAA) chapter that designs remote control planes for competition. She is also a coordinator for the peer mentoring program, a member of the President's club, and on the varsity swim team. She has always been interested in the safety of engineered products and hopes to use her degree to improve the safety of flight.

Abstract: This project will compare flow separation on a wing that does not have vortex generators and an identical one that does. This comparison will be done by placing models in a wind tunnel with smoke and observing the vortices that form around the wing. The results will be compared and validated with the results of CFD models of the same airfoil.

Publications: None yet.

10	Michael R. Turner

Marietta College

Julie Schlanz

Senior, Biochemistry
Advisor: Dr. Suzanne Parsons

Effects of Mononitroparaben on Lipid Content of Melanoma Cells

Biography: Julie Schlanz is a senior Biochemistry major at Marietta College from Shadyside, Ohio with a minor in English. At Marietta College, Julie participates in many clubs and activities such as the Gardening Club and being the president of the Chemistry Club. Additionally, she works as a chemistry solution preparatory assistant and a teaching assistant for the General Chemistry labs. During the past two summers, Julie has had the opportunity to focus on research at Marietta College as well as Johns Hopkins Medical School. After graduation, Julie will attend graduate school to obtain her PhD in chemistry with hopes of becoming a chemistry professor. Outside of school, Julie enjoys reading, crocheting, walking her dog, and spending time with horses.

Abstract: Parabens are commonly used as preservatives in regularly used topical products, but their safety is under discussion since small amounts of paraben have been found in tumor tissue. Mononitroparaben causes cell death in melanoma cells with an LC_{50} value of 7.02mM after twelve hours of treatment. This study focused on how mononitroparaben affects the cellular lipid content during induced cell death.

The experiment was conducted by growing the M624 melanoma cells, dissolving the paraben, and then leaving 0 mM, 5 mM, and 10 mM concentrations of paraben on the melanoma cancer cells for twelve hours. The paraben was then removed from the cells, and the cells were lysed. Colorimetric cholesterol assays and ceramide assays were completed to determine the changes in cellular cholesterol and ceramide content and the role of cellular lipids in cell death signaling.

Publications: None yet.

6	Bill Johnson

James Schmitz

Senior, Mechanical Engineering
Advisor(s): Dr. Harok Bae

Reduced Modeling Development for Hypersonic Vehicle Design Exploration

Biography: James is a senior at Wright State University pursuing a major in Mechanical Engineering with a minor in Computer Science. After graduation, he plans to continue his education by pursuing a Master's Degree in Mechanical Engineering through Wright State's "4+1" program. James grew up in Beavercreek, Ohio where he developed a love for engineering and mathematics from an early age. After finishing his education, James hopes to begin a career in the aerospace industry. Outside of his studies, James enjoys reading, playing board games, and playing sports, particularly soccer.

Abstract: To develop aerospace vehicles that excel in performance and air superiority, we need to push past traditional designs and models. Models need to be examined early in their development under various operational conditions and design configurations. Reduced models, such as surrogate or machine learning models, can provide important information to aid in decision making and design discovery. This project will seek to develop a hypersonic vehicle structural model to estimate aerodynamic pressure and thermal loads under operational conditions of interest. After the initial model development is complete, a reduced model of aerodynamic and thermal structural responses will take place to accelerate conceptual design exploration.

Publications: None yet.

10	Michael R. Turner

Wilberforce University

Jamari Stevenson

Junior, Computer Science
Advisor(s): Dr. Deok Nam

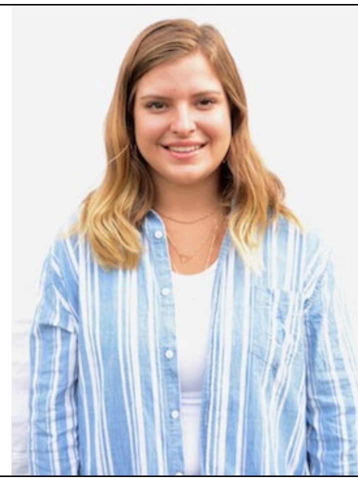
Artificial Intelligence for Space Exploration

Biography: Jamari Marcel Stevenson was born on March 12, 2002, in Augusta, Georgia to parents Mark Stevenson Jr. and Eureka Davis. He is the only son on both sides, as well as having a total of 6 sisters. In his early days, Jamari was always seen around computers and had a love for video games and technology, which immediately played a factor in choosing computer science to study in college. In high school, Jamari was on the robotics team and kept above a 3.8 GPA, graduating with honors in the year of the COVID-19 pandemic. Jamari was accepted into multiple universities, but after graduating, Jamari enrolled at Wilberforce University as a computer science major, where he remains today as a junior.

Abstract: In recent years, various national space agencies are looking for cutting-edge technologies in several of the main space engineering areas related to Artificial intelligence (AI) for space exploration such as the design of intelligent space agents. This has led to an increasing interest in artificial intelligence by the entire aerospace community. Moreover, artificial intelligence comprises all the techniques needed for computers to imitate intelligence and it has been used in a wide range of industries. In this project, the topic of space exploration and artificial intelligence will be looked at in terms of the field of space engineering and space technology including AI's role in space exploration, AI-based assistants and robots, image analysis automation, intelligent navigation system, autonomous rovers, and the prosperous future of space exploration placed in the hands of AI.

Publications: None yet.

15	Michael Carey



Aubrey Strong

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

Differential Expression of microRNAs in Glioblastoma

Biography: Aubrey Strong is a Senior Molecular Biology student at Cedarville University and will graduate in May 2023 with a B.S. Biology degree, as well as minors in Spanish and Biblical Studies. She is from Westfield, IN and has worked at the University of Kentucky doing research in the field of muscle physiology. Upon graduation, Aubrey plans to pursue a PhD degree in Cancer and Cellular Biology with hopes to continue research and teach at the collegiate level. Her research for the last five consecutive semesters has focused on microRNA differential expression Glioblastoma which can be used to further understand potential biomarkers or therapeutic targets for this highly aggressive form of brain cancer.

Abstract: Glioblastoma (GBM) is an aggressive type of brain cancer, leaving patients with very limited treatment options and a poor prognosis. Glioblastoma, like all types of cancer, is caused by uncontrollable cell division that happens as a result of dysfunction at a genetic level. MicroRNAs are small, non-coding segments of genetic material that play a role in gene expression, and influence the development and progression of many diseases, including cancer. Understanding the relationship between microRNA expression and Glioblastoma could lead to the development of miRNA targeted therapies or better diagnostic methods to improve patient outcomes.

Using reverse transcription and real time quantitative polymerase chain reaction (rt-qPCR), it was possible to determine the relative concentration of various microRNAs in Glioblastoma cell lines compared to the relative concentration of microRNAs in normal human astrocytes, specifically microRNA-145, which is a suspected tumor suppressor that is downregulated in many cancer types. These experiments compare the microRNA-145 (miR-145) concentration in Glioblastoma cell lines T98 and U251 to the concentration of miR-145 in normal human astrocytes. The U251 cell line had a relative miR-145 concentration of 1.5%, and the T98 cell line had a relative miR-145 concentration of 16%. Following rt-qPCR, a series of transfection protocols were performed, and results were analyzed using flow cytometry. The goal of these experiments was to make chemo-resistant Glioblastoma cells more susceptible to temozolomide chemotherapy by transfecting them with mimic miR-145. More trials are currently being performed to confirm results; however, preliminary data suggests that both U251 and T98 cells were significantly more responsive to temozolomide after transfection with miR-145 compared to the non-transfected cells.

Publications:

1. **Strong AC**, Keeble A, Wells JC, Barnes T, Bocook D, Wiggs, MP, Fry CS, Dungan CM. Cisplatin induces the accumulation of senescent cells in skeletal muscle. Manuscript in preparation. Target journal: *JCSM Rapid Report*.

CEDARVILLE UNIVERSITY

Andrew Swift

Senior, Geology
Advisor: Dr. John Whitmore

Geological Analysis and Modeling with UAS in Southern Ohio

Biography: I am a senior Geology major at Cedarville University with strong interests in planetary geology, geologic hazards, and using remote sensing to further understand the two. I was born in Cincinnati, OH and later moved to Overland Park, KS where I have lived since. I have loved everything space-related since I was very young and have been a camper and counselor at the Kansas Cosmsophere and SciEd Center in Hutchinson, KS. As a geology major at Cedarville, I have conducted several independent studies in planetary geology such as Mars geomorphology which I presented at the OSGC Symposium last spring. I love anything that flies and currently hold a Part 107 FAA drone license and am working towards a private pilot license. I plan to work as a wildland firefighter this summer before attending graduate school in the fall.

Abstract: Remote sensing techniques are crucial in the field of planetary geology for terrestrial-based research initiatives. As of now, rovers, and landers on Mars give most of our geological knowledge of the planet. When humans finally set foot on Mars, field geology will be of the utmost importance to understanding where to find evidence of past life and the geological history of the Red Planet. Given present technology, traditional field geology techniques such as those that astronauts have conducted on the Moon will prove difficult due to various factors such as Mars dust and suit mobility. However, the Ingenuity helicopter has recently shown that powered flight similar to drones is possible on Mars. This experimental study will look at small UAS (unmanned aerial vehicle) techniques astronauts can use to conduct field geology in a safe and effective manner. A small UAS will be flown over locations around Cedarville, OH that are of geological interest and take measurements and images that will be used to model the topography, geology, and structures of the areas. In the future, these same techniques can be refined and used to conduct field geology using UAS on Earth, Mars and other planets where in-person field geology is extremely difficult.

Publications: None yet.

10	Michael R. Turner

Victoria Swiler

Junior, Environmental and Plant Biology
Advisor(s): Dr. Sarah Wyatt

Potential Role of AHA2 Protein in Plant Gravity Signaling

Biography: Victoria Swiler is studying plant biology at the Ohio University Honors Tutorial College, where she is also minoring in communications. In spring 2021, Victoria joined Dr. Sarah Wyatt's lab to research the molecular mechanisms of plant gravity response, where she continues to work. Victoria also interned at the Boyce Thompson Institute in the summer of 2022 to genetically engineer groundcherry plants for crop improvement. She volunteers with Community Food Initiatives and at OU she is the Vice President of Bobcats Go Green. After graduation, she will pursue a Ph.D. to improve crops via genetic engineering.

Abstract: Following the BRIC-20 spaceflight experiment on the International Space Station, it was discovered that AHA2 proteins in *Arabidopsis thaliana* were differentially phosphorylated in microgravity compared to ground controls. AHA2 was less phosphorylated in the spaceflight environment, meaning it was less active. This project investigates the molecular mechanisms of plant gravity response by researching AHA2 protein phosphorylation in Arabidopsis. The three steps of plant gravity response are gravity sensing, signal transduction, and growth response. Although gravity sensing and growth response are relatively well understood, there is still much work to be done in gravity signal transduction. This mechanism needs to be understood to engineer agricultural plants that thrive during spaceflight. To test if AHA2 phosphorylation is involved in gravity signal transduction, Arabidopsis mutants with altered phosphorylation are being developed. Thus far, Arabidopsis mutants without the *AHA2* gene have been identified, and five AHA2 DNA constructs were created that biomimic phosphorylation or prevent phosphorylation, causing the protein to stay constantly active or inactive. These DNA constructs are being inserted into the mutant Arabidopsis lacking the *AHA2* gene. Once the altered DNA is inserted into the mutants, the mutant's gravity response can be observed through reorientation experiments and compared to wild-type Arabidopsis. These experiments will show if the AHA2 protein is involved in a plant's response to gravity, which will further our knowledge of plant molecular mechanisms and put us another step forward in developing bioregenerative life support on spaceflights.

Publications: None yet.

5	Robert E. Latta

The University of Akron

Jakub Sychla

Senior, Aerospace Systems Engineering
Advisor(s): Kwek-Tze Tan

Analysis of 3D Printed Thin-Walled Structures Utilizing Carbon Fiber Composites

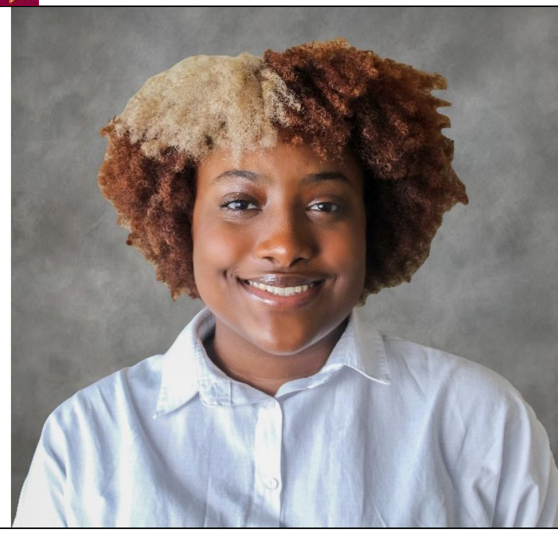
Biography: Jakub Sychla is currently an undergraduate student studying Aerospace Systems Engineering at the University of Akron. He joined Dr. Tan's research group in January 2021. He is from Cleveland Ohio and found his passion for aviation from science fiction movies and wanting to progress humanity into that direction. While at the University of Akron, Jakub participated in the Co-op program working for Bowden Manufacturing as a manufacturing intern, and Delta Airlines as a propulsion intern in the test cell facility. Jakub is also very involved with the Akron Rocket Design Team where he is currently Structures System Manager, managing the vehicle design, flight dynamics, manufacturing, composites, and structural testing sub teams.

Abstract: Additive manufacturing provides many opportunities to utilize carbon fiber reinforced polymers (CFRP) in rapid prototyping of complex geometries. There has been significant development in commercially available composite 3D printers that utilize fused filament fabrication (FFF) techniques to fabricate CFRPs. This research aims to investigate thin-walled complex structures printed using the Markforged Mark II 3D printer using an Onyx and continuous carbon fiber CFRP. The thin wall structure chosen was a symmetrical airfoil, one that could be used as a fin for a rocket. Several configurations were set up to explore the structural effects of the number of carbon fiber spars in the samples as well as the number of concentric rings of the carbon fiber in the spars as well as comparing those configurations with a configuration that has the carbon fiber laid throughout the entire sample. Each of the spars in the samples consisted of eight layers of material. The fill density of the parts remains consistent throughout the experiment as well as the overall dimensions of the samples. The samples are separated into two groups, samples that get a compression test and samples that receive an impact test and then a compression test. The results were then analyzed and compared to see how the impact test effected the compressive performance. Damages were further characterized using X-ray micro-computed tomography to examine severity of damage.

Publications: J. Sychla and K.T. Tan (2022). Investigating Effects of Fiber Layers in 3D Printed Carbon Fiber Reinforced Polymer Composites, Conference Proceeding for **American Society for Composites 37th Technical Conference**, 19-21 Sept, Tucson, Arizona, USA.

J. Sychla, C. Zhang and K.T. Tan (2021). Analysis of Printing Parameters in 3D Printed Carbon Fiber Composites using Design of Experiments, Conference Proceeding for **American Society for Composites 36th Technical Conference (Virtual)**, 19-21 Sept, College Station, Texas, USA.

Sri Tyler



Status: Junior, Industrial Technology
Advisor(s): Dr. Augustus Morris

High Altitude Ballooning Technology: From Concepts to Near Space

Biography:
Sri Tyler was born in Cleveland, Ohio and graduated from Mc2STEM High School where she was not only a high student but a full-time college student at Cuyahoga Community College. While attending high school Sri found a passion for welding and robotics. In 2021 she graduated from high school, with a Certification in FAUNC Robotics. Sri Tyler is a third year student in the department of Manufacturing Engineering at Central State University. She is majoring in Industrial Technology and is actively engaged in undergraduate research.

Abstract:
The project focuses on designing and building the critical instrumentation needed to collect atmospheric data at high altitudes while tracking the location of the balloon during flight. Data collected includes altitude, temperature, pressure, and humidity of the atmosphere during flight. GPS and radio communication links are needed to track and recover the balloon and payloads.

Publications: None yet.

Kenneth Vigorito

Senior, Civil Engineering
Advisor: Dr. Richard Deschenes, P.E.

Feasibility study on the use of geopolymers for additive construction

Biography: Kenneth is a senior majoring in Civil Engineering at Youngstown State University with a minor in mathematics. His ambition to become a Structural Engineer has made him passionate about different topics, such as 3-D printing geopolymer for lunar application. He is currently the President of the YSU ASCE student chapter, assisting the steel bridge and concrete canoe teams. He plans to continue his education by obtaining a Master of Science Degree in Structural Engineering to pursue a career in Seismic design. Besides engineering, Kenneth loves woodworking and restoring old vehicles and farm equipment. Kenneth continues to use every opportunity to improve himself to better the world around him.

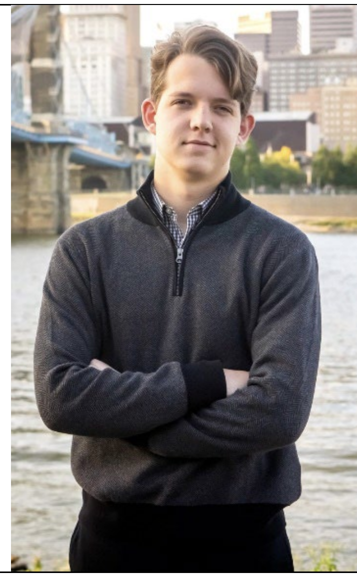
Abstract: The development of building techniques for the lunar terrain is the first step in making the moon habitable and traversable. In-situ methods of creating building materials have demonstrated the possibility of creating geopolymers for Lunar roads and structures. Additive manufacturing, such as 3-D printing, is a building technique that could be used to construct said roads and structures using a lunar regolith-based geopolymer concrete. This study aimed to develop a geopolymer concrete suitable for 3-D printing with minimal resources. Creating a geopolymer with high set times and low viscosity using aluminosilicate-rich materials, an alkaline activator, and a low water content proved challenging. A fly ash based geopolymer was the closest to the lunar simulant-based geopolymers and was used in this paper. Compressive strength was the initial criterion for developing the geopolymer concrete mix design. The strength of the geopolymer concrete in just 7 days is similar to normal portland cement concrete at 28 days, roughly 4,000 psi. Once this strength was achieved, the geopolymer was tested using a viscometer to record viscosity readings until the concrete began to set.

Recording printability was another measurement that used a nozzle and a testing machine to record the force required to print through a nozzle over time. Each batch was oven cured at 45℃ and compression tested at 7 days, 14 days, and 28 days. Based on the data, we modified and refined the mix design by increasing or decreasing the water content or introducing admixtures such as sucrose to benefit the set time. The data shows that printing geopolymer requires a specific mix design to satisfy the printability and strength factors. Reducing the set time from 30mins to an hour was possible with the addition of sucrose to delay the reaction between the 8 M alkaline activator and the fly ash. Sucrose also decreased the required mixing water due to the delayed reaction. 3-D printing geopolymer has shown to be possible, but further testing of the layered concrete in extreme temperature conditions and its overall durability on the lunar surface is required. The future of lunar habitation is set on the feasibility of 3-D printing geopolymer concrete.

Publications: None yet.

13	Emelia Sykes

Garrison Wettengel



Academic Pre-Junior, Aerospace Engineering
Advisor(s): Kelly Cohen. Ph.D

Genetic Fuzzy Logic Controller for Explainable AI Asteroids Arcade Game

Biography: Garrison is a Pre-Junior at the University of Cincinnati pursuing his bachelor's degree in Aerospace Engineering. He has completed an internship with the UC Protégé Scholar Program working on Fuzzy PID Controls and Genetic Algorithms under Dr. Kelly Cohen, as well as a co-op rotation with Northrop Grumman as a software engineering co-op. He has a passion for guidance systems as well as autonomous controls. Upon Graduation, he looks to continue his educational career with a master's degree in Aerospace Engineering.

Abstract: The usage of Genetic Algorithms to train a fuzzy system allows us to optimize the behavior of an AI agent. A fuzzy logic-based controller is developed for the arcade game Asteroids. The controller developed is responsible for target acquisition and object avoidance in a congested asteroid field. The use of fuzzy logic allows for explainable decision making for safety critical processes compared to black-box methods. The genetic algorithm trains the input/output functions of the fuzzy system. The controller aims to optimize the bullet accuracy, fuel spent, mission time, and asteroids avoided.

Publications: None yet.

1	Greg Landsman

Abhilash Yarlagadda

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

Towards Noise Mitigation in Tactical Aircraft Using High Frequency Control

Biography: Abhi is a senior in Aerospace Engineering at The Ohio State University. A lifelong passion for STEM turned into the path to his current major through exposure to engineering classes in high school. Abhi is a member of the Buckeye Space Launch Initiative at Ohio State, where he serves as the ground systems equipment lead for the Liquid Engine project within the club. Through coursework, he developed an interest in flow physics which was complemented by joining the Gas Dynamics and Turbulence Laboratory in the summer of 2022. There, he has studied supersonic flows and flow control for jet screech reduction under Dr. Samimy and Dr. Webb, and he intends to pursue a Master's in aerospace engineering through further work with this lab. Outside of school, Abhi is an avid guitarist, occasional hiker, and amateur homebrewer.

Abstract: Supersonic rectangular twin jets have become a topic of interest for implementation in most recent and next generation tactical aircraft designs. Non-axisymmetric nozzles offer benefits such as reduced radar reflectivity, drag reduction, and easier integration of aerodynamics and propulsion, especially thrust vectoring systems, over circular jets. As a result, research into the differences in flow physics between these nozzle shapes is key to improve the performance of rectangular jets. A primary issue with all jets is the screech associated with their operation in supersonic, off-design regimes. This noise is exacerbated in a twin jet configuration, where the resonance phenomenon that causes screech in a single jet can establish coupling between the two jets to further increase the intensity of both near-field and far-field radiated noise. Reducing such noise is important for the health of military personnel who are regularly exposed to it, and it can help lessen fatigue on aft aircraft components that experience the high-frequency pressure fluctuations that produce screech.

This research aims to use localized arc filament plasma actuators (LAFPAs) to study and control the development of the supersonic flow from a twin rectangular jet configuration. Previous research in our lab has assessed the control authority of LAFPAs to affect and alter the organization of the acoustic resonance that causes screech and screech coupling across a range of supersonic flow speeds. Until now, work has been primarily focused on unheated jet flows, but upcoming research will analyze the use of LAFPAs with heated flows to match actual jet operating conditions more closely. The LAFPAs' performance will be evaluated using measurements of near- and far-field pressure fluctuations and schlieren imaging of a scale model of twin rectangular jet nozzles.

Publications: None yet.

2	Brad R. Wenstrup

Community College

Lorain County Community College

Jeffrey Burns

Junior, Micro-electromechanical Systems
Advisor(s): Greg Mylnar, Johnny Vanderford

Diode Manufacturing

Biography: Jeff Burns is a Junior in the Micro-Electromechanical Systems program at Lorain County Community College. Jeff is non-traditional student who decided to pursue a degree in engineering technologies after being laid off from his job of 11.5 years. Science has always been an interest of Jeff's since a young age when he would pour over books and VHS documentaries about outer space from the local public libraries. Jeff is currently working at DanMar in Norwalk, Ohio, a midlevel electronics manufacturing operation as a manufacturing technician/apprentice electrical engineer. For now, he plans to continue growing at DanMar, playing bass and video games, and spending time with his dog and friends. In time, he would like to contribute to outer space exploration efforts by working at NASA or a private company in the same field.

Abstract: To create a pedagogical and hands on process for manufacturing an integrated circuit from a silicon semiconductor wafer using community college level laboratory equipment and community college budgets. This process may be used to train students, trainers, and other interested semiconductor manufacturing parties. I also hope to help train and inform Ohio's workforce in relevant skills that will provide them employment opportunities that are sure to come after the passing of the CHIPS and Science Act of 2022.

Begin with a p-type, single side polished (SSP) 100 orientation wafer. Will then clean wafer and grow silicon dioxide (may buy wet ox wafers if equipment to grow my own silicon dioxide proves to be process prohibitive). Use photolithography to plot wafer with 1mm squares for the n-well and diffuse according to chart (1000°C for ~30 minutes). Conduct cleaning with hydrofluoric acid, then place into sputtering system with shadowmask jig. The intention of this process is to produce working diodes that are accurately measured in the microamp to milliamp region.

Publications: None yet.

4	Jim Jordan

Cincinnati State

Emily Bursk

Sophomore, Astrophysics and Astronomy
Advisor(s): Dr. Jeremy Huber

Discovering the Distant Universe Using Strong Gravitational Lensing

Biography: Emily Bursk is a student at Cincinnati State Technical and Community College. She is currently working towards her Associates of Science degree and plans on continuing her study at the University of Cincinnati to obtain a bachelor's degree in astrophysics. She then plans on continuing her academic career in graduate school for a master's and ultimately a PhD in astrophysics. As a member of the Cincinnati Astronomical Society, Emily utilizes their 14-inch reflector telescope to observe planets and deep sky objects, such as galaxies and nebulas. Emily is also currently interning at the Cincinnati Observatory where she participates in outreach programs and advocates science and astronomy education.

Abstract: During the total solar eclipse in May of 1919, Albert Einstein's theory of general relativity was proved to be accurate when astronomer Arthur Eddington observed stars were displaced from their normal position as the moon passed in front of the sun. The applications of this discovery have since then aided in many revolutionary scientific discoveries from gravitational waves to gravitational lensing. Gravitational lensing, more specifically, strong gravitational lensing (SGL), allows a closer look at the distant and early universe in which regular telescopes would not be able to see. An advantage of using strong gravitational lensing as opposed to weak or microlensing is that SGL involves a large mass lens allowing for a larger deflection of light and geometry of the image is more favorable. This project will examine the use of SGL to study background objects in galaxy clusters and the role of astronomical survey data in these studies.

Publications: None yet.

2	Brad R. Wenstrup

Ashley Meyer

Freshman, Chemical Engineering Technology
Advisor(s): Abigail Yee, Ann Fallon

Recycling the Discarded: A More Efficient Approach to Waste

Biography: Ashley is currently a Freshman at Cincinnati State Community and Technical College. She is majoring in Chemical Technology, and plans to transfer to a 4-year university to complete a bachelor's degree in chemical engineering. Following that, she plans to continue to graduate school, with the hopes of getting a full-time job doing meaningful research. Outside of school, she has a full-time job and enjoys snuggling with her two cats, reading a good book, and baking.

Abstract: One of the key processes that makes the International Space Station habitable for extended periods of time is the ability to purify and reuse water. This is a process done by multiple filters that remove impurities from waste liquids and discard them into space—but what if those impurities could be separated and repurposed? Urine has all the necessary components to formulate ammonium nitrate, a very effective high-nitrogen fertilizer—which would be used to facilitate fresh food options and limit the number of trips needed to restock resources on ISS.

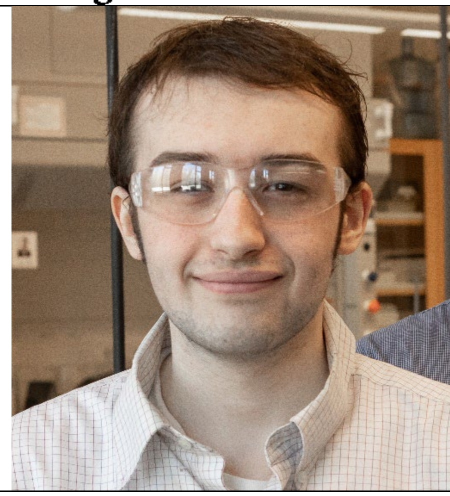
This separation would occur before the liquids are purified and would be done by size-exclusion chromatography. The urine would travel through a column containing porous beads, separating the molecules by size. The ammonium and nitric acid would then be combined to form ammonium nitrate, and this would be used to fertilize the vegetation on the International Space Station.

Publications: None yet.

1	Greg Landsman

Lorain County Community College

Nicholas W. Valescu



Sophomore, Computer Science
Advisor(s): Regan Silvestri

Title: Evaluation of Growing Rod Surgical Implants Used in the Treatment of Pediatric Scoliosis by Finite Element Analysis

Biography: My name is Nicholas Valescu. I am 20 years old and currently studying Computer Sciences. For the majority of my life, I've been fascinated by computers and software design and I'm hoping to pursue a career in the tech industry after I'm finished with this project. I'm happy to be onboard with this as it helps me branch out my skill set to other types of work. I am hoping to learn much more about STEM applications as well as the construction and examining of orthopedic devices.

Abstract: Scoliosis is a three-dimensional curvature of the spine. Curvatures of greater than 45 degrees are treated by surgeries that implant orthopedic hardware devices to correct the curvature and fuse the vertebrae. Early onset pediatric scoliosis however must be treated with implant devices that allow for continued growth of the patient through puberty. Various constructs of so called "dual growing rod" implants are used in surgeries to correct pediatric scoliosis, as the "growing rods" allow for extension of hardware and continued growth of the patient. Our work is toward evaluating new proposed design modifications for dual growing rod constructs used as orthopedic surgical implants to treat pediatric scoliosis; evaluation of proposed new constructs for growing rod implants is performed using finite element analysis computer modeling.

Abaqus/CAE finite element analysis software is being used to model the stresses and strains in dual growing rod constructs. As such, the failure load and displacement of a construct design can be accurately predicted, as well as areas of stress concentrated located. Therefore, computer modeling using the Abaqus software package can be used to test the new proposed design modification to dual growing rod constructs without the time consuming need to fabricate and evaluate the constructs via mechanical testing.

Publications: None yet.

5	Robert E. Latta

Education Scholars

University of Cincinnati

Morgan Boldt

Senior, Early Childhood Education
Advisor(s): Laura Dell

Weather throughout the Year

Biography: Morgan Boldt is currently a senior at the University of Cincinnati and graduating in Spring of 2023. She is majoring in Early Childhood Education with a minor in Psychology and a certificate in Digital Learning. While at the University of Cincinnati, Morgan has been involved in ROAR Tour Guide and is a Head Resident Advisor for a resident hall. Morgan has always had a passion for education and is very excited to being teaching. After graduation, Morgan is looking for a full-time teaching position.

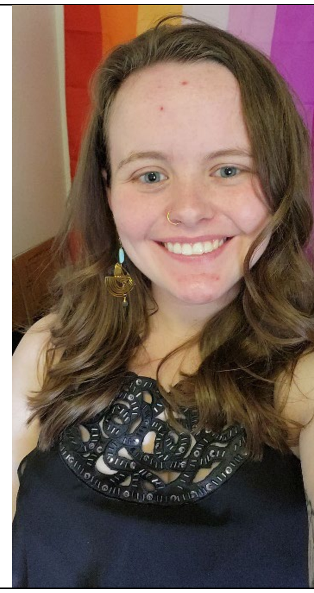
Abstract: In this lesson, the class will measure weather over the school year. The students will set up a small area outside where they can put their tools to collect data. The class will put a thermometer, barometer, hygrometer, anemometer, and a rain gauge in this area to collect the data. They will have a chance to create some of these tools in the classroom and have their own creations out there. We will have real tools out there to get a more accurate measurement. We will start off by explaining each of the tools that will be used and how to read the measurements. As a class, every day, we will take a walk to this area to collect the data. Each student will get a turn to read off the data and graph it on a big chart in the classroom. We will have two charts, one chart will be for that month, and the second one will collect the information for the whole school year. At the end of each month, we will take a moment to look at the data and have a discussion about anything they notice or patterns they see. This will occur every month until the end of the year. At the end of the year, they will look at all the data they have collected. This will conclude with another big discussion with the class about what we learned about weather.

Publications: None yet.

11	Shontel M. Brown

NORTHERN

Makenna R. Chappell



Junior, Engineering Education
Advisor(s): Dr. Todd France

Roof Structures: Avoiding Collapse

Biography: Makenna Chappell is currently a junior at Ohio Northern University, originally from St. Louis, Missouri, and is majoring in Engineering Education with a minor in Mathematics. Along with being a student, she is involved in the American Society for Engineering Education (ASEE), Society of Women Engineers, Theta Tau, and Teachers of Tomorrow. Outside of student organizations, she is a tour guide for the office of admissions and a specialized engineering tutor for the Writing Center on campus. She also serves as a Good News Bear and an Orientation Leader. Makenna started taking engineering and STEM courses in the sixth grade and took them all throughout middle and high school. The engineering teachers she had for those classes helped her find a passion for engineering, and she decided she wanted to help young students find that same passion as well— thus the decision to pursue a career in Engineering Education. Makenna believes that taking engineering and STEM classes should be available in all school levels because they provide hands-on learning experiences, teach valuable teamwork skills, and help develop creative thinking.

Abstract: Student groups will act as a roof design firm for buildings in northern Ohio. Their design firms need to design new roof systems maximizing peak load and minimizing the overall cost of materials. Many structures have been failing due to increased levels of snowfall, so their roofs will need to support the snow levels expected in their region. The team will design a prototype of a truss system out of the provided materials, and using a force gauge, test how many pounds of force (using a force gauge) the roof can take before collapsing. The teams will then perform a cost analysis of their truss system and retest to find the best combination of strength and cost for their roof.

The goal of this activity is to gain hands-n experience with the engineering design process through prototyping and redesign, as well as mathematics experience in working in scale and performing cost analysis. Students will come out of this activity with knowledge of structural engineering, strengths, trusses, communication and teamwork skills, and more confidence in mathematical modeling.

Publications: None yet.

5	Robert E. Latta

Abby Collins

Sophomore, Engineering Education
Advisor(s): Dr. Todd France

Engineering Exploration through Rover Tires

Biography: Abby Collins is a sophomore studying Engineering Education at Ohio Northern University. She is originally from Avon Lake, Ohio. Growing up, she always knew that she wanted to teach and had a deep love for learning. Eventually, in high school, she also found a love for engineering. She has always loved learning how things work and the hands-on aspect of learning. She especially loves seeing the creativity students bring into design problems. She has happily been able to combine these two interests in college. Through her major, she will be licensed to teach 7-12th grade Mathematics. However, her ultimate goal is to run a makerspace type innovation room in a school. When not in classes, you could find Abby helping design and build offroad vehicles for the ONU Baja team, volunteering for Habitat for Humanity, or reading.

Abstract: Through this activity, students will build small model rover bases with a DC motor. Using the Engineering Design Process, they will be able to test out the speeds of different designs for the wheels using various materials and sizes. These can be tested for speed on various Mars-like surfaces. This will be simulated with a sandy course, an inclined course, and with rocky terrain. This will encourage students to think like engineers to optimize their design to balance out drawbacks of different applications.

This project can bring up topics such as friction, surface area, size, mass, materials, research, and testing procedures as well as aligning with the SMD. This activity provides a real-world application as their process of modelling and testing is similar to the process engineers had to go through for the Curiosity rover's tires at NASA Glenn. Students can spend time researching beforehand. Students will also have to measure out quantities such as mass, circumference, time, and distance. Friction can also be discussed as they choose materials for their tires. Overall, this activity allows students to dive into a hands-on project, mirroring real engineers, to test and reiterate a rover tire design that they can justify.

Publications: None yet.

9	Marcy Kaptur

Jacob Cowan

Junior, Physics
Advisor(s): William Theisen

Two Versions of Gravity

Biography: My name is Jacob Cowan. I am a Senior Physics major at Ohio Northern University with a concentration in chemistry and a teaching license. I also play football at Ohio Northern. My ultimate goal is to graduate college and help pass down my knowledge to the next generation of America's finest. My Biggest Achievement is playing college football all four years of my college career and putting myself in a place to graduate college.

Abstract: Students will be split into two groups. One group will research Einstein’s version of gravity and one group will research Newton’s version of gravity. The research will take place for a whole 45 minute class period. The second day of class each group will argue why their group has the correct version of gravity. Teachers may need to have guided questions to encourage debate between the class. Students should find that in certain areas it may be better to use Einstein's version and in others it may be better to use Newton’s version.

Publications: None yet.

4	Jim Jordan

BALDWIN WALLACE UNIVERSITY

Mamdouh El-Mahdy

License + Master's, Early Childhood and Special Education
Advisor: Dr. Brandi Seither

Water Conservation

Biography: I am from Strongsville, Ohio. I graduated from Baldwin Wallace with a Bachelor's in Public Health, planning on heading to Medical School. However, after taking a gap year with City Year, a non-profit AmeriCorps program serving in under-resourced schools aiding students with their Math, ELA, and behavior, I decided to head for education. So I returned to Baldwin Wallace for my License and Master's in Early Childhood and Special Education. I love traveling and have studied abroad for an entire semester in Japan. I love languages and can get by in English, Arabic, French, Japanese (I learned it in Japan), and Spanish. My passion in education is broadening students' horizons by introducing them to various cultures and having them develop solutions to problems they may encounter.

Abstract: Students will first track their water usage over a week using a data collection sheet from NASA's educational resources. After collecting the data, the students will learn about water conservation, its importance and how to apply it in their lives. From there, they will predict how their tracking results would change if they used what they learned. Then they will re-track their water usage while including various water conservation skills they have learned in class. They will then analyze their results by comparing the before and after and determine whether their prediction came true. From there, the students may discuss how these small changes can make a difference and potentially advocate for further conservation efforts beyond their own lives to that of their community or beyond.

Students must learn the importance and applications of water conservation. Fortunately, my students and I live in Ohio, which does not have water shortage issues. However, places worldwide and even within the U.S. are undergoing severe droughts, amplified due to Climate Change. Even if we are not experiencing a water shortage, there is no guarantee that we will not experience one in the future with climate change. Fortunately, when residents see the importance of conserving water, they can limit the effects of droughts. For instance, Cape Town, South Africa was counting down to their last day of water, but when the residents cut back their water usage, they pushed back the date of no water until they eliminated it. Let's teach our students when it is avoidable rather than when it is a necessity.

Publications: None yet.

16	Anthony Gonzalez

Cora Gill

Secondary Education
Integrated Sciences: Chemistry
Advisor(s): Laura Dell, Aly Rauen

Creating an Ecosystem on a Different Planet
(Space Life Science)

Biography: My name is Cora Gill, I am a sophomore 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 he 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 based on the basic biological factors of life for a freshman biology class. I would begin with a lesson on the characteristics of life, teaching the students about the in-depth requirements for each characteristic. Then over the next two or three days, the students would work in groups of 3-4, to discuss the specific requirements for a full ecosystem in space. Each group would be assigned a planet other than Earth where they would have to design an ecosystem based on what is present on that planet (assume a flat surface for gaseous planets). The groups would have to use what is already at their disposal on their planet, and determine what they need to bring/create, or design. Students would then present their findings to the class in a formal presentation using diagrams, PowerPoint, physical models, or any other form of presentation.

I have always felt it was important to allow students to think outside the box, giving them the chance to think creatively about a problem. I have always felt that this is the best way to learn. Because of this, I made sure that my lesson plan allowed for this creativity of thought and discovery.

Publications: None yet.

9	Marcy Kaptur

Ethan Hatch

Junior, Comprehensive AYA Science Ed Major
Advisor: Dr. William Jones

Research in Space

Biography: Growing up in rural New Hampshire Ethan Hatch developed an early love and appreciation for nature. He was fascinated by the complexity and diversity of life and wanted to learn all about it. Both his parents loved the outdoors and would always take Ethan and his siblings on adventures through the woods. His curiosity could never be satisfied, he always wanted to learn more and more about the world around him. He decided that the perfect career and outlet for life was to become a high school science teacher. He loved school and so many teachers had a great influence on his life, Ethan thought it only natural to become an educator himself.

Abstract:
The education project “Research in Space” is a project based learning activity using the resources provided on NASA’s website. This project allows students the flexibility and scaffolding to explore the world of science using the tools provided by NASA, allowing their creative and scientific minds to explore the universe. During this project students will develop skills like critical thinking, problem solving, collaboration, ingenuity, and presentation skills.

The students will be grouped and prompted with the big-picture question “why do research in space?” from there students will be provided scaffolding to help answer this question. Some of the major scaffolding steps include: Why is space so special? What experiments have already been conducted in space? What future research will be conducted in space? How does research in space differ from research on earth? These leading questions will help guide student discovery, providing them the support and direction needed for them to be successful.

The students will then collect their findings in an appropriate presentable form of their own choosing and present the material to the class. This process will require students to take ownership of their learning and invest in lifelong skills.

Publications: None yet.

10	Michael R. Turner

WRIGHT STATE UNIVERSITY

Andrew Horton

Senior, Middle Childhood Education
Advisor(s): Dr. Brian Boyd

Gravity Impacts the Mass of Our Class

Biography: Andrew Horton is entering the last semester of his undergraduate degree at Wright State University in Middle Childhood Education with specializations in math and science. Andrew first became interested in teaching when he worked as a camp counselor in high school. While in high school, Andrew pursued and earned an associate degree in Liberal Arts from Sinclair Community College. After his time at Sinclair, Andrew continued to teach the youth as an assistant teacher for the YMCA, a head coach for Soccer Shots, and a tutor for the Down Syndrome Association of Central Ohio during his time at Wright State. Andrew is part of Sinclair's and Wright State's honors societies. After graduation, Andrew plans to teach math or science around the Dayton Area.

Abstract: This lesson involves the Next Generation Science Standards MS-PS2-4 Motion and Stability: Forces and Interactions passage, which focuses on students being able to construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. To start the lesson, students will be shown the *NASASTEM@Home:Rockets in Motion-Newton's Third Law* video and given the materials described in the video. Students will create their own rocket. Then, students will be placed into groups of 2 or 3 so that each group will be responsible for conducting research on a planet in our solar system. This research students conduct will include them finding the composition and gravitational pull of every planet. Each group will create a small poster describing the composition and gravitational pull of their assigned planet. Students will then explore the different gravitational pulls of different planets. Finally, students will use the data they have collected about how their weight changes on different planets to make conclusions about how the composition or mass of a planet impacts the weight they have on those different planets.

Publications: None yet.

10	Michael R. Turner

The University of Akron

Kate Must

Senior, Middle Level Education Math and Science
with Intervention Specialist
Advisor(s): Gary Holiday

The Movement of Earth

Biography: My name is Katelyn Must and I am currently twenty-one years old and living in Akron, Ohio. I am in my final year of college majoring in Middle Level Math and Science with Intervention Specialist. I am planning to student teach this upcoming fall and graduate this December. My passion for Math and Science led me in my decision to major in education so I can teach these very important subjects to our future generations. Along with going to school, I have two jobs working as both an Akron Public School Literacy tutor and at Young Chefs Academy which is a cooking school in Strongsville, Ohio. I hope to be able to inspire the children of our society to achieve anything they want to in their lives, including going into Math and Science related work!

Abstract: The lesson I created is titled, *The Movement of* Earth. This lesson is specific for fifth grade students. This lesson allows students to be able to explain Earth's rotation, revolution, or orbit, read and comprehend a text about Earth's orbit and represent rotation and revolution using an active activity. First, students will be introduced to Earth's rotation and revolution with a quick video. After the video, students with be able to get out of their seats and represent rotation and revolution while spinning. Students will then be asked to read a quick reading and write their own summary based off of the information they were provided. Overall, the combination of interactive activities, reading, watching videos, and collaborating with peers will be able to give students a clear understanding of how the planet we live on revolves and rotates.

The Movement of Earth Lesson Plan

Publications: None yet.

7	Max Miller

The University of Akron

Matthew Ripple

Senior, AYA Integrated Science Education
Advisor: Dr. Nidaa Makki

The Human Impact on Global Climate

Biography: Matthew Ripple is a senior at The University of Akron studying AYA integrated science education. Matthew discovered his passion for teaching while tutoring for the College of Engineering at UA. Matthew enjoys any opportunity to advance student learning such as his field placement, substitute teaching in Akron Public Schools, and tutoring for the department of physics at UA. Matthew also volunteers at The Vincent House, an after school program for elementary school students in Akron Public Schools. He is also involved with Citizens Akron Church, and is the president of the student organization Village. After graduation Matthew hopes to teach science in a city school.

Abstract: Over time, data trends have shown that human actions have a large, and often negative, impact on Earth's climate. It is extremely important to teach students about this impact so they can make informed decisions in their everyday lives. This lesson is meant to give students an opportunity to learn about the impact of human actions on climate change. The lesson focuses on the effect of greenhouse gasses in Earth's atmosphere on global temperature. Students engage in the scientific practices of using models, planning and carrying out investigations, analyzing and interpreting data, and constructing explanations to learn more about the phenomenon of global warming.

Throughout this lesson, students are challenged to apply data gathered through scientific practices to construct explanations regarding the impact of human actions on global climate trends. There are three main ways the students gather evidence to support their claim. First, the class completes an experiment measuring air temperature in an erlenmeyer flask containing air with and without carbon dioxide when both are exposed to light from a lamp. Students then explore the mechanism behind the difference in temperature change using online simulations developed by PhET Colorado. Students also use the simulations to observe how greenhouse gasses can increase temperature on a global scale. Students also use the Greenhouse Gas simulation to learn about the impact of decreasing arctic sea ice on global temperature. After students use the experiment and models to learn about the mechanisms of global warming, they use data from the NASA Vital Signs website to construct explanations for current global temperature increases. They also use this information to further discuss the push by global leaders to decrease greenhouse gas emissions. Overall, this lesson helps students learn how to use evidence from scientific investigations and real world data to evaluate claims and understand the impact of human actions on the global climate.

Publications: None yet.

16	Anthony Gonzalez

Chaz Stump

Senior, Special Education
Advisor(s): Dr. Stephen Kroeger

Levels of Engagement, Prediction, and Discussion for Students with Disabilities When Given a Lesson on Deep Space

Biography: Chaz Stump is currently a Senior at the University of Cincinnati where he studies Special Education. After graduation, he hopes to pursue a master's degree related to the field of Education Policy or teacher students with mild to moderate disabilities in a high school setting. Chaz is involved in a variety of extracurricular activities and organizations: UC Dance Marathon where he recently finished his term as President, Undergraduate Student Government where he currently serves as a Senator At-Large and works as a Direct Service Provider at IMPACT Innovation, a program for adults with autism on campus Chaz is excited to share his findings on working with 5th graders on Deep Space because he believes that all students from various backgrounds have the capability to maximize their potential and understanding. Chaz is passionate about ensuring representation for students with disabilities in academia and is thankful for the Ohio Space Grant Consitorium for this opportunity.

Abstract: This lesson was designed in alignment with the Ohio Standards for 5th grade science, using the materials provided by NASA related to deep space. At the beginning of the lesson, background knowledge will be activated by asking students to write on a post-it note what they already know about space and then to make a prediction about what they think deep space is. I will then play a video NASA created about deep space. After this, students will get into groups and select one of the five hazards NASA outlines for them to research further. They have the video that corresponds to each hazard in which they are to watch and select a media to make a presentation on. This can be a PowerPoint, trifold board, or another media of choice. They are to discuss what hazard they selected, how it affects astronauts on an individual level, how it affects the entire team of astronauts, and their overall opinion of the hazard. After each presentation, students will ask each group questions about their presentations to engage in discussion. Students will compare and contrast their predictions from the post-it note and then complete an exit slip at the end to track data on what they learned from the lesson.

There is a set of planned supports in place for students to ensure that the lesson is accessible for each student in the class. The contingency plan is designed to provide examples and clarity for students on what is being asked of them, such as providing examples of what opinion they could put in their presentation. In addition, I as the role of the teacher will have a presentation prepared to model for the students so they knowledge about what to do.

Publications: None yet.

10	Michael R. Turner

Anna zurBurg

Junior, Integrated Mathematics Education
Advisor(s):

Bottle Rockets and Trajectory

Biography: Anya zurBurg is a Junior undergraduate student enrolled in Cedarville University's BA program in Integrated Mathematics Education. She has been working as a tutor in seventh grade Pre-Algebra for the past semester and will continue thing next semester. The year before she was employed by one of the professors on campus as a grader for Calculus 1 and 2. She is currently the Junior representative for an organization called MuKappa for international, missionary kids, and third culture kids on campus. In her free time, Anya enjoys playing intermural soccer, intermural volleyball, and rock climbing at the school gym. After graduating, Anya plans to work overseas in an international school or boarding school of some sorts.

Abstract: This lesson would be directed at older middle school students or high school students. For this lesson, I would like to introduce the idea of calculating the trajectory of bottle rockets. It could be modified to fit a Geometry class or a Precalculus/ Trigonometry class. We would start off by learning the mathematics behind the calculations used for these predictions. Once the students have a grasp on the mathematical part, we would then go through some examples of projectiles and see how accurately we can predict their path. Then, we would have one day where we go out and, having already made our predictions, we would shoot the bottle rockets and see how closely our predictions come to the measurements we make.

Publications: None yet.

10	Michael R. Turner