

Spring 2021 Recognition of Graduates

April 21, 2021



Pictured are the Propulsion Research Center students, staff, and faculty. This mosaic picture will remind us in the future that we are all “sheltering in place” this semester because of the COVID-19 epidemic. Our traditional picture of everyone gathered outside the JRC in new PRC shirts is not possible this semester. This year we assembled online to celebrate our students achieving three PhDs, seven master’s degrees, and seven bachelor’s degrees supported by research at the UAH Propulsion Research Center. We also recognize some other significant contributors.

New graduates, as you continue your studies or enter the new (online) workforce, take pride in all the people who have made UAH and the PRC an outstanding place for you to build relationships, gain an exceptional education, and participate in cutting-edge research projects.

Now with COVID-19 isolating us for a season we need to be intentional and to find new ways to “*Keep our relationships more important than tasks or problems.*” We wish all the graduates a successful and enjoyable future. Call on us in the future. We look forward to hearing from you.

Dr. Robert A. Frederick, Jr.
PRC Director
Professor of Mechanical and Aerospace Engineering
From Home, April 21, 2021



Spring 2021

PRC Graduate Recognition Program

Welcome

Dr. Robert Frederick, PRC Director

Recognition of Graduates

Ph.D. Students

Master's Students

Undergraduate Students

Virtual Reception

Introduction of Special Friends and Family Members





2021 PRC Graduate Recognition

Recognition of Doctoral Graduates

 <p>Dr. Joseph Robert Kennedy Buckley La Crosse, WI</p>	<p>Joseph Robert Kennedy “Joe” Buckley is receiving a Doctor of Philosophy degree in Mechanical Engineering. Joe completed his dissertation on “<i>Network Based Pressure Drop Modeling of Heterogeneous Porous Hybrid Rocket Motor Grains</i>”, with his advisor Dr. George Nelson. He explained, “I modeled the pressure drop of gas in a porous hybrid rocket fuel grain as a resistance network. Resistance components were determined from x-ray computed tomography (XCT) of grain specimens.” Joseph added, “I contacted Dr. Frederick after I graduated from Purdue. We work hard, we have fun, and we care about each other.” Dr. Frederick said, “We are so pleased that Joe joined our team at UAH. He was instrumental in establishing new x-ray capabilities in our energetics laboratory and being a regular featured singer at our off-site events!” Dr. Nelson says, “Joe is a diligent student and researcher, and he has a good eye for detail. He has made valuable contributions to setting up X-ray imaging capabilities here on campus and related analysis tools. He has also supported experiments that we’ve run at DOE National Labs on several occasions. It has been a pleasure to guide him as he has built his knowledge in diverse areas, ranging from network analysis of porous microstructures to not ordering salmon at a Denny’s.” Joe plans to work in the aerospace industry in applied propulsion research.</p>
 <p>Dr. Joseph Indeck St. Louis, MO</p>	<p>Dr. Joseph Indeck is receiving a Doctor of Philosophy degree in Mechanical Engineering. Joseph completed his dissertation on “<i>The Effect of Microstructural Defect Evolution during Elastic Fatigue Loading on Subsequent Mechanical Properties</i>” with his advisor Dr. Kavan Hazeli. Dr. Hazeli said that, “It is so true that the first Ph.D. student of early-career faculty has a pivotal role in their success. Joe, indeed, has played a vital contribution in establishing my research lab, performing high-quality research and passing lessons learned to incoming students. Joe is a dream candidate for any employer. He is talented, polite, organized, dedicated, and focused on his pursuits. I wish him an outstanding career and a very happy life.” Joseph plans to continue his research career after graduation.</p>
 <p>Dr. Althea Wilson</p>	<p>Advisor: Dr. Shotorban Dissertation Topic: ‘<i>Computational Modeling of Dusty Plasmas.</i>’</p>

Recognition of Master's Degree Graduates

 <p>Prathmesh Anantwar Pune, India</p>	<p>Prathmesh Anantwar is receiving a Master of Science degree in Mechanical Engineering. Prathmesh completed his thesis on <i>“Quantification of the Relationship Between Topology and Microstructure and Their combined Influence on the Quasi-static and Dynamic Behavior of GRCop-84 Lattice Structures”</i> with his advisor Dr. Kavan Hazeli. Prathmesh said, “I am grateful to my advisor Dr. Kavan Hazeli. As an undergraduate student, he kindled the flame of curiosity within me that led me to pursue my master's degree. Through the years, he taught me the value of excellence and quality in research. Dr. Hazeli said, “Prathmesh set an exemplary model of transition from an undergraduate student to a reliable and strong experimentalist. He has been a key member of our lab. His journey in turning to a high quality researcher with remarkable personality has become one of my favorite stories for enthusiasts undergrad. I wish him best of luck in all of his future endeavors.” Prathmesh plans to pursue a career in the engineering industry specializing in materials and manufacturing.</p>
 <p>William Hankins Lexington, AL</p>	<p>William Hankins is receiving a Master of Science degree in Aerospace Engineering. He completed his thesis titled, <i>“Assessment of Performance Parameter Uncertainty of a Solid Fuel Ramjet”</i> with Dr. Robert Frederick as his academic advisor. William said, “My work has focused on the modeling and performance analysis of several systems including a nitrous oxide hybrid motor, warm gas generator, and solid fuel ramjet. I started working with the PRC in 2019 while in the rocket design senior design project with Dr. Lineberry.” When reflecting on his time with the PRC William said, “I am grateful for the phenomenal support I have received while working at the PRC. Dr. Frederick has been an outstanding advisor helping me work through numerous drafts of my thesis at all times and hours of the day. Dr. Lineberry and the PRC test staff have also been invaluable for their assistance and insight throughout my various projects.” Dr. Frederick said, “Will is an outstanding engineer who has demonstrated his skills in developing aerospace simulation programs and supporting hands-on experimental research in our laboratories. Will is a great team player, and I predict will be a very valuable contributor for his future employers.” William plans to pursue a position in modeling and simulation related to propulsion.</p>



Margarita Hockensmith
Lexington, KY

Margarita “Maggie” Hockensmith is receiving a Masters of Science degree in Aerospace Systems Engineering. She pursued the non-thesis option while working full-time for Dynamic Concepts, Inc. Her degree focused mainly on propulsion, as she took Rocket Propulsion I, Rocket Propulsion II, Adv Solid Rocket Propulsion, and Airbreathing Propulsion. She also took Hypersonic Flow and Elements of Spacecraft Design, which she enjoyed as well. She completed her Undergraduate Honors Capstone Thesis *“Cold-Side Heat Transfer Characteristics of a Double Wall Plate with a Louver Slot and Impingement Jet Array Cooling”* with her advisors **Dr. Ligrani** (Undergraduate Research) and **Dr. Cassibry** (JUMP). Maggie stated, “From November of 2019 to April of 2020, I conducted research within the double wall cooling facility.” She explained, “My initial involvement with the PRC began when I signed up for the Rocket Design section of Senior Design, where we finished third overall in the 2020 Student Launch Initiative.” “I really appreciate the family-type atmosphere that the PRC provided to me during both my undergraduate and graduate careers, and am extremely grateful for the relationships I’ve developed along the way.” **Maggie said, “I plan to continue full-time after graduation, hopefully helping NASA with the Space Launch System.”**



Erik Korzon

Erik Korzon is completing a Master’s degree in Aerospace Systems Engineering. During that time he has also worked at Blue Origin. His degree has focused on fluids and advanced propulsion. He’s currently taking CFD II, intro to electric prop, and intro to nuclear prop. **Dr. Frederick** said, “Erik is a hard worker and reliable performer who supported our research programs while he was an undergraduate at UAH. “ We are pleased to recognize his achievement of a Master’s degree and his continued interest in propulsion.



Ward Manneschmidt
Knoxville, TN

Ward Manneschmidt is receiving his Master of Science degree in Mechanical Engineering, including completion of an M.S. Thesis, entitled, "*Investigations of Dusting Hole Film Cooling on a Transonic Turbine Blade Tip with a Squealer and Different Tip Gaps.*" This project is very complex and involves advanced transient surface heat transfer measurements within a transonic flow environment. The results are especially unique and important because new information is provided on surface heat transfer characteristics from blade tip dusting film cooling holes. Associated data and discussions will soon be submitted for archival journal publication. Ward was also involved in another research effort involving flow control within a supersonic inlet. That project also produced many excellent outcomes, all of which were attributable to Ward's outstanding actions and accomplishments. According to **Dr. Phillip Ligrani**, "we are very fortunate to work someone as capable and knowledgeable as Ward. His knowledge and expertise in engineering, measurement technologies, data acquisition systems, software codes, and software development are all important assets which propel related project activities and outcomes. In addition, Ward's research efforts and activities are consistently outstanding, with complete and meticulous attention to every experimental and analysis detail." **Ward is planning to continue graduate studies at the University of Alabama in Huntsville in pursuit of a Ph.D. degree.**



Evan Unruh
Eagle Creek, OR

Evan Unruh is receiving a Master of Science degree in Mechanical Engineering. He completed his thesis titled "*Development and Testing of a Rotating Detonation Rocket Engine with a Racetrack Combustor and Shear-Coaxial Injectors*" with his **advisors Dr. Frederick, Dr. Xu, and Dr. Lineberry**. Evan stated, he "built and tested an RDRE to compare detonation wave behaviors between propane and methane." He got involved with the PRC when taking the Senior Design class with Dr. Lineberry. According to Evan, he appreciated "too many people to list succinctly. I value the opportunity to learn from the wide variety of talents and perspectives that everyone has, and appreciate that everyone was so willing to spend the time to teach me." Dr. Xu says "Evan was instrumental in the successful test of the UAH RDE. He personally designed, machined, and built the engine. I am very grateful for Evan and all that he has done at the PRC." Dr. Frederick said, "Evan pulled off an impossible job by design, building, and testing a new RDE in the middle of a pandemic. He is a phenomenal machinist, engineer, and project manager. He also graded a lot of papers for me in propulsion with the same attention to detail, which I appreciate greatly!" **Evan has started a position at Aerojet Rocketdyne.**



**The Viall Family from
Left to Right: Wesley,
Strider, Mary Kate.**

Madison, Alabama

Wesley Viall is completing a Master's Degree in Aerospace Systems Engineering. During that time, he completed an extensive project on determining the thrust uncertainties in ramjet engine testing. **Dr. Frederick** said, "Wesley's work provided valuable insights into making more accurate measurements at our test facilities applying analytical and Monte Carlo methods to assess how measurement uncertainties can affect experiment results. Wesley is a hard-working, reliable, and very talented engineer that knows how to apply his academic skills to solve important, practical problems." Wesley extends his gratitude to all the MAE faculty and staff saying, "While we may all be sick of hearing about Covid-19; I would like to sincerely thank all of the faculty and staff for their joint handling of the transition to online education during the global pandemic. My MSASE degree, with the exception of January-March 2020 in Dr. Hollingsworth's Heat Transfer class has been entirely done online. Typically an all online degree may foster discredit in the eyes of some. However, I do not believe my educational experience has suffered at all. For that, I am thankful. I am excited to continue my studies in the PhD program." **Wesley plans to continue with a PhD program at UAH while continuing to work for the government.**

Recognition of Bachelor's Degree Graduates



Melissa Costa
Decatur, AL

Melissa Costa is receiving a Bachelor of Science degree in Aerospace Engineering with the support of her mentors **Dr. Lineberry** and **Dr. Frederick**. Melissa said, "While at the PRC, I aided in hot-fire tests of various solid and liquid rocket engines and I also had the chance to study fuel injector flows through 3D printed parts while cold-flow testing at the Spray Facility. I have had the opportunity to help with many projects while at the PRC like 3D printed fuel injector flow characterization, solid hybrid rocket motor testing, and the test cell PLC electrical upgrade. I have learned so much through hands-on work doing light machining and small electrical repair jobs. Dr. Xu and the MATRIX program introduced me to Dr. Lineberry and I started volunteering on a part-time basis at the PRC in the Spray Facility. Eventually, I was offered a position and started helping with many more in-depth projects. I would like to thank Dr. Lineberry and Tony Hall for being so patient and always willing to teach me. I am grateful to Dr. Frederick and Amit Patel for pushing me out of my comfort zone and helping me gain confidence in my own abilities. Thank you to everyone at the PRC for all the great experiences and memories!" Dr. Frederick said, "Melissa acquired great practical skills in our research laboratories and provided important research support to assist us in completing our research projects. She is a great engineering designer and works very well in the laboratory." **Melissa plans on pursuing a position that will help her further refine the skills she has gained at the PRC.**

	<p>Matthew Cox is receiving a Bachelor of Science degree in Aerospace Engineering. Matthew has assisted with the operation of the transonic/supersonic wind tunnel during his time at the PRC. Matthew explained, "I became involved with the PRC after applying for a UGRA position with Dr. Ligrani. I am grateful for the opportunity to work with Dr. Ligrani as well as Hallie Collopy, Chandler Larson, and Ward Manneschmidt.</p> <p>Matthew Cox is receiving his Bachelor of Science degree in Aerospace Engineering, including completion of an Honors Capstone Thesis, entitled, "Investigation of Dusting Hole Film Cooling on a Transonic Turbine Blade Tip with a Squealer." This project is very complex and involves advanced transient surface heat transfer measurements on turbine blade tips with squealers and film cooling, operating at transonic conditions. The results of Matthew's exemplary research work are especially important as they provide new insight into the physical effects related surface heat transfer characteristics from blade tip dusting film cooling holes. Associated data and discussions will soon be submitted for archival journal publication. Matthew was also involved in other efforts, including the project involving flow control within a supersonic inlet, and another project involving analysis of the unsteady flow characteristics of normal shock waves. This latter effort led to co-authorship on the paper "Spatial Coherence of Low-Frequency Unsteadiness Associated With a Normal Shock Wave," which is soon to be published in the archival journal <i>Aerospace Science and Technology</i>. According to Dr. Phillip Ligrani, "everything that Matthew touches 'turns to gold'. His research efforts and activities are consistently outstanding, with complete and meticulous attention to every experimental and analysis detail. In addition, it has always been a pleasure to work with someone with such an excellent work-ethic, who is also soft-spoken and modest as he undertakes different research tasks."</p>
<p>Matthew Cox Tullahoma, TN</p>	
	<p>Kyle Goethals is receiving a Bachelor of Science degree in Aerospace Engineering with the support of Dr. Phillip Ligrani. Kyle said, "since I have been at the PRC, I have assisted with: instrument calibration and set up, data analysis involving a normal shock wave, and test operations in the transonic/supersonic wind tunnels. I got involved with the PRC after Dr. Phillip Ligrani mentioned he was looking for undergraduate research assistants in his thermodynamics I class. I am very appreciative of Dr. Phillip Ligrani, Dr. David Lineberry, Hallie Collopy, Chandler Larson, and Ward Manneschmidt in helping me become a better engineer throughout my time at the PRC."</p> <p>Kyle Goethals is receiving his Bachelor of Science degree in Aerospace Engineering. Recent research efforts have been directed to investigations of surface heat transfer characteristics along a transonic turbine blade tip with dusting film cooling hole arrangements, a squealer rim, and a squealer recess. This project is especially challenging because it involves advanced transient surface heat transfer measurements in a transonic flow environment. The results of Kyle's exemplary research work are especially important as they provide new insight into the physical effects related to surface heat transfer characteristics from blade tip dusting film cooling holes. Associated data and discussions will soon be submitted for archival</p>
<p>Kyle Goethals Tullahoma, TN</p>	

	<p>journal publication. Kyle was also involved in other efforts, including the project involving flow control within a supersonic inlet, and another project involving analysis of the unsteady flow characteristics of normal shock waves. This latter effort led to co-authorship on the paper "Spatial Coherence of Low-Frequency Unsteadiness Associated With a Normal Shock Wave," which is soon to be published in the archival journal <i>Aerospace Science and Technology</i>. According to Dr. Phillip Ligrani, "Kyle's research activities, efforts, and outcomes are consistently excellent. No matter what the task, Kyle attends to every detail and every aspect of the research in an exemplary manner. It has also always been a pleasure to work with someone who is determinedly successful, but also consistently polite, and supportive of the activities of the research team." Kyle is planning to continue graduate studies at the University of Alabama in Huntsville in pursuit of a Master of Science degree.</p>
 <p>Benjamin Knox Trussville, AL</p>	<p>Benjamin Knox is receiving his Bachelor of Science degree in Mechanical Engineering. Benji supported efforts on a project related to impingement and effusion cooling, as employed within a double wall cooling arrangement. The results of this research effort are applicable to combustor liners of gas turbine engines, which are utilized both for aero-propulsion and for utility power generation. According to Dr. Phillip Ligrani, "Benji did a great job in setting up the measurement devices and apparatus for the experimental facility, including flow qualification and heat transfer measurement checks and verifications."</p>
 <p>John McDonough Tuscaloosa, AL</p>	<p>John McDonough is receiving his Bachelor of Science degree in Aerospace Engineering. John supported efforts on a project related to impingement and effusion cooling, as employed within a double wall cooling arrangement. The results of this research effort are applicable to combustor liners of gas turbine engines, which are utilized both for aero-propulsion and for utility power generation. According to Dr. Phillip Ligrani, "John's excellent laboratory work led to important new experimental data for combustor liner configurations and conditions which were not previously investigated."</p>
 <p>Christopher Smith Charlotte, NC</p>	<p>Chris Smith is receiving his Bachelor of Science degree in Aerospace Engineering. Chris supported efforts on a project involving flow control within a supersonic inlet, a research effort which is focused on intake systems of aero-propulsion engines within high performance aircraft. According to Dr. Phillip Ligrani, "Chris was involved in development and installation of measurement apparatus for the project, including a variety of pressure transducers and data acquisition system components. His laboratory efforts helped support the acquisition of successful experimental measurements for several flow control configurations."</p>



Nathan Ulmer

Nathan Ulmer is receiving his Bachelor of Science degree in Aerospace Engineering. Nathan joined the adaptive structure laboratory as an undergraduate research assistant in 2019. He conducted design and test of piezoelectric energy harvester prototypes by exploiting flow-induced vibration in a SBIR phase I effort. **Dr. Gang Wang** said, "I am glad to have Nathan in my research group. He is a motivated, hard-working student with considerable talent. He made a great contribution to this SBIR phase I effort, which leads to the phase II award."

A few of our values:

- **Opportunity:** "I have an opportunity for you."
- **Courage:** "Aerospace is not for the faint of heart."
- **Relationships:** "Keep your relationships more important than tasks or problems."



Michaela Hemming has her choice of three national graduate engineering scholarships

Excerpts from an article by Jim Steele (full article by J. Steele at <https://www.uah.edu/prc>)



Michaela Hemming
UAH Graduate Student

"Michaela Hemming has qualified for the U.S. Department of Defense (DoD) National Defense Science and Engineering Graduate (NDSEG) fellowship and DoD's Science, Mathematics and Research for Transformation (SMART) scholarship, as well as the NASA Space Technology Graduate Research Opportunities (NSTGRO). Each begins in the fall semester.

"I heard from NDSEG and immediately felt a sense of relief knowing that my graduate research is funded. Then on the same day within the same hour, I heard from SMART and NSTGRO," Hemming says.

"From Fort Dodge, Iowa, Hemming is in her second year pursuing a master's degree in aerospace systems engineering (MSASE) at UAH, a part of the University of Alabama System. En route to a doctorate, she's a graduate research assistant in UAH's Propulsion Research Center (PRC) and is advised by Dr. Gabe Xu, an associate professor of mechanical and aerospace engineering."

"Michaela is currently working on her MSASE degree studying the effect of plasma discharges on detonation waves using a linear detonation tube experiment," Dr. Xu says. "She should be done this summer and will progress to her PhD project in rotating detonation engines. For her PhD, she will be studying the effect of injector designs on propellant mixing, atomization, detonation wave propagation and engine performance."

Thoughts for the Future

The UAH PRC stands poised to build upon a rich legacy of research advances in propulsion. One of our original strategies was to pursue funding support for projects that would support students. The faculty associated with the PRC have followed that vision and we are on the verge of assisting 300 graduates with advanced degrees on propulsion topics and total expenditures at \$60 million in our first 30 years. That averages to about \$200,000 of external investment per degree. Our strategy forward will focus on continuing a legacy of excellence in student education in the propulsion arena, equipping the future workforce for success in their careers. - *Dr. Robert Frederick*, Director, UAH Propulsion Research Center