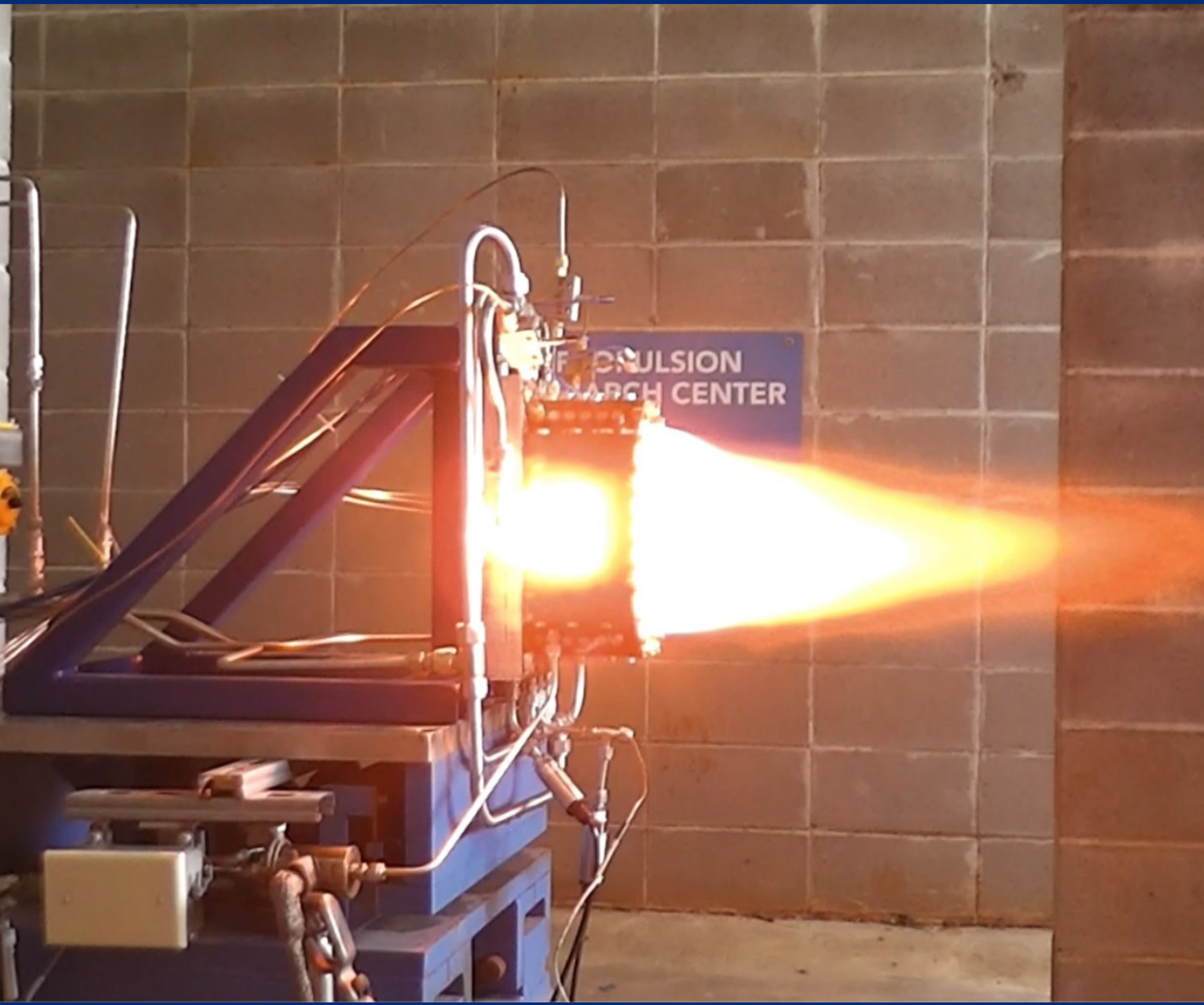
launch

January 2022

INNOVATION • INSPIRATION • INTEGRITY



THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

COLLEGE OF ENGINEERING

PART OF THE University of Alabama System

L A U N C H

Engineering at UAH | Review

EDITOR:
Jennifer English

PHOTOGRAPHER:
Michael Mercier

ARTICLE CONTRIBUTORS:
Russ Nelson
Jim Steele

•••

DEAN OF ENGINEERING
Shankar Mahalingam

ASSOCIATE DEAN
GRADUATE EDUCATION & RESEARCH
Michael Anderson

ASSOCIATE DEAN
UNDERGRADUATE EDUCATION
Jennifer English

•••

ENGINEERING DEPARTMENT CHAIRS
CHEMICAL & MATERIALS (CME)
Anu Subramanian

CIVIL & ENVIRONMENTAL (CEE)
Michael Anderson

ELECTRICAL & COMPUTER (ECE)
Tommy Morris

INDUSTRIAL & SYSTEMS (ISEEM)
Sampson Gholston

MECHANICAL & AEROSPACE (MAE)
D. Keith Hollingsworth

•••

Birgit A. Gatlin, Administrative Assistant to the Dean

UAH College of Engineering

301 Sparkman Drive, EB 102

Huntsville, Alabama 35899

Telephone: (256) 824.6474 Email: birgit.gatlin@uah.edu

Cover Art (see story on pages 18-19)

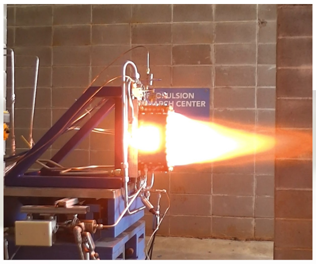


TABLE of CONTENTS

CHARGER GIVING

Friends and alumni can assist our mission by providing financial support and resources that will contribute to the College's strategic research and educational goals. Consider giving to support both undergraduate and graduate student scholarships, to fund faculty endowments, and to enhance research and educational facilities and programs.

To learn more about giving options, please contact the Dean of Engineering, Prof. Shankar Mahalingam at shankar.mahalingam@uah.edu or 256.824.6474, or the Vice-President for Advancement, Ms. Mallie Hale at mallie.hale@uah.edu or 256.824.6501.

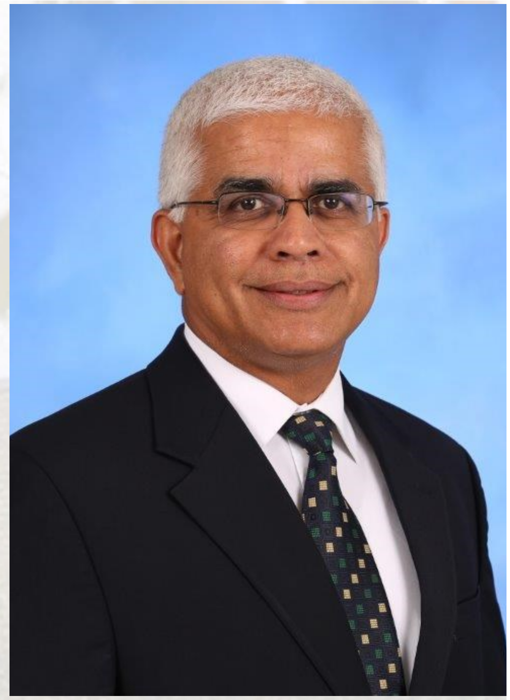
BECOME A CHARGER

Faculty: The College of Engineering (COE) has several open faculty positions. For more information, go to www.uah.edu/hr/careers/faculty-careers and select College of Engineering. UAH is an affirmative action, equal opportunity institution.

Graduate Students: The COE offers MSE and PhD degrees in a broad range of engineering disciplines. College faculty lead strong research programs to support student research projects. For more information on graduate programs, go to www.uah.edu/eng.

Undergraduate Students: The COE offers the BS degree in 8 (7 ABET-accredited) programs: Aerospace, Chemical, Civil, Computer, Cybersecurity, Electrical, Industrial & Systems, and Mechanical Engineering. Undergraduate students have numerous hands-on opportunities including nationally recognized engineering teams, undergraduate research, and cooperative education and internship programs. For more information go to www.uah.edu/eng/departments/undergraduate-engineering.

It is my honor to once again share some of the highlights achieved by the College of Engineering faculty and students over the past year.



The 2021 year was filled with personal and professional challenges as the COVID-19 pandemic seemingly faded, transformed, and reappeared. Unfazed by the pandemic, our faculty, staff, and students began the 2021-2022 academic year, back in the classroom and laboratories on campus.

Our collective efforts led to the award of 499 BS, 102 MSE/MS, and 25 PhD degrees in engineering over the course of the most recent year. In the fall of 2021, our undergraduate enrollment dropped by nearly 4% for the first time, while our graduate enrollment soared by 23%! Our research expenditures continued to climb to a record $13 million, and the overall value of all current contracts and grants with College of Engineering faculty as PI's or COI's also reached a record figure of approximately $41 million. Our faculty authored 157 refereed journal articles, 58 proceedings, 14 book chapters, and 92 conference papers.

Dr. Salman and his graduate students are collaborating with NASA MSFC to test and evaluate potential lunar concrete that can be manufactured using in-situ lunar materials. Dr. Thomas and his students are dedicated to discovering essential mathematical and empirical principles that will form the underpinnings of systems engineering, while exploring new technologies for space missions. With funding from NSF, Dr. Kanistras is utilizing phase-locked volumetric particle image velocimetry to study active flow control systems for aircrafts. With funding through an NSF CAREER grant, Dr. Liu is discovering novel energy-efficient, compact, and secure methods in wireless communication systems that will revolutionize IoT devices. With funding from DoD, Dr. Xu and his collaborators are developing rotating detonation engine concepts for application in hypersonics. Alumna Dr. Kimberly Robinson was appointed CEO of the US Space and Rocket Center, and alumnus Taylor Reed recently launched a new non-profit organization that provides mobile showers, and personal care to the homeless. We are proud to acknowledge AE student Declan Brick for winning the coveted Goldwater Scholar award. Alencia Hall (AE), Michaela Dent (CBSY), and Savannah Baron (ME) were named recipients of the prestigious DoD SMART scholarship award. These are just some of the amazing accomplishments that you will read in this edition of the *launch*.

I want to thank the many units on the UAH campus that support our educational and research endeavors in so many ways. In closing, and on behalf of the College of Engineering faculty, staff, and students, I want to express my appreciation to our alumni, corporate sponsors, and many other external stakeholders for their continued support.

With appreciation, Go Chargers!

Shankar Mahalingam
Dean
January 9, 2021

RESEARCH FOCUS

Extra Terrestrial Infrastructure: *Building on the Moon*

Despite the intensifying interest in moon exploration and settlement, the high cost of developing support structures for a long-term presence on the Moon continues to threaten the realization of such an idea. This is due, primarily, to the lack of economical and sustainable methods of transporting the necessary materials from Earth as well as an effective construction method. To overcome these challenges, extra-terrestrial structures need to be designed for, and built with two prime considerations: in-situ resource utilization (ISRU) and the use of autonomous or remote construction methods (Additive Manufacturing/Additive Construction (AM/AC)). The capability to autonomously or remotely construct infrastructure elements to protect astronauts from radiation, micrometeorites, dust, and the lunar environment does not currently exist. With NASA's plan to send a crewed mission to the Moon by 2024 with a sustained presence by 2028, the need to develop the materials and manufacturing processes to enable this presence has never been more critical.

Creating a supply chain from Earth to the moon is neither practical nor cost-effective. Thus, ISRU aims to utilize readily available extra-terrestrial natural resources to support a sustained lunar presence as well as deep space exploration. One of the objectives of ISRU is to extract binders from regolith for extra-terrestrial cementitious applications, as opposed to bringing them from Earth. Processed materials such as pulled molten regolith glass fiber can also be used as reinforcement for concrete structures on the Moon.

Ease of construction of extra-terrestrial structures hinges on autonomous or remote construction capabilities. The use of AM/AC as an alternative to conventional manufacturing processes has many advantages in terms of automation, flexibility, and optimization potentials and has shown great promise in construction. In the effort to explore the Moon, AM/AC has been strongly recommended as a cost-effective alternative for building permanent structures compared to the conventional method of construction. Other advantages offered by AM/AC in space exploration include absence or drastic reduction in human labor and a significant reduction in energy and material waste.

To support the development of AM/AC techniques for lunar surface structures utilizing planetary materials, UAH and NASA–MSFC are involved in collaborative efforts for the design and fabrication of a subscale landing pad. These efforts will support activities to realize AC on the Moon using ISRU-based cementitious materials. These prospects are exciting, but much research regarding the mechanical properties of the in-situ materials, AM/AC as an emerging technology, and the impacts of AM/AC applications in the sourcing and utilization of these materials for extra-terrestrial construction is needed.

To support NASA's ongoing effort, Civil Engineering Assistant Professor, **Dr. Abdullahi Salman,** will develop methods to evaluate structures made from in-situ resources and research the effect of manufacturing variables on the resulting properties. Critical to the success of this proposed effort will be verifying the structural integrity of printed structures using a variety of regolith simulants. This research also lays the groundwork for further development of these technologies for remote terrestrial military applications in addition to remote space applications. The project has three objectives: (i) investigate the mechanical properties of potential lunar concrete materials that can be manufactured using in-situ materials and reinforced with pulled molten lunar regolith glass fiber and rebar cast from molten lunar regolith, (ii) investigate the mechanical properties of the concrete material manufactured using AM/AC methods, and (iii) investigate the impact of curing time on the properties of the concrete material.

Prof. Salman and his research team are currently testing and evaluating the properties of two potential lunar concretes that can be manufactured using in-situ lunar materials: Magnesium oxide-based concrete and Calcium Sulfo-Aluminate concrete. All the materials in the two concretes are extractable form lunar regolith. They are also comparing the properties of the two materials with and without fiber reinforcement.

Two fibers are being evaluated: polypropylene fibers, which need to be taken to the moon from earth, and glass fibers pulled from molten lunar regolith simulant (LRS). They are also testing structural elements (beams) constructed using AM/AC. For comparison, terrestrial Portland-cement-based concrete is being used as a baseline. Although Portland cement concrete is not being considered for lunar applications, it serves as a good control material and helps the researchers to understand the performance and behavior of the potential lunar materials.

The anticipated benefit of the project are to advance the understanding of the behavior of lunar structures reinforced with in-situ materials and constructed using AM/AC methods. This knowledge is needed to ensure the safety of future lunar structures, and advancing the economical and sustainable construction of lunar structures by increasing NASA’s current AM/AC Technical Readiness Level (TRL) from 1 to 3 to a pre-production TRL of 4.

Compressive strength test of potential lunar concrete material that can be manufactured using in-situ materials

Split-tension test of potential lunar concrete material

3D-printed concrete beams

3D-printed beams for flexural strength testing

Failure of 3D-printed beams

For more information:

Prof. Abdullahi Salman email: ams0098@uah.edu

RCIS Webpage: https://sites.google.com/uah.edu/rcislab/home?authuser=1

COMPLEX SYSTEMS INTEGRATION

The various engineering disciplines anchor themselves in the laws of Newton, Ohm, Maxwell, and Bernoulli to name a few, and build a rich basis of principles of practice upon this empirical foundation. Systems engineering lacks such an empirical foundation of laws, and instead relies entirely upon heuristics and lessons-learned for the principles of practice. The system engineering principles in aggregate lack coherency at best and are in conflict at worst. During **Dr. Dale Thomas'** NASA tenure, challenging assignments in systems engineering for the International Space Station, various launch vehicles, and scientific spacecraft revealed glaring shortcomings in the theoretical and quantitative underpinnings of systems engineering, and these shortcomings revealed themselves in often inefficient, sometimes ineffective, and occasionally failing systems design and operations.

Now, Dr. Thomas, Professor of Industrial and Systems Engineering and Engineering Management (ISEEM) and Eminent Scholar of Systems Engineering works to address systems engineering challenges. The focus of his research team is described in the mission statement for the **Complex Systems Integration Laboratory** (CSIL) – *To discover mathematical and empirical principles through modeling and simulation of complex systems while developing the next generation of innovative engineers.* And his resarch team is making progress!

The three aspects of systems engineering are (i) integration across time throughout the system life cycle, (ii) integration across engineering disciplines comprising the elements of the system, and (iii) integration across domains including enterprises, people, and other systems. Sponsored research is presently underway by the CSIL research team on all three aspects.

Technology evaluation within a context of mission analysis is the focus of research for the NASA Space Nuclear Propulsion Program Office at Marshall Space Flight Center (MSFC). NASA is focused primarily on design and realization of a Nuclear Thermal Propulsion (NTP) engine for a human mission to Mars. They are modeling and simulating a variety of missions, both human and robotic, to a variety of destinations throughout the Solar System to inform NASA in its choice of engine design parameters such as specific impulse, thrust level, and total energy. His team has already discovered, for instance, that NTP enables large scale scientific missions (think Cassini) to Jupiter and Saturn – on direct injection orbits rather than the elaborate multi-planetary fly-bys for gravity assists trajectories required for these missions in the past. This means annual launch opportunities rather than having to wait years for the proper planetary alignment. And they are also researching the system integration aspects of a NTP engine. In one example, Dr. Thomas's team researched the vehicle and mission impacts of using ammonia as the propellant in a NTP powered vehicle rather than hydrogen and defined the mission scenarios for which it is preferred. In another example, they are researching whether an Electric Pump Fed (EPF) system for a NTP engine makes sense. It will greatly simplify integration and testing versus traditional turbomachinery, but at a loss of performance. Is that a worthwhile trade? ***Stay tuned.***

In partnership with the UAH Propulsion Research Center, the research team has just gotten started on an advanced NTP effort in which the uranium NTP fuel is allowed to heat up until it liquefies to theoretically double the engine performance. Of course, there is a fine line between a highly performing liquid fuel NTP engine and a highly radioactive hot mess – and the research team is in the very early stages of establishing the engineering viability of this engine concept with today's technologies. Will it work? If it works, for what missions will it be the engine of choice? ***Stay tuned.***

While the NTP engine resides very early in the life cycle, a CSIL research team is also supporting the MSFC Engines Office in researching strategies for making the Space Launch System (SLS) Core Stage Engine more affordable. The SLS Core Stage Engine is the RS-25, which was the Space Shuttle Main Engine. While it is a very high performance and highly reliable engine, it is very expensive as it was designed to be reusable for 25 missions on the Space Shuttle. For the SLS, the entire Core Stage including four RS-25 engines are expendable. Hence NASA's interest in making the engines more affordable.

"Of course, the big challenge is that changes to make the engine cheaper must be re-qualified for flight, which includes expensive ground testing, and raises the risk of spending $10 to save $1. And that is the problem that we are researching from two distinct directions.", says Dr. Thomas.

His research team is modeling and simulating the engine re-qualification process to assure that candidate RS-25 design changes will indeed result in cost savings. Fellow ISEEM Professor Bryan Mesmer's research group is partnering with Dr. Thomas' team on this study to research how to improve the MSFC engineering culture with respect to affordability in general, such that the MSFC engineering teams are focused not just on flying safely, but also affordably.

The preceding two research efforts illustrate the temporal and interdisciplinary spans of systems engineering research underway. Another ongoing research effort involves supporting the MSFC Advanced Concepts Office in their strategic transformation to a model-based engineering paradigm. The current research is focused on development of a spacecraft systems ontology to provide the backbone of their information integration and sharing among the engineering team members for the various discipline based analyses supporting conceptual design of the wide variety of spacecraft and missions developed by the MSFC Advanced Concepts Office. And in a related study on a smaller scale but spanning multiple organizations, a spacecraft architecture framework is being defined and utilized for the Alabama Burst Energetics eXplorer (ABEX), a 12U CubeSat concept sponsored by the Alabama Space Grant Consortium and was submitted in response to NASA's Astrophysics Research and Analysis solicitation in December 2021. The ABEX effort includes seven partner universities and colleges within Alabama, and the CSIL team is leading the ABEX systems engineering effort.

In summary, Dr. Thomas and his research team are focused on discovery of empirical systems engineering principles based on the engineering of actual complex engineered systems to assure the utility of those principles. Significant discoveries to date include a measure of systems complexity and the identification of five principles governing systems integration. Research continues on discovering how to best use those measures and principles in new methods and techniques for systems design and development.

Dr. Thomas notes, "Much research lies ahead of us, but there is much progress behind us."

For more information

Prof. Dale Thomas

dale.thomas@uah.edu

https://www.uah.edu/csil

AERODYNAMICS MORE THAN JUST GOING WITH THE FLOW

The **Applied Aerodynamics and Flow Control Laboratory** at UAH has its focus directed toward fundamental and applied problems of active flow control, aircraft performance and design. Led by Assistant Professor **Kostas Kanistras** of the Mechanical and Aerospace Engineering Department, their work is primarily experimental and can be broadly classified under the following categories: active flow control, aircraft stability and control, and morphing wing design.

Active Flow Control

Prof. Kanistras' research focuses on the experimental investigation of the 3D steady and unsteady effects of ejected flow on actively deformable surfaces to improve the effectiveness of next-generation active-flow-control (AFC) systems. AFC is the method of actively manipulating a flow field through some form of actuation or interaction to produce a desired change in the flow behavior. This process involves forced changes to flow structures, mixing behavior or momentum injection in the flow field to produce more desirable performance characteristics from a given aerodynamic geometry. (Figure 1).

Figure 2 depicts the performance of induced momentum (trailing-edge blowing) on a conventional flap at 30° deflection. The non-intrusive technique that is used to collect the flow data around the airfoil is called phase-locked volumetric particle image velocimetry, where the timing of the laser and cameras is controlled by a trigger signal sent from an external source. This technique allows to collect data and measure the unsteady aerodynamic effects during flap actuation. A comparison between the no-blowing and blowing cases shows that the flow remains attached longer when momentum is introduced. The research will contribute to the development of next-generation aircraft with improved aerodynamic performance (reduced fuel consumption leading to more *green* aircraft), improved aircraft maneuverability, and operate with reduced-in-size control surfaces (weight and complexity reduction).

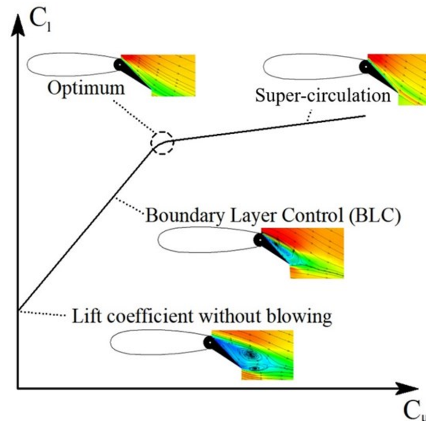


Figure.1: *Effect of the momentum coefficient of blowing (Cμ) on lift coefficient (C_l).*

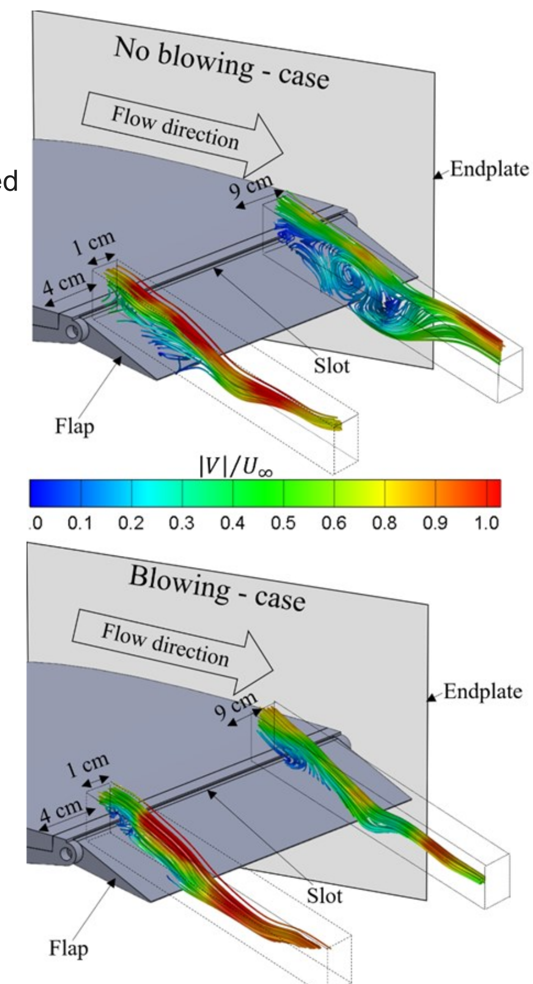


Figure 2: Phase -locked V-PIV: Effects of trailing edge blowing on an actuated flap.

Aircraft Stability and Control

Winglets can improve aircraft performance primarily by reducing the lift-induced drag, which accounts for approximately 40\% of the total drag. However, when used outside of their intended flight envelope, winglets can produce undesirable effects. The study of morphing structures inspired by the natural world, is resulting in new perspectives on the solution of increasing aircraft performance. Aviation's future relies on developing an aircraft equipped with novel technologies that minimize or eliminate deflecting surfaces without jeopardizing the aircraft's flight stability and control.

The significant benefit of morphing winglets (Figure 3) is that they allow for off-design configuration application, which can be beneficial for each stage of flight, compared to a fixed design, optimized for a limited range of flight conditions. The purpose of this research work is to investigate the effects of symmetric

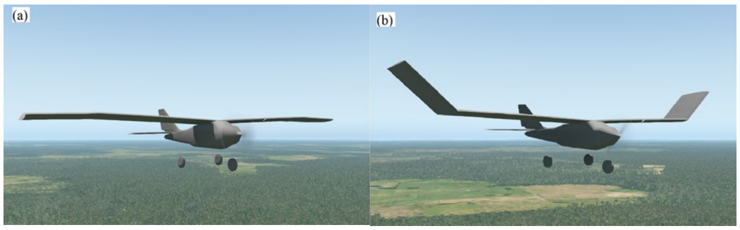


Figure 3: *X-Plane model of Apprentice S 15e at: (a) wingtip deflection of zero degrees (b) wingtip deflection of 45 degrees.*

and asymmetric wingtip actuation on the stability parameters of a small-scale fixed wing unmanned aerial vehicle operating at low Reynolds numbers. Figure 4 shows how asymmetric wingtip actuation can be utilized for improved maneuverability and more aggressive aircraft banking turns, when a faster change in aircraft heading is required. It is feasible and should be considered to replace a portion of the aileron while retaining roll control. The research will contribute to improving aircraft aerodynamic performance (targeting more environmentally friendly air transport systems), aircraft versatility (providing the ability to operate at different flight conditions and operation in challenging weather environments), and sensor/actuation technology for aerospace applications.

Morphing Wing Design

The word morph comes from the Greek word *"morphos"*, which means shape. Morph indicates the ability to transform shape or structure. A morphing wing is more competitive compared to the conventional fixed wing design as it allows an airplane to perform effectively and efficiently. An aircraft with a morphing wing can change the geometric shape of its wing during flight and optimize its performance based on mission requirements. The overarching idea of a morphing wing is to adapt its aerodynamic shape to each flight condition to improve aircraft performance. This study focuses on the conceptual development of a trailing edge that utilizes compliant mechanisms to provide a smooth and a continuous contour flap deflection, without slots and separated surfaces. A compliant mechanism is a specific mechanism that replaces multiple moving joints with a fluid, continuous geometry to achieve motion by relying on the flexibility of the material it is constructed with. For this flap (Figure 5), half of the large displacement monolithic compliant mechanism, Flex-16, was considered in the rib geometry, providing a 60 degrees flap deflection.

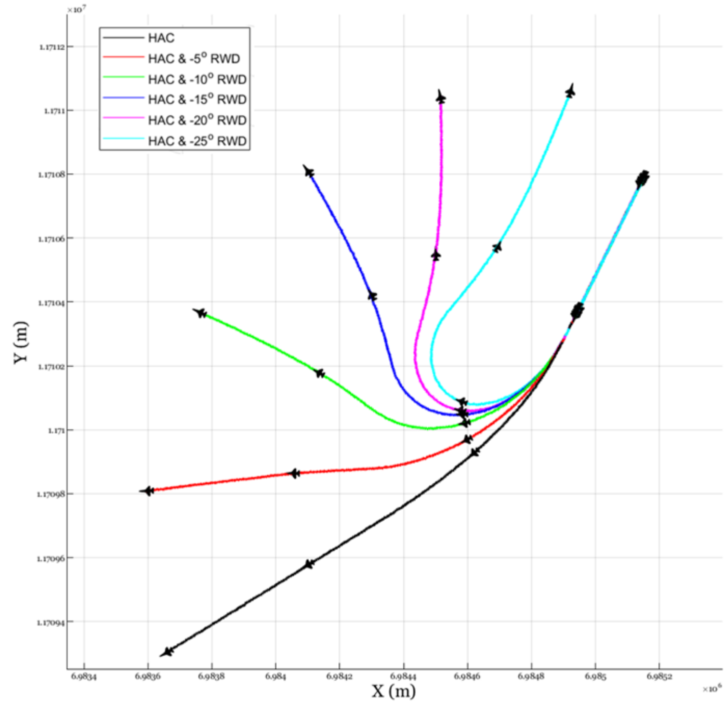


Figure 4: *Downward wingtip asymmetric deflection combined with half-aileron configuration (HAC) deflection. The left wingtip remains planar and the right wingtip deflection (RWD) deflects downward (-5 to -25 degrees). The rate of wingtip deflection is set to 5 degrees/s.*

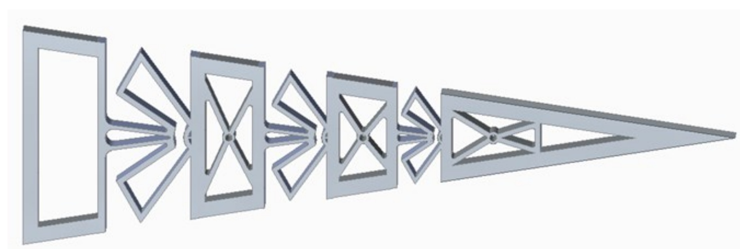
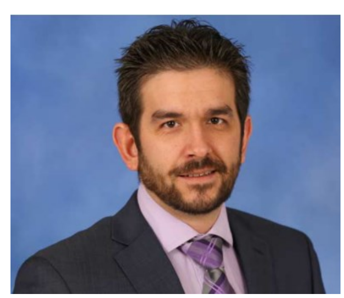


Figure 5: Flap CAD design utilizing the compliant mechanism



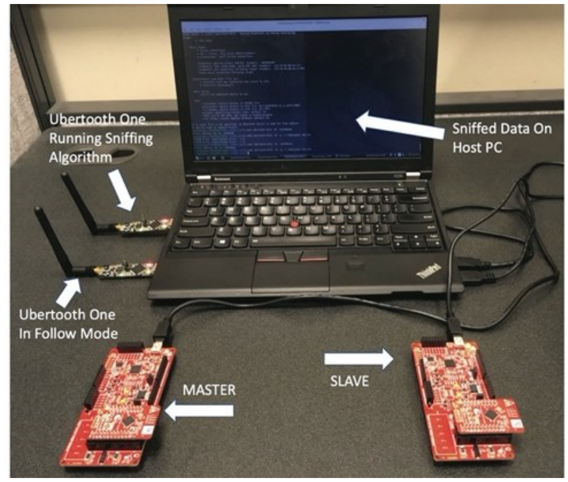
Prof. Kostas Kanistras:

kk0083@uah.edu

https://aafc.uah.edu/

NSF CAREER AWARD:

CONTROLLING and MANIPULATING DATA ERRORS for WIRELESS DEVICES

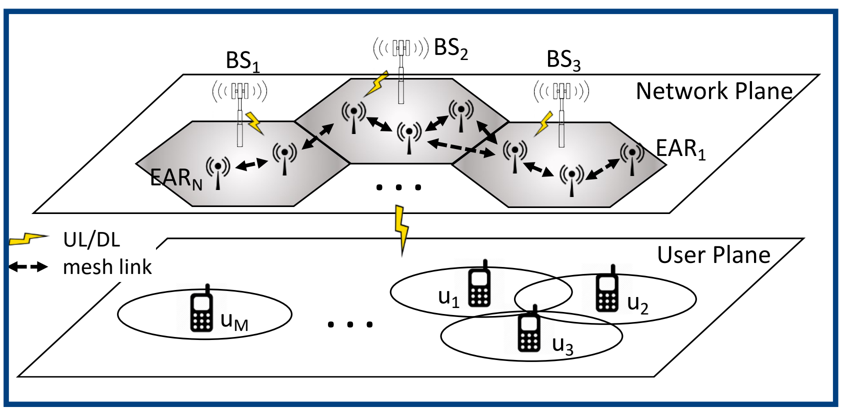


Research into taming wireless devices' inherent errors for performance gains has garnered one of its professors a $500,000 National Science Foundation (NSF) Faculty Early Career Development Program (CAREER) Award. The research by **Dr. Jianqing Liu**, an Assistant Professor of Electrical and Computer Engineering, could have broad implications for wireless standards and electronic devices.

Prof. Jianqing Liu

Prof. Liu's research interests lie broadly in wireless communications and networking, network security, and data privacy. His research efforts are mainly devoted to address the wireless research problems in edge (or distributed) networks, mobile health, and Internet-of-Things (IoT) systems. Prof. Liu's research is widely recognized, and he is the recipient of four best paper awards in top-notched conferences and IEEE technical committees. Specifically in this NSF CAREER project, Prof. Liu proposes innovative techniques to control and manipulate data errors in wireless devices using hardware and software co-design approaches.

"Every wireless device, say our cell phone and laptop, is very shaky and unreliable during its communication, computation and storage. This might not sound very intuitive as we see these wireless devices running pretty smoothly in our daily life. The reason is that there are lots of error control modules in those devices that combat noises, failures, and imperfect behaviors of internal electronics. Herein lies the research conundrum. These error control modules consume a significant amount of resources such as battery, storage space, and CPU. But, data errors are not always harmful. Sometimes they are benign or even beneficial. For instance, the fundamental idea of protecting security is through noise injection or encryption, whose intention is to corrupt and garble the original data. So, here comes the novel idea, can we relax the error control modules to permit certain data errors and meanwhile manipulate and turn them into good things in wireless devices? The benefits are two-fold. (1) We save resources that are otherwise wasted by running error control modules. (2) We don't need dedicated modules such as encryption algorithms to create corrupted data, but instead harvest errors from wireless devices naturally. This idea is like the old saying "kill two birds with one stone"."



Prof. Liu along with his research team and his collaborator Prof. Na Gong from University of South Alabama have developed some prototypes to show (1) how memory failures in low power can be turned into privacy-preserving noises; (2) how wireless channel erasure noises can be harnessed to carry additional information.

"This research has many benefits to wireless devices and customers like us. Just to name a few, our wireless devices can become more lightweight and power-saving as some heavy and redundant modules can be removed. It will also make our wireless devices more secure because we do not need a third-party program to ensure system security anymore, but instead our wireless devices can protect our data by itself. In the next few years, our team will be able to continue this research and show more exciting research findings to the community".

For more information:

Prof. Jianqing Liu

jianqing.liu@uah.edu; http://www.ece.uah.edu/~jl0152/index.html

RESEARCHERS DEVELOPING GLASS FIBER DRINKING WATER MONITOR WITH EPA GRANT

A novel sensor network using glass fibers to safeguard drinking water supplies is being developed under a U.S. Environmental Protection Agency grant in a cross-campus collaboration at UAH. The grant is through the EPA's P3 Awards: A National Student Design Competition Focusing on People, Prosperity and the Planet.

Led by **Dr. Tingting Wu**, an Associate Professor in the Department of Civil and Environmental Engineering, and **Dr. Lingze Duan**, a Professor in the Department of Physics and Astronomy, the research team will include students and will utilize glass fibers to develop a novel sensor network with distributed fiber probes and a centralized interrogation-detection-data processing system for real-time water quality monitoring.

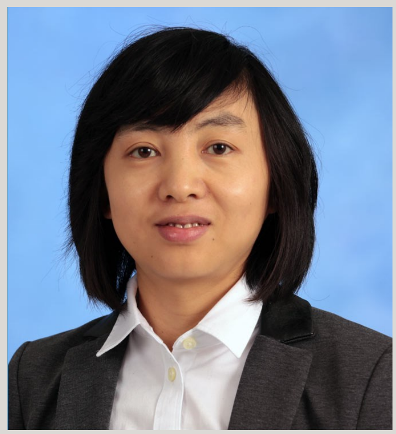
"Turbidity is caused by the existence of suspended particles, organic matter and chemicals, and is widely measured in natural resources, irrigation water, the food and beverage industry, and drinking water," says Prof. Wu. "As an important water quality parameter, turbidity not only indicates the efficiency of some treatment processes but also reflects water quality changes in the distribution systems."

Increased turbidity has been correlated with contamination with *Giardia* and *Cryptosporidium* and it is used as a surrogate measure for risk of contamination by those pathogens. Studies also revealed a strong temporal relationship between turbidity and gastrointestinal events during and preceding the major waterborne disease outbreak in Milwaukee in 1993. "All these findings emphasize the importance and necessity for turbidity monitoring in a contamination warning system," she says.

Current turbidity measuring systems are lab-based or are bulky and expensive. The high costs and limited timeframe for measurements can prohibit their application in drinking water distribution systems. A limited lifetime and higher maintenance are also prohibitive. "On the other hand, fiber optical turbidity sensors possess some important advantages such as low cost, compactness, great flexibility, high stability over a wide temperature range, immunity to electromagnetic interference, water and corrosion resistance, and compatibility with multi-sensor schemes," says Prof. Wu.

Using glass fibers rather than the commonly used plastic fibers also provides system advantages, researchers think. "Glass fibers have much lower loss than plastic fibers, permitting long-distance light delivery and enabling true distributed networks," Prof. Duan says. "They are also more compact and corrosion-resistant than plastic fibers."

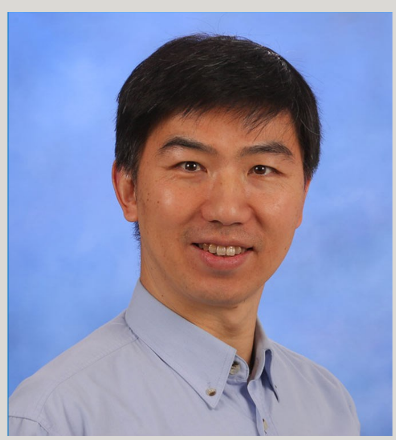
In Phase 1, the team is focusing on developing and evaluating the glass fiber-based optical system under drinking water relevant conditions. Later, they will build the architecture of the hub-spoke monitoring system/ sensor network from scratch. The advantage of the network topology is its efficiency in lowering the cost of interrogation-detection systems, as many sensor stations can share the service of one central hub. Since a single interrogation-detection system can support a large number of sensors, the investigators note that it's economically feasible to develop more complicated multi-function interrogation-detection systems, allowing future multi-parametric sensor networks.



For more information:

Prof. Tingting Wu

tingting.wu@uah.edu



For more information:

Prof. Lingze Duan

lingze.duan@uah.edu

BEHAVIOR and APPLICATIONS of COLLOIDAL SUSPENSIONS

Prof. Isaac Torres-Díaz

Dr. Isaac Torres-Díaz, Assistant Professor in the Department of Chemical and Materials Engineering, is developing new computational approaches to describe suspensions composed of interacting anisotropic colloids with substrates and with electromagnetic fields. The rapid increase in the variety of synthesized colloidal particles with complex shapes in the last decades, such as ellipsoids, rods, cubes, polyhedral, superspheres, and superellipsoids, make them attractive for different applications.. Anisotropic colloids possess directional interactions as a function of the relative position and orientation while undergoing a translational and rotational Brownian motion. The new computational approaches are relevant for different applications, such as assembling hierarchical spiky surfaces for biofilm prevention in aerospace applications and anti-fouling prevention in maritime applications. Additionally, the new computational approaches are relevant in understanding how such colloids with different shapes and material properties interact with each other to scale down the microfabrication processes of nanorobots with multiple degrees of freedom and actuation, which potentially will revolutionize non-invasive medical treatments.

Prof. Torres-Díaz and his research team combine the synthesis, characterization, real-time imaging/measurements, and multi-scale modeling to fundamentally understand the interactions and collective response of suspensions composed of anisotropic particles. They are interested in the fundamental phenomenological behavior and applications of colloidal suspensions composed of anisotropic particles and suspensions with a polarized behavior generated by the influence of electromagnetic fields. They use theoretical, numerical, and experimental approaches to describe the dipolar and hydrodynamic interactions between anisotropic particles with different shapes, sizes, and material properties. The microscopic models are implemented in large-scale simulations to describe the equilibrium and non-equilibrium behavior of mixtures of polarized and polarizable suspension and their macroscopic properties, compared with the experimental data (See Fig. 1).

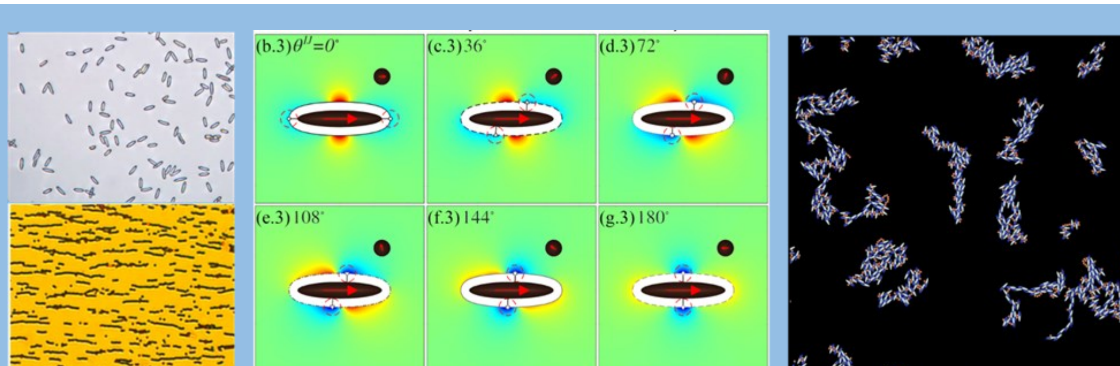
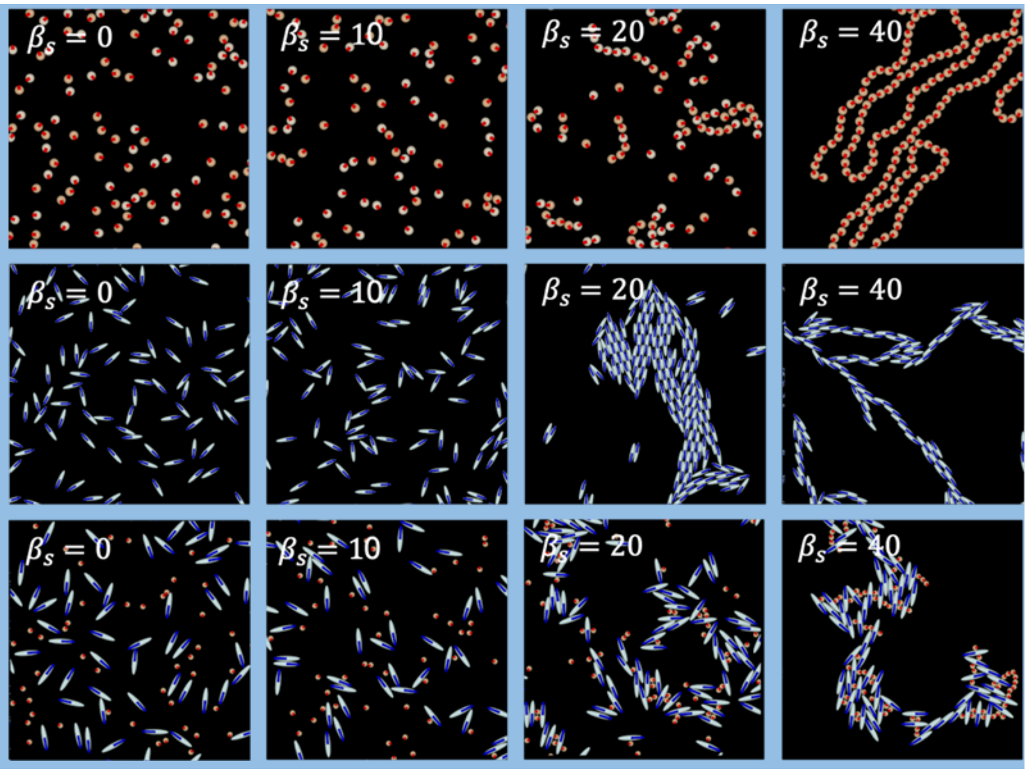


Figure 1. Dr. Torres-Díaz and his research team combine the synthesis, characterization, real-time imaging/measurements, and multi-scale modeling to fundamentally understand the interactions and collective response of suspensions composed of anisotropic particles.

Some preliminary results of dilute suspensions of permanently magnetized ellipsoids and spherical particles in two-dimensional confinement show that the shape anisotropy modifies the head-to-tail interaction with respect to a uniform suspension of spheres. The simulation results show that a uniform magnetic field tunes the local configuration of both uniform anisotropic particles and binary anisotropic particles, which is relevant for future approaches in the assembly of nanorobots with multiple degrees of freedom. Still, the interactions in binary suspensions are under analysis for different dipolar interactions and field conditions; the collective magnetic response limits the formation of structures of monodisperse particles along the direction of the external magnetic field. (See Fig. 2) Currently, we are exploring and characterizing the structures formed in suspensions with different particle concentrations and different material properties to understand the most appropriate conditions for the

Figure 2. The effect of dipolar interactions on the local arrangement of suspensions composed of binary suspensions compared to uniform suspensions composed of ellipsoids and spheres. The dipolar interaction modifies the local configuration of particles and the dimension of the assembled structures.



formation of tunable structures with multiple degrees of freedom. Additionally, we are studying the tunable

assembly using different particle shapes and magnetic fields, implementing non-equilibrium models to capture the dynamics of anisotropic particles at different field conditions. In this matter, the undergraduate student Daniel Duke won the Best of College Poster award for his work on the "Brownian dynamics of interacting anisotropic magnetic nanoparticles" in summer 2021 (see story page 26).

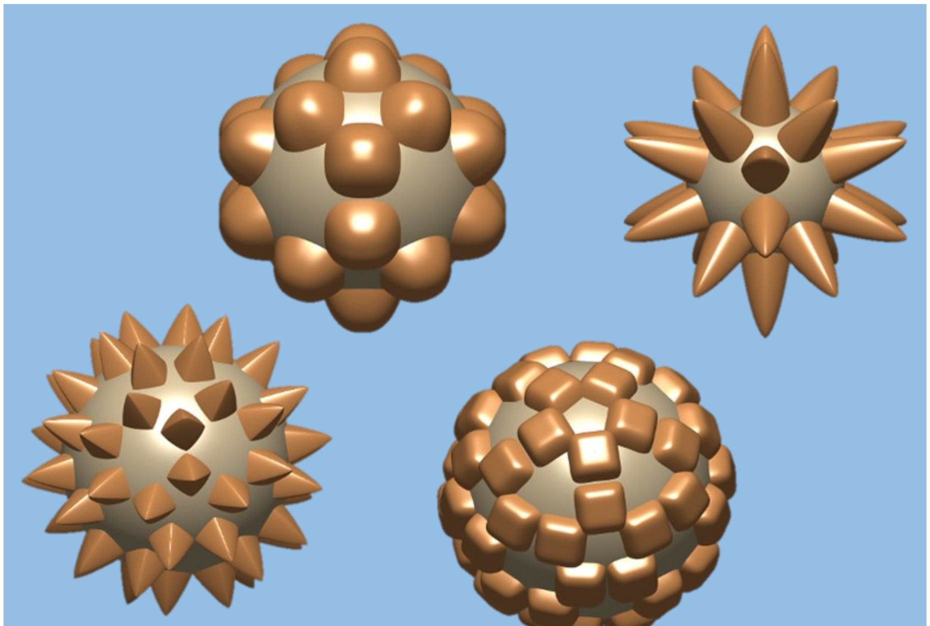


Figure 3. Modeling spiky colloidal particles to promote the assembly of colloidal particles with spiky structures to generate multi-scale anti-fouling surfaces.

Prof. Torres-Díaz and graduate student Elizabeth Andrew are working on assembling spiky colloidal particles to fabricate hierarchical spiky surfaces for biofilm prevention in aerospace applications and anti-fouling surfaces for maritime applications. The new model quantifies the DLVO interactions of the anisotropic particle as a function of position and orientation to maximize the adhesion of the particles on the substrate by enhancing the resistive torque, which keeps the particles in place under different shear conditions. Currently, they are working on understanding the effect of the spike shape and the equilibrium behavior of the assembly of particles over a planar substrate for biofilm prevention and anti-fouling surfaces (See Fig. 3).

For more information on Prof. Torres-Diaz' research:
sites.google.com/view/torresdiazlab/home
isaac.torres.diaz@uah.edu

INCLUDE: GRAND CHALLENGE NEEDS INTERDISCIPLINARY SOLUTION

Faculty members from the UAH Colleges of Engineering and Arts, Humanities & Social Sciences have devised a program called INCLUDE, an Interdisciplinary Undergraduate Experience tasked with the goal of "conceptualizing a space ecosystem" as a jumping-off place for a journey to the stars for everyday explorers.

The program is the brainchild of Dr. Bryan Mesmer, an Associate Professor in the Department of Industrial & Systems Engineering and Engineering Management (ISEEM), working in collaboration with Dr. Kristin Weger, an Assistant Professor of Psychology in the College of Arts, Humanities and Social Sciences (CAHS). INCLUDE was piloted successfully over the previous fall and spring semesters as a project dedicated to examining the daunting hurdles and opportunities most likely to affect the future of humankind.

"Dr. Mesmer was the creator of INCLUDE, and together we collaborated to get this program set up and rolling," Dr. Weger explains. "It's the first of its kind at UAH and entails interdisciplinary work by a student team to tackle a Grand Challenge."

A 'Grand Challenge' is defined as a significant problem or obstacle facing society that requires solutions beyond the reach of ordinary research. The end results or outcomes of these efforts are seen as potentially globally beneficial in scale, and ultimately achievable through a collaboration of many technical and non-technical disciplines.

"INCLUDE came about through the needs for interdisciplinary work to address 21st century research questions and in response to our students being thrown into the workforce where they will be interacting immediately with diverse people from disciplines that are not the student's own," Dr. Mesmer says. "Many of the students – up until INCLUDE – have only interacted significantly within their own disciplines, and that is just not how the real world works."

"With the guidance of a steering committee of mentors from both academia and practice, students immerse themselves in a project that explores innovative approaches and models to a predefined Grand Challenge. The Challenge presented to student teams requires knowledge and experiences from multiple disciplines, with best solutions found at the intersection of each discipline. The project also examines the distinctive characteristics and missions of the independent disciplines that enable solutions to the world's largest challenges. The project for the 20-21 academic year is in collaboration with NASA, Dynetics and AOA. For the University, it is a way to get faculty from diverse colleges and departments working together. For industry, it is a way to give back to the community and also identify potential employees in the students."

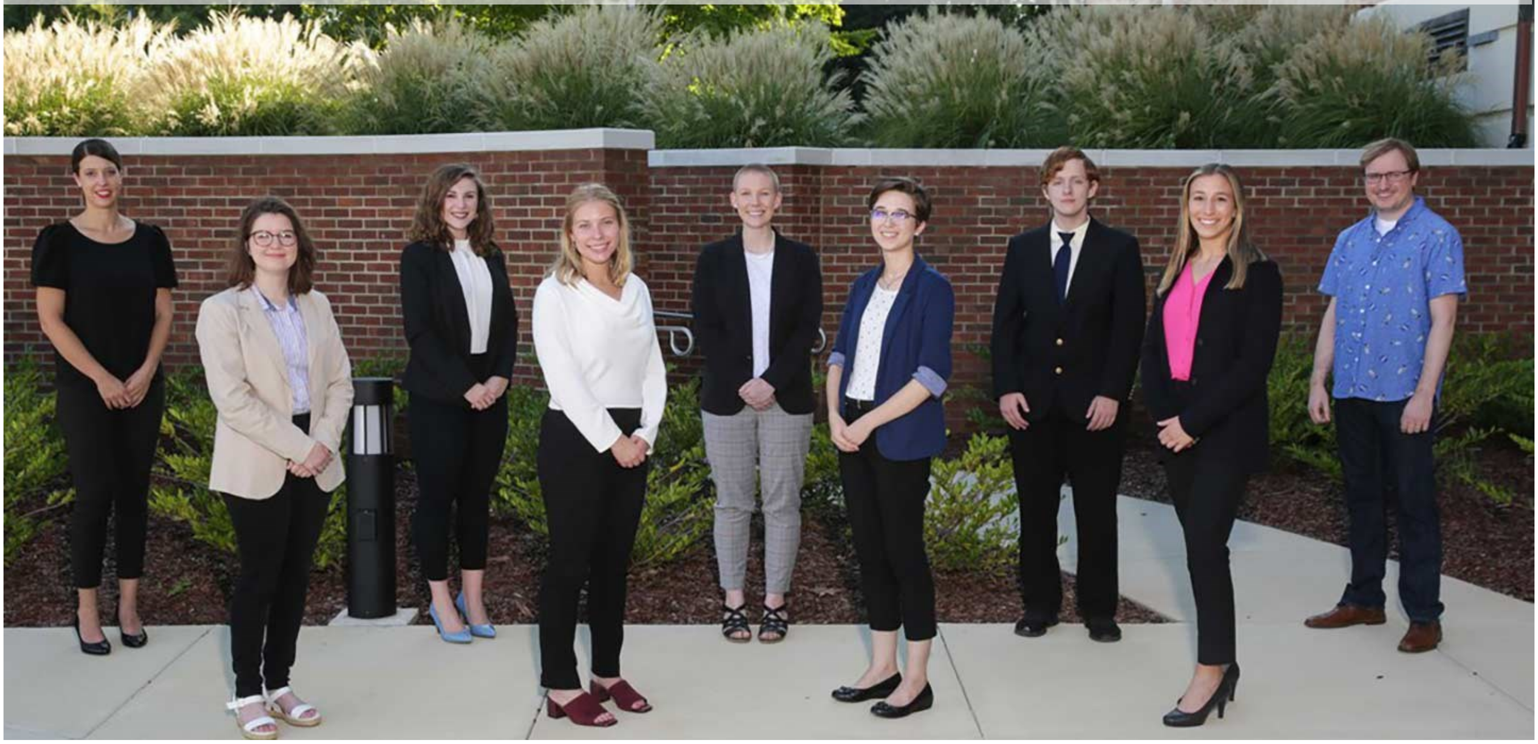
The Grand Challenge offered to the group as the pilot project involved exploring cutting-edge solutions and designs to solve important space-related problems and answer these two questions: 1) Can a multi-country, mixed commercial, government, civilian and military Space Ecosystem be viable in 2030, 2040 and 2050? And 2) How to best creatively assess expectations and engage society in the future Space Ecosystem?

To mentor the team, other UAH faculty were selected to provide perspectives from their various disciplines, including Amy Guerin (Theatre), Vinny Argentina (Animation and Game Design); Dr. Nicholaos Jones (Philosophy), Dr. Liwu Hsu (Marketing) and Dr. Nicholas Loyd (ISEEM).

"The student teams consist of junior or senior undergraduate students selected from diverse colleges and departments," Dr. Mesmer says. "Student participants will experience cultural and social challenges and benefits to working in a highly diverse team. Mentors provide guidance and knowledge to the teams, encouraging novel, yet rigorous, solutions. Through its students, mentors and university support, INCLUDE will provide a capstone experience to prepare students for the diverse organizations and interdisciplinary challenges they will face in the workforce."

"The group consists of SE, Psychology, Art and Philosophy students," project spokesperson and manager (and ISE student) Anna Shipman says. "This last semester they brought on a Marketing student as well. My role as Project Manager is to ensure there's a smooth flow between all the disciplines and ensure the students are routinely communicating with each other. I interface with the stakeholders, students and advisors." Other student team members include Hailey Simon (ISE), Rosie Cortelli (ISE/PSY), Alana Flint (ISE), Hailey Heaton (PSY), Harleigh Bass (Art/Animation(AA)), Elizabeth Berhow (AA), Madison Travis (Digital Marketing & Entrepreneurship) and Joseph Atchley (PHL).

The psychology students on the team administered a



(L-R) Dr. Kristin Weger, co-PI and Assistant Professor, Psychology Department; Elizabeth Berhow; AA student; Anna Shipman, INCLUDE Project Manager and ISE student; Alana Flint, ISE student; Rosemary Cortelli, ISE student, PSY student; Harleigh Bass, AA student; Andrew Atchley, PHL student; Hailey Simon, ISE student; Dr. Bryan Mesmer, PI and Associate Professor, ISEEM Department.

survey to 250 members of the community and UAH to solicit preferences about the proposed space port to answer questions about things such as preferred amenities and the cost they would be willing to pay to go to space.

"We're focusing on an Earth-based space port that offers amenities to a range of economic backgrounds and is more accessible than the current space tourism offerings," Shipman says. "So this space port is a blend of Space Camp with Disney World, and it sounds very futuristic and 'sci-fi,' but it could very much be a reality, which is the cool part of it! We want our space port to be kind of a resort-style offering. So, people could come to the resort and look at museum exhibits or go through Space Camp-style training experience or even go to space, if they can afford it."

The science and engineering students have been focused on modelling the space port, as well as developing requirements and determining economic frameworks for the project, resulting in a first-place finish at Research Horizons Day for the College of Engineering co-authors.

"The AA student will be finalizing the VR program," Shipman notes. "The marketing student will be helping us tie all these pieces together and come up with a pitch and website and something to sell to society. The PHL student and a SE student are working on space policy, which is really cool, because there's a huge lack of space policy in the aerospace industry. They'll be addressing the challenges of developing a space port that could potentially have commercial tourists, government facilities and also launch government satellite payloads."

The team's interdisciplinary strengths helped them grapple with far-ranging topics, such as the psychological rigors of space travel, the legal and political obstacles such an "ecosystem" might encounter, and finding ways to make space travel more accessible and equitable. With the current cost of "commercial" space travel ranging from $250K for a sub-orbital flight to $20M+ to actually achieve orbit, the team instead emphasized engaging the widest spectrum of society possible, regardless of a traveler's educational background or financial standing. The goal was to offer everything from mission-style physical or virtual reality simulations to real astronaut training, museum exhibits, resort-style "immersive" entertainment and, ultimately, the opportunity to actually lift off.

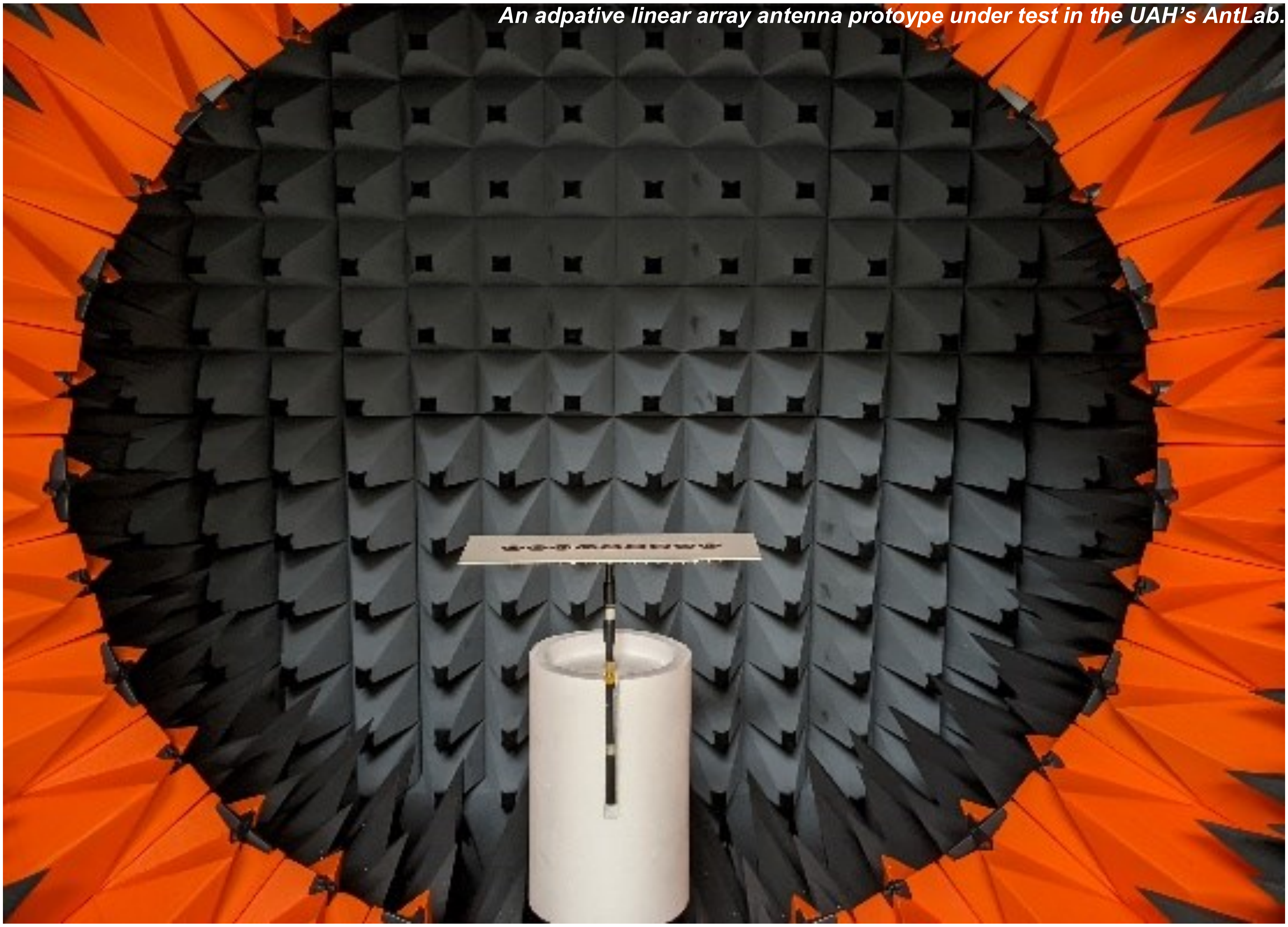
Dr. Mesmer agrees as he looks to the future of the program. "We see this as a yearly effort tackling new Grand Challenges," he says. "The 2021-2022 Grand Challenge involves robotic systems interacting with each other in a 'sport' competition."

For more information:

Prof. Bryan Mesmer

bryan.mesmer@uah.edu

sites.google.com/uah.edu/mrg



An adpative linear array antenna protoype under test in the UAH's AntLab.

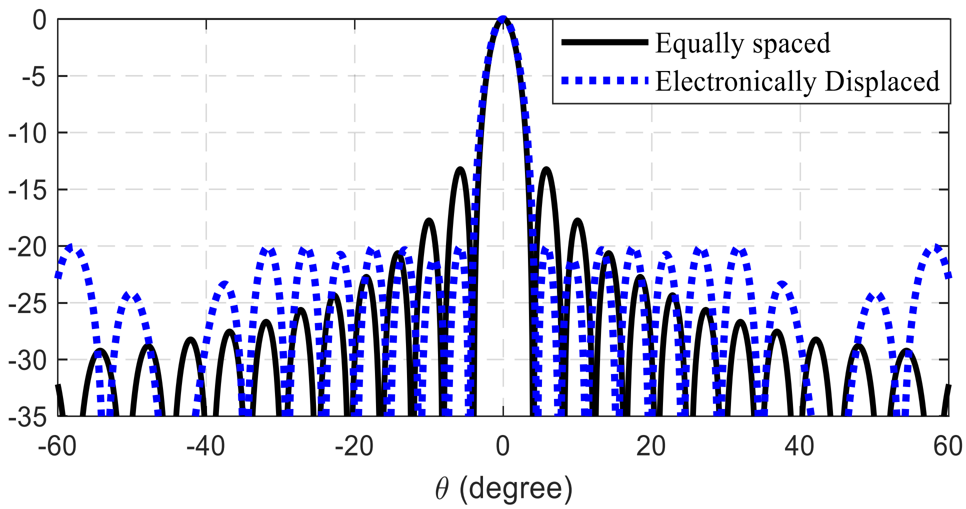
ANTENNA TECHNOLOGIES & APPLIED ELECTROMAGNETICS RESEARCH

Dr. Maria Pour, Associate Professor of Electrical and Computer Engineering, leads a team of graduate and undergraduate research assistants in the areas of applied electromagnetics and antennas. Her current research projects are funded by the U.S. National Science Foundation (NSF), NASA, and Alabama EPSCoR program. Dr. Pour has been serving as an Associate Editor for the IEEE Transactions on Antennas and Propagation and the IEEE Antennas and Wireless Propagation Letters since August 2016 and July 2020, respectively. She has co-authored 6 book chapters and over 90 journal papers and conference proceedings.

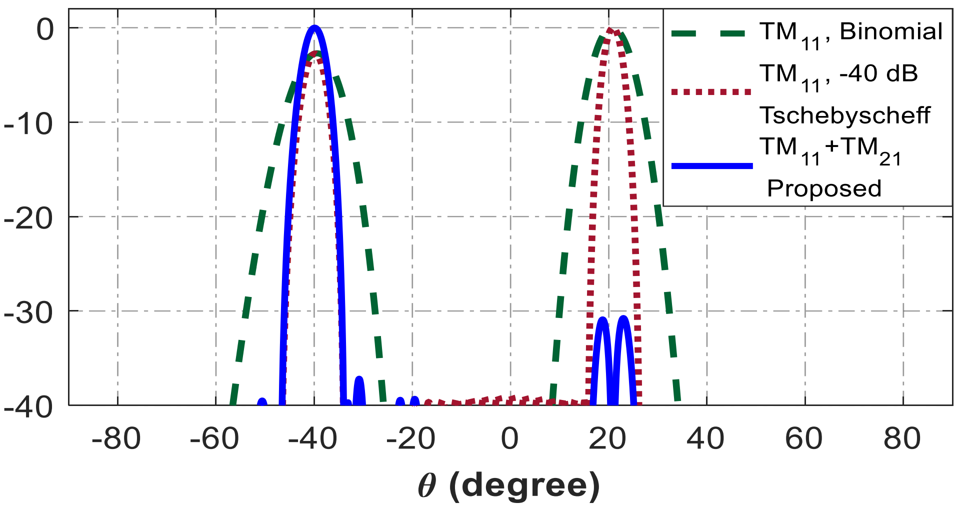
Prof. Pour and her students have been working on developing transformative techniques for the next generation of phased array antennas, adaptive apertures, boundary value problems, wideband multi-mode feeds, reconfigurable antennas, wireless sensors for structural health monitoring, RF energy harvesting antennas, and many more. In 2018, she established an **Antenna Laboratory (AntLab)**, which is a spherical near-field test range placed in an anechoic chamber, allowing her research group to conduct cutting-edge research on emerging antenna technologies. The AntLab has increased UAH's capacity to train and educate undergraduate and graduate students in antennas and applied electromagnetics. Her former students are currently working at NASA, Boeing, Harris Corporation, Raytheon, and Technology Service Corporation.

An NSF-funded ongoing research project focuses on adaptive phased array antennas with reconfigurable element spacing, reduced grating lobes and sidelobes, adaptive null steering, and wide-angle scanning capabilities. This research has promising applications in agile mobile and communications systems and radars for homeland security and remote sensing applications. Examples include wide-angle scanning radars, adaptive synthetic aperture radars, passive multi-functional imaging radars, interference cancellers, autonomous vehicles, massive multi-input multi-output (MIMO) radars, automotive radars, and atmospheric remote sensing. The results of this research have been published in Nature, Scientific Reports, IEEE Transactions on Antennas and Propagation, IEEE Antennas and Wireless Propagation Letters, Progress in Electromagnetics, as well as presented in national and international IEEE-sponsored conferences, including IEEE International Symposium on Antennas and Propagation and USNC-URSI Radio Science Meeting and IEEE International Symposium on Phased Array Systems and Technology.

For more information:
Prof. Maria Pour
maria.pour@uah.edu

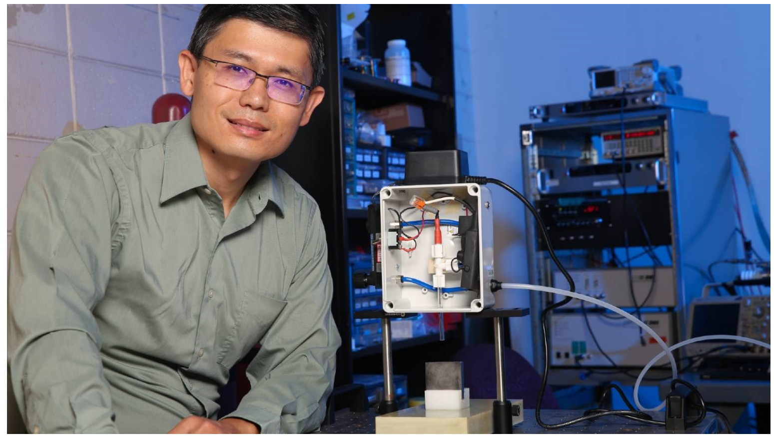


Sidelobe reduction in a 20-element linear array with the equally-spaced and electronically displaced elements, without any amplitude tapering.



Grating lobe reduction in a 21-element linear array with a one-wavelength element spacing and a scan angle -40°, consisting of conventional single-mode and proposed adaptive dual-mode elements.

HYPERSONICS RESEARCH GETS BOOST FROM DOD GRANT



Development of a new concept for a solid-fueled ramjet using a rotating detonation engine (RDE) for hypersonic air-breathing propulsion has attracted a three-year, $1.5 million grant. The project's principal investigator is MAE Associate Professor, Dr. Gabe Xu and the funding comes from the University Consortium for Applied Hypersonics (UCAH), a U.S. Department of Defense (DOD) funded initiative managed by Texas A&M University in which UAH is a partner. The research is included in the first set of grants issued by UCAH.

"The main goal of the project is to demonstrate feasibility of the concept by developing some of the 'tall tent pole' or high-risk components," Dr. Xu says. "The research will be a combination of experiments and computational modeling."

Ramjets are a class of air-breathing engines that utilize the forward motion of the engine to compress the incoming air for combustion without the need for a mechanical air compressor. The UAH research marries that function to an RDE engine. Instead of burning the propellant in a traditional flame, RDEs use spinning detonation waves – essentially explosions – to further compress and combust the fuel and oxidizer to create hot gas and generate thrust.

The two main objectives of the UAH RDE ramjet experiments are identifying a solid fuel formulation that will vaporize/pyrolyze at ram air heated temperatures but does not actually burn, and designing and configurating fuel and air injectors with a manifold to feed the ram-heated fuel into the RDE.

Prof. Xu's Plasma and Electrodynamics Research Lab will do the work through UAH's Propulsion Research Center (PRC) and will rely heavily on PRC facilities and staff, as well as industry partners CFD Research Corp. (CFDRC), Quadrus Advanced Manufacturing and Aerojet Rocketdyne (AR).

"CFDRC will conduct the computational modeling and work with us to find fuel formulations and injector designs," says Dr. Xu. "Quadrus will provide metal additive manufacturing capabilities to produce the complicated injectors this concept will require. AR is providing subject matter expertise support, due to their extensive work on RDEs and hypersonics."

Dr. Robert Frederick, PRC director, and Dr. David Lineberry, a PRC research engineer, are leading the solid fuels development part of the UAH project. Tony Hall, a PRC test engineer, is assisting with the experiments.

"They will be critical to the project, as they have the experience in operating the various equipment at UAH's Johnson Research Center," Dr. Xu says.

Dr. Frederick was part of the UCAH team that helped Texas A&M land its contract with the government. He served as the lead for the propellant and energetics portion of the proposal.

"For the fuel, it is crucial that the new fuel formulation can transition to a gas when it encounters the high-temperature air ingested into the engine, but does not combust at that point," says Dr. Frederick.

"The work involves selecting new solid fuel ingredients and studying in detail the types of gas molecules that are generated when the solid decomposes into a gas," he says. "We will use a new mass spectrometer instrument that we recently acquired through a DOD grant to measure these gas species in our UAH laboratories."

Based on spectrometer measurements, the solid fuel ingredients will be adjusted to get the desired gas properties.

"UAH will also provide these data to CFDRC, which will perform detailed modeling and simulation of these gases in the RDE combustor," Dr. Frederick says. "The research will not only develop a new propulsion technology, but also advance the field of solid propellants by characterizing and modeling new fuel formations."

The U.S. Army Combat Capabilities Development Command Aviation & Missile Center is also supporting the fuel development research to help formulate new compositions.

The project will support two graduate students and two undergraduate students for its duration, advancing the workforce development goal of UCAH.

“UCAH’s mission is to help develop the U.S. academic base and future workforce pipeline in hypersonics,” Dr. Xu says. “And we’re very glad to be part of that effort.”

A matter of engineering interest for over 60 years, RDEs are a tantalizing concept that has only been developed and studied as a technology for about the past 15 years. They could be transformative for rocket propulsion, offering better fuel efficiency than continuous-burn solid or liquid propellant engines if the inherent instabilities that make them run can be better controlled.

“I started to gain interest in RDEs around 2015 and wrote a few internal and external proposals in the next few years,” Dr. Xu says. “But without the hardware and demonstrated operation, we didn’t get anywhere.”

UAH’s RDE program was jump-started in 2019 by a seed grant from the National Science Foundation’s Established Program to Stimulate Competitive Research: Connecting the Plasma Universe to Plasma Technology in Alabama (CPU2AL) and personnel support from the PRC, allowing it to build and test RDE hardware.

The UAH team test-fired its RDE engine in August, 2020, at Johnson Research Center. UAH mechanical and aerospace engineering master’s student Evan Unruh, who was heavily involved with the effort, has graduated on the work, Dr. Xu says. Michaela Hemming, a doctoral student in aerospace systems engineering, is currently working on RDE research on a NASA fellowship.

“Now with this new UCAH project, we’re finally at the critical mass stage where we can produce novel results and contribute to the technology,” Dr. Xu says. “I find it a good example of the challenge of starting something new in research.”

HYPERSONICS INSTRUMENTATION

Researchers plan to investigate new fuels for hypersonic vehicles once chromatography/mass spectroscopy equipment arrives later this year at the Propulsion Research Center (PRC). The purchase of a pyrolysis-gas chromatography/mass spectroscopy (Py-GC/MS) instrument, including an Agilent 8890 gas chromatograph, an Agilent 5977B mass spectrometer, and a Gerstel pyrolyzer and cryo trap, was made possible through a $185,938 U.S. Department of Defense (DoD) grant awarded to Dr. Robert Frederick. The award is sponsored by the U.S. Army Research Office.

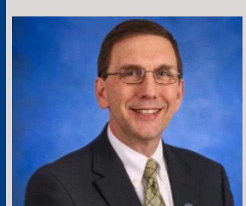
"This is an instrument to measure and analyze the gases that come off SCRAMJET and RAMJET fuels," says Dr. Frederick, who is the principal investigator. "We’re looking for new solid ramjet fuels that expand the operating envelope and range of supersonic and hypersonic vehicles."

The equipment will be used to study the flammability response of a solid polymer fuel as a function of the proportions of the ingredients, says Dr. Daniel Jones, who along with Dr. David Lineberry, Dr. Gabe Xu and Dr. Frederick developed the funding proposal.

"Py-GC/MS analysis will detect and measure the chemical species that are produced as the fuel is heated up to its decomposition temperature," says Dr. Jones. "Additionally, this instrument will be used along with a cryogenic pump to measure and quantify products produced in a rocket combustion chamber during firing in order to obtain a direct measurement of combustion efficiency."

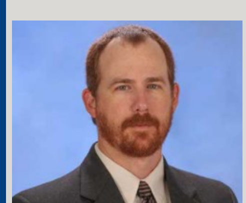
The UAH instrumentation grant is among $50 million in fiscal year (FY) 2021 DoD awards under the highly competitive Defense University Research Instrumentation Program (DURIP).

Learn more about hypersonics research and activities at UAH at www.uah.edu/prc.



Prof. Robert Frederick
MAE Professor & PRC Director
robert.frederick@uah.edu

Prof. Gabe Xu
MAE Associate Professor
gabe.xu@uah.edu



Dr. David Lineberry
PRC Research Engineer
david.lineberry@uah.edu

FACULTY HONORS

The College of Engineering was well-represented at the 2021 UAH ceremony to honor patent recipients. Each inventor was recognized with a plaque that displayed the first page of their patent.

"The commemorative plaques express the university's appreciation for the innovative work of these researchers, which has resulted in patents being awarded by the United States Patent and Trademark Office," says Dr. Robert Lindquist, vice president for research and economic development. "The award of a patent means the inventor has developed a novel innovation that has the potential to be of benefit to society, and we congratulate each of them on their achievement."

UAH over the last two years has received 25 patents, says Kannan Grant, director of the Office of Technology Commercialization.

"That is in indication of the type of translational research that goes on at UAH, and how our faculty, staff and students are embracing innovation and solving real-world problems," he says.

The university is committed to the entire innovation chain and ecosystem, Grant says.

"It starts with recruiting the best faculty members for our students," he says. "These faculty members not only teach, but also conduct groundbreaking research and involve our students in conducting the research."

COE inventors are:

- Apparatus and Method for Determination of Liquid Mass; James Blackmon (Propulsion Research Center)
- Omni-Directional Ultra-Thin Reflection Optical Filters and Methods of Fabrication; Junpeng Guo (Engineering)
- Liquid Container Systems and Methods for Monitoring User Hydration; Emil Jovanov (Engineering)
- Systems and Methods for Multi-Modal and Non-Invasive Stimulation of the Nervous System; Emil Jovanov (Engineering)
- Unmanned Aerial Vehicle Docking System; Stewart King (Engineering) and Brian Landrum (Engineering)
- Specimen Testing Systems and Methods; Kalob Ownby, Michael Henry, Mark Creel, Jeff Evans, Jordan Fulmer, Matt Fulmer, John Le, Melissa Lee, Derek Odom, and Russ Walton (All of Engineering)
- Systems and Methods for Sensing Radiation Using Flash Memory; Biswajit Ray (Engineering)
- Chemically Assisted Rapid Algae Harvesting from Dilute Phase; James Smith (Engineering) and Chen Zhang (Engineering)

2021 College of Engineering Outstanding Faculty Member

Congratulations to MAE Associate Professor, Dr. Jason Cassibry for outstanding contributions to research, education, and service.

INDUSTRY PARTNERS

TORCH TECHNOLOGIES MAKES COMMITMENT TO NAME SPACE IN OLIN KING TECHNOLOGY HALL

(L-R) Dr. Dan Schumacher, Director Technology Development, Torch Technologies; Dr. Bruce Peters, Business Development Solutions Lead, Torch Technologies; Amanda Clark, Director EXPRESS Program Manager, Torch Technologies; John Watson, President & CEO, Torch Technologies; Bill Roark, co-founder, Torch Technologies; joined by Dr. Darren Dawson, UAH President; Dr. Christine Curtis, UAH Provost and Executive Vice President Academic Affairs; Dr. Shankar Mahalingam, Dean UAH College of Engineering; and Mallie Hale, UAH Vice President for University Advancement/Executive Director of UAH Foundation.

Torch Technologies has committed $60,000 to name Room N263 in Olin B. King Technology Hall. The space will be known as the Torch Technologies Measurement and Instrumentation Laboratory.

"On behalf of the Mechanical and Aerospace Engineering Department and the College of Engineering, I am very grateful to Torch Technologies for their support of our Measurement and Instrumentation Laboratory," says Dr. Shankar Mahalingam, Dean of the UAH College of Engineering. "This laboratory provides students with hands-on experience in carrying out experimental measurements, signal acquisition and signal interpretation with broad applications to many engineering areas. Since the relevant course offered in this laboratory is required for both mechanical and aerospace engineering majors, Torch Technologies' investment directly impacts the learning of approximately 300-plus students each year."

Founded in Huntsville, the aerospace and defense industry company has strong ties to both UAH and the surrounding community.

deciBel RESEARCH PLEDGES $90,000 TO NAME ENGINEERING LAB

UAH announced that deciBel Research has pledged $90,000 to name room ENG 264 in the Engineering Building. This space will be called the "deciBel Research Communications and Signal Processing Laboratory."

"UAH's College of Engineering is grateful to deciBel Research for its generous gift to our Electrical and Computer Engineering department," says Dr. Shankar Mahalingam, Dean of the College of Engineering. "This gift will enable hundreds of electrical and computer engineering students to gain valuable hands-on experience in radar systems, antenna design, signal processing using ultra-wideband devices and control systems."

deciBel Research, an employee-owned company, was founded in 2002 to support radar system and sensor technologies research, development, integration and advancement with an emphasis on modeling and simulation analysis; sensor and system test and evaluation; algorithm development; intelligence, surveillance, and reconnaissance; and sensor and system engineering.

(L-R) Jeff Gronberg, deciBel Research CEO and President, Dr. Enrico Poggio, deciBel Chief Scientist, Eric Cochran, deciBel Chief Financial and Operating Officer and Sally Santos, deciBel Chief Analyst joined by Dr. Christine Curtis, UAH Provost and Executive Vice President Academic Affairs, Dr. Darren Dawson, UAH President, Dr. Shankar Mahalingam, Dean UAH College of Engineering and Mallie Hale, UAH Vice President for University Advancement/Executive Director of UAH Foundation

ALUMNI HIGHLIGHTS

PAUL GALLOWAY— 2021 ALUMNI OF ACHIEVEMENT AWARD

Paul Galloway

UAH Alumnus Paul Galloway was selected as the was selected as the 2021 Alumni of Achievement award winner for the College of Engineering. Mr. Galloway earned a BSE in Chemical Engineering in 1983 and a MSE in Mechanical Engineering in 1990.

Mr. Galloway is a Senior Systems Engineer at Teledyne Brown Engineering (TBE) and has amassed 38 year's experience in space payload design, development, testing, integration and operations for manned and unmanned launch vehicles, including the International Space Station (ISS) and SpaceX Dragon. He is tasked with the critically important role of helping ensure the safety and success of each mission he supports.

"I lead and advise the payload development science and engineering team through the ISS Integration and Safety Process," he says. "My job is to work with the scientists and engineers that have a concept or design for a space experiment, and then develop the flight hardware, interface equipment and operational processes that will fully achieve their science objectives in space."

"It is a great responsibility to formally 'sign' for flight hardware developed by a third party," the alumnus says. "I certify to NASA that the hardware and operations do not pose a risk to the flight crew, the vehicle, and that all hazards are known and controlled. Over my career I have designed, developed, integrated and operated about 40 science payloads for the Space Shuttle, Mir Space Station and ISS. Some of these are stand-alone short-term experiments, and some are complex multi-user equipment that has been operating on ISS for decades."

In looking over a career filled with highlights, the engineer points to several that are especially memorable, such as the Multiple User System for Earth Sensing with DLR Earth Sensing Imaging Spectrometer program, a complex pointing system on the exterior of the ISS.

Mr. Galloway says, "I am very appreciative to the UAH Alumni Association and the College of Engineering. This opportunity would not have been possible without the first-class education provided at UAH and the continuing Huntsville success story."

DESTIN SANDLIN OUTSTANDING YOUNG ALUMNI

Destin Sandlin

UAH Alumnus Destin Sandlin was selected as the 2021 Alumni of Achievement Outstanding Young Alumni award winner. Mr. Sandlin earned a MSE in Aerospace Engineering in 2011 and is pursuing a doctoral degree in mechanical engineering, also at UAH.

He is employed as an engineering contractor for ERC in Huntsville, a company that provides technical support to the defense and aerospace industries. Though he's best known for the educational video series he created and hosts, ***Smarter Every Day*** (SED), a YouTube phenomenon that makes science accessible – and fun – for those curious about the way things work.

"I've always been a 'tinker-thinker,'" Sandlin explains. "I really enjoy exploring and learning stuff. I was working as an engineer, and at night I would work on things in my garage, like trying to recreate Dr. Harold Edgerton's photos." Harold Eugene "Doc" Edgerton was a scientist at the Massachusetts Institute of Technology who transformed the stroboscope from an obscure laboratory instrument into a popular device for making stroboscopic photographs.

The UAH alumnus soon discovered he had a real talent for elucidating how things work on camera that became the impetus for launching SED. Since its debut in 2011, the series has exploded in popularity with over 10 million subscribers and almost 300 episodes.

For more information: https://www.youtube.com/c/smartereveryday/featured

ALUMNA NAMED US SPACE AND ROCKET CENTER CEO


Dr. Kimberly Robinson

Dr. Kimberly Robinson has been named Executive Director and CEO of the U.S. Space & Rocket Center (USSRC). She earned a MSE in Industrial and Systems Engineering in 1999 and a PhD in Industrial Engineering is 2010, both with an emphasis on Engineering Management.

Dr. Robinson is a 31-year veteran of NASA, where she was awarded an Exceptional Achievement Medal and the Silver Snoopy. She began her career at Marshall Space Flight Center in 1989 as a Project Engineer in the Propulsion Laboratory, became an astronaut trainer, served as an Executive Intern to the Center Director, was the Project Integration Manager for the Ares 1-X test flight, served as the Payload Mission Manager for Artemis 1 (the first integrated flight test of NASA's Space Launch System rocket with the Orion spacecraft) and most recently led Utilization for all Artemis missions for NASA HQs/Advanced Exploration Systems.

A critical goal is to mitigate the financial impact brought about by the COVID-19 crisis.

"It would have been easier to step into this role had the Rocket Center been in a better financial situation rather than in a recovery mode after the pandemic," the new CEO says. "But it wouldn't have appealed to the part of me that enjoys the challenge. I had a mentor at NASA who said if you want to be valuable to an organization, you go to where they need you. You don't go where you want to go or go for the best pay or the best title; you go where someone needs you, and do the best job that you can – that's how you prove your value."

Dr. Robinson also fully understands the importance of helping this cherished Huntsville landmark thrive once more.

"It is a solemn responsibility that I take seriously. It is human nature to explore the unknown and push the boundaries, and space exploration is one way we have done that to a magnificent degree. The U.S. Space & Rocket Center showcases those human achievements that have expanded technologies, opened new frontiers and discovered new worlds. The story itself is the compelling narrative, and we're here to make sure it shines in a way that connects to each visitor who walks in the door."

ALUMNUS LEADS NON-PROFIT WORK

UAH Alunmus Taylor Reed recently launched *ShowerUp Huntsville*, a 501(c)3 non-profit that provides mobile showers, personal care and hygiene supplies to the homeless.

Mr. Reed earned a BS in Mechanical Engineering in 2016 and recently completed a six-year term on the UAH Alumni Association Board. He is employed as the Quality, Safety & Mission Assurance Lead for Advanced Research for the Missile Defense Agency in Huntsville. He says his passion for helping others comes from a deep wellspring of personal values he was taught and a belief in giving back to others.

After an anonymous donor agreed to provide funds to build a custom shower trailer to launch the operation, ShowerUp Huntsville was born. Mr. Reed quickly transitioned from fundraiser to leader and, since May 2020, he has been overseeing the day-to-day operations of the group. He also coordinates special events and collaborates with local businesses, churches and organizations to form partnerships to serve the homeless. Little did he know that he would immediately be guiding his vessel of hope straight into the storm of a pandemic.

Looking to the future, Reed says his group is still hoping to raise awareness with the general public who may have resources or ways they can help or partner.

"Being a non-profit, we run solely off of volunteers and donor support," the UAH alumnus adds. "The more people who donate and partner, the more we can continue to do amazing things!"

For more information: https://www.facebook.com/showeruphuntsville

STUDENT SUCCESS


Declan Brick

AE STUDENT NAMED GOLDWATER SCHOLAR

Declan Brick, an aerospace engineering and physics double-major has been named a Goldwater Scholar, the first from UAH in 13 years. Brick is an undergraduate research assistant at the UAH Plasma and Electrodynamics Research Laboratory and is mentored by Dr. Gabriel Xu, an associate professor of mechanical and aerospace engineering.

The honors student says the application process helped point him toward what he wants to do in his Ph.D. research. His Capstone project involves plasma jet modeling where low temperature plasma and plasma devices have been shown to sterilize biological materials without incurring thermal damage.

“It’s been great working with Dr. Xu!” the student says. “He’s been very supportive. Helping out, but not handholding. He offers guidance but lets me go into the muck. I really appreciate that. I’m a computationalist, whereas his line is very experimental. Somehow I’m a computationalist who likes to experiment a lot!”

The Barry Goldwater Scholarship was established in 1986 by Congress in partnership with the Department of Defense National Defense Education Programs (NDEP) to honor Senator Barry Goldwater, who served 30 years in the U.S. Senate. The undergraduate scholarship is given annually to applicants in the natural sciences, engineering and mathematics to around 300 college sophomores and juniors nationwide with the goal of providing the country with a continuing source of highly qualified scientists, mathematicians and engineers. The scholarship is awarded based on merit, up to a maximum of $7,500 per academic year. Colleges and universities are allowed to nominate only four undergraduate students per year, making it a premier award in the U.S.

EATON NAMED 2021-2022 AMELIA EARHART FELLOW


Casey Eaton

Casey Eaton, a doctoral student in Systems Engineering was one of 36 women from 22 countries to be awarded a $10,000 Zonta International Amelia Earhart Fellowship for the 2021-2022 academic year. The AE fellows were chosen from 183 applicants worldwide, according to Zonta International, which says that just 25 percent of the workforce in the aerospace industry consists of women. The fellowship is designed to enable talented women from around the world who are pursuing doctorate degrees in aerospace engineering and space sciences to invest in state-of-the-art equipment to conduct their research, present their research at international conferences and participate in specialized studies.

Ms. Eaton is advised by Bryan Mesmer, an associate professor of Industrial and Systems Engineering and Engineering Management. Eaton graduated summa cum laude from UAH in May 2019 with a bachelor's degree in industrial and systems engineering with an honors diploma, and she earned a UAH master's degree in systems engineering in July 2020.

“This is a very prestigious award, which I think reflects the excellence of UAH's research in aerospace and systems engineering,” she says. “I've been very fortunate to be able to study here.”

With Prof. Mesmer’s guidance Eaton is working on two NASA-funded projects, one on the value of model-based systems engineering (MBSE) and another on project factors that lead to failure.

“Through these projects, Casey has become recognized as a leader in the field of project factors that lead to failures,” Prof. Mesmer says. “She has taken full reign of the projects and is leading them to success through multiple future publications.”

RESEARCH EXPERIENCE ON ADVANCED INFRASTRUCTURE MATERIALS

Wesley Hong

Wesley Hong, a Chemical Engineering and Honors College student at UAH, won a National Science Foundation Research Experience for Undergraduates (REU) summer internship at the University of Louisiana Lafayette's Advanced Infrastructure Materials (AIM) program. During this summer internship, Hong had the opportunity to work on cutting-edge research projects pertaining to advanced infrastructure materials.

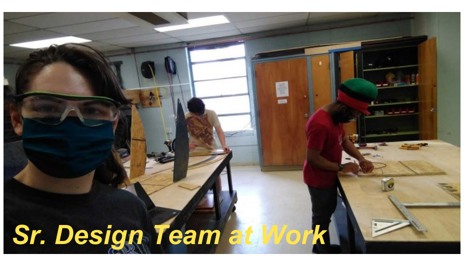
Hong was paired with faculty mentor, Prof. Dilip Depan, to research the use graphene oxide nanoscrolls with a polycarboxylate to make cement composites, a carbon nanomaterial reinforced concrete.

Hong’s experience with the University of Louisiana Lafayette’s AIM program directly aligns with his future goal of pursuing a M.S. degree in chemical engineering.

After obtaining his M.S. degree, Hong aims to enter into a research and development career in the chemical engineering industry.

Hong notes, “I got introduced to performing research, I really enjoyed it and I believe that my career will in some way incorporate research. I also am much more interested in pursuing a graduate degree and doing research at a graduate level.”

MAE SR. DESIGN PROJECT SUPPORTS NAVY SUBMERSIBLES



Sr. Design Team at Work

A unique storage system for a U.S. Navy Submersible developed by a MAE senior design team will be in the running for actual Navy use. Team lead is Nadia Alexander, a ME major and team members are fellow ME majors Jay Hayman, Tegan Ruffalo, Kayli Wood and Nic Shelton and AE major Christopher Smith.

The team was given a list of objects that need to be stored on the submersible and some pictures of what the interior looked like. The goal was to deliver a final, usable product to the customer. It’s been a fluid process and the storage solution design the team is currently manufacturing bears very little resemblance to its initial design.

After a product readiness review, the product was shipped to the Navy for testing in the operational environment of a submersible.

ASE GRADUATE STUDENT WINS BEST PAPER AWARD

Saroj Kumar

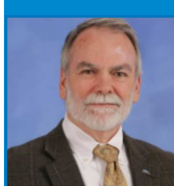
Saroj Kumar, a doctoral student in the Department of Mechanical and Aerospace Engineering has won an inaugural Best Student Paper award at the Nuclear and Emerging Technologies for Space (NETS) 2021virtual conference sponsored by the Oak Ridge National Laboratory.

His paper, "Decoding Mission Design Problem for NTP Systems for Outer Planet Robotic Missions" was awarded in the conference’s Track 3 – Mission Concepts and Policy for Nuclear Space Systems. Kumar is majoring in aerospace systems engineering and is from Kanpur, India.

NTP is the acronym for nuclear thermal propulsion. NASA is currently focused on a crewed mission to Mars as the driving scenario for development of an NTP engine. Kumar’s research explores other, uncrewed solar system exploration missions that would benefit from a more powerful propulsion technology.

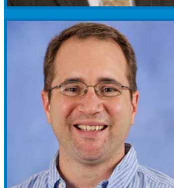
Working in UAH’s Complex Systems Integration Laboratory (CSIL), Kumar is advised by Dr. Dale Thomas, UAH’s eminent scholar in systems engineering and a professor of industrial and systems engineering, and Dr. Jason Cassibry, an associate professor of mechanical and aerospace engineering. His focus is on developing mission architectures, conducting high-fidelity trajectory analysis for NTP systems and simulating mission operations using model-based engineering and model-based systems engineering.

Kumar’s paper demonstrates the mission feasibility of NTP for voyages to the outer planets and addresses the development challenges needed to conform with the requirements of NASA’s planetary science mission programs.



Prof. Dale Thomas

dale.thomas@uah.edu



Prof. Jason Cassibry

jason.cassibry@uah.edu

SUMMER COMMUNITY OF SCHOLARS ENGINEERING STUDENT AWARDS

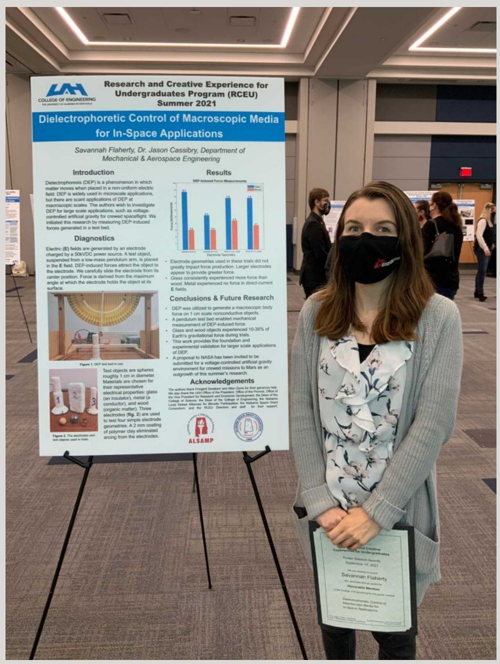
The Summer Community of Scholars (SCS) is composed of the Research or Creative Experience for Undergraduates and the Honors Capstone Research Summer Program. Its purpose is to support research or creative experiences for undergraduate participants in all fields of study.

The overall vision of the program is to sustain a vibrant culture of research and creative activities for undergraduates at UAH. Participants undertake activities within a project of research or creative works.

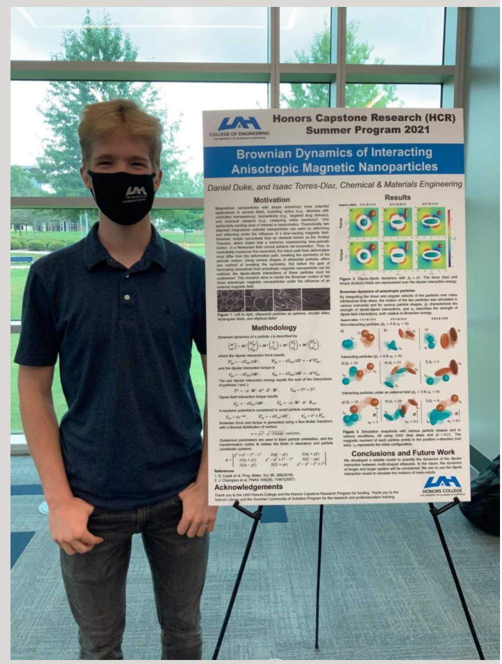
There were 37 SCS undergraduates who spent the summer working with faculty and research staff on cutting-edge projects from astrophysics to history. The College of Engineering “Best of College” was awarded to Sam Blackwell whose research topic was “*Simulation of a Trailing Edge Flap Using a Compliant Mechanism*”. His research mentor is MAE Professor Kostas Kanistras. Honorable Mention was awarded to Savannah Flaherty whose research topic was *“Dielectrophoretic Control of Macroscopic Media for In-Space Applications”*. She is mentored by MAE Professor Jason Cassibry.

Chemical Engineering major and Honors College student, Daniel Duke, was awarded “Best of College” for his research topic, “Brownian Dynamics of Interacting Anisotropic Magnetic Nanoparticles”. His research mentor is CME Professor Isaac Torres-Diaz.

Sam Blackwell, AE Major

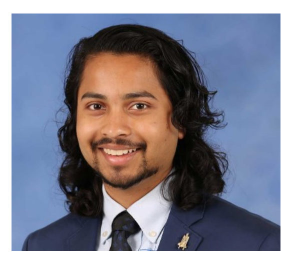


Savannah Flaherty, EE Major



Daniel Duke, CHE Major

MATTHEW ISAKOWITZ FELLOWSHIP AWARD TO MAE UNDERGRADUATE



Alay Shah

MAE undergraduate student Alay Shah has been selected to the Matthew Isakowitz Fellowship Program. Shah, a junior, is one of 30 fellows selected from over 280 applicants for the 2021 summer internship and executive mentorship program designed to inspire the next generation of commercial spaceflight leaders. His fellowship host company is Blue Origin.

His UAH mentors include Dr. Dale Thomas, a professor of industrial and systems engineering and eminent scholar in systems engineering for whom Shah is an undergraduate research assistant at the Complex Systems Integration Laboratory (CSIL), and Jonathan Patrick, a systems engineer for the Rotorcraft Systems Engineering and Simulation Center (RSESC).

The highly selective program awards exceptional college juniors, seniors and graduate students pursuing aerospace careers with paid internships at cutting-edge commercial space companies. Fellows also receive one-on-one mentorship from accomplished members of the space community, including astronauts, engineers, entrepreneurs, executives, investors and others.

Micheala Hemming

ASE GRADUATE STUDENT WINS THREE SCHOLARSHIPS

Michaela Hemming, an Aerospace Systems Engineering (ASE) graduate student has been awarded three separate graduate scholarships. She was awarded the U.S. Department of Defense National Defense Science and Engineering Graduate fellowship and DoD's Science, Mathematics and Research for Transformation scholarship, as well as the NASA Space Technology Graduate Research Opportunities with each begins in the fall semester.

Ms. Hemming is a graduate research assistant in UAH's Propulsion Research Center (PRC) and is advised by MAE Prof. Gabe Xu. She plans to pursue her Master's Degree and then start her doctoral program.

"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."

Hemming has also been mentored by Dr. Levon Gevorkyan and Dr. Robert Driscoll at The Aerospace Corp., who wrote recommendation letters for her applications. In addition to her graduate work, Hemming is working with her step-father, Kevin Friesth, on the beginning stages of standing up a launch vehicle company using recyclable,

TEAM FALCON WINS THIRD PLACE IN ROVER CHALLENGE

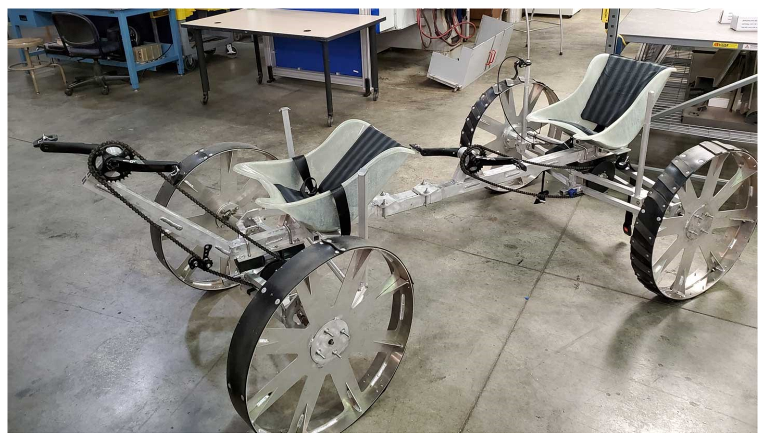
For more than 25 years, the annual NASA Human Exploration Rover Challenge (HERC) has tasked high school and college teams from around the world to design, build and test a human-powered rover capable of traversing simulated terrain from the moon, Mars and other rocky planets. Along the way, teams are also required to complete scientific tasks, reflecting spacewalks that were completed during NASA's Apollo Program and may be completed during NASA's Artemis Program.

Team Falcon, one of two rover teams competing from UAH won third place overall in the collegiate division at the 2021 HERC event.

Team Falcon relied on light weight and simplicity when it redesigned a rover from a previous class for the pandemic altered competition. The rover weighed in under 150 pounds, extremely light compared to other rovers in the UAH fleet.

HERC judging was virtual this year and the in-person moon obstacle event at the U.S. Space & Rocket Center was cancelled. In January, MAE Senior Design Moon Buggy class Teams Falcon and Twisted Metal presented a design review to a NASA panel consisting of subject matter experts. The teams then presented an operational readiness review to the same NASA panel in March. The competition also included video presentations.

David Fikes is the Moonbuggy Senior Design Instructor and serves as an MAE Lecturer. "The students were willing to put in the time that it took to do the extra things that are required to successfully build a rover," Fikes says. "They met a lot on weekends to get the work done. The pandemic didn't seem to slow them down that much. Some put in many, many extra hours to complete their project."



Team Falcon members (majors) were:

- John Baggett (ME), Team Lead
- Susan Duron (ME), Rider and Practice Course Lead
- Maggie Fielder (ME, Social Media Lead
- Julia Fullinwider (ME), Financial Lead
- Lindsey Kaesemeyer (ME), Task Design and Integration Lead
- Robert Lewallyn (ME), Rider and Design Team
- Haley Schumann (ME), Financial Team and Backup Rider
- Luke Smith (ME), Financial and Design Team

ENGINEERING STUDENTS ARE FIRST PREVOST SCHOLARS


Tiffany Dinh


Michael Sorrell

The College of Engineering proudly recognizes selection of the first two Prevost Scholars through the UAH Honors College: Tiffany Dinh, who is majoring in computer engineering, and Michael Sorrell, a mechanical engineering major.

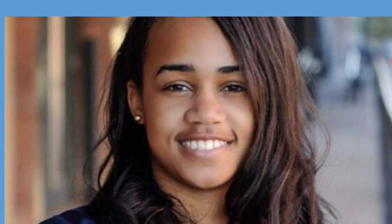
Prevost Scholars are funded through a gift by Stanley E. Prevost. The Stanley E. Prevost Honors Scholarship is designed to function as an "Honors within Honors program" to attract the top STEM students to the College by providing an exceptionally rigorous educational experience. The program is intended to target top STEM students within the Honors College, following the National Science Foundation's (NSF) definition of STEM fields.

Dinh was also chosen the Dr. Jeanne Fisher Most Outstanding Student Leader, an award named in honor of Stanley Prevost's former wife, who passed away in 2015. Dinh serves as the SGA Outstanding Cabinet Member as well and was selected for a Department of Defense (DoD) Internship as Cyber Force Incubator Project Manager for the Center for Cybersecurity Research and Education.

DOD SMART SCHOLARSHIP AWARDEES FROM COE

The Department of Defense Science Mathematics and Research for Transformation (DoD SMART) is a nationally recognized scholarship-for-service program in which the DoD provides a full scholarship for recipients to pursue STEM degrees that are focused on research to further the DoD's mission, along with health insurance, an annual stipend and an assignment to an experienced mentor in their field.

The College of Engineering proudly recognizes the following engineering undergraduates that were awarded SMART scholarships this year.

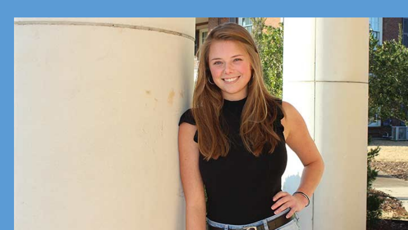

Alencia Hall

Alencia Hall is an Honors junior majoring in Aerospace Engineering and has been awarded an undergraduate SMART scholarship. She has been offered a position with the Missile Defense Agency (MDA) on Redstone Arsenal and will have the opportunity to accept summer internships at the agency. Hall is involved with several organizations at UAH, including the Alabama Louis Stokes Alliance for Minority Participation Scholarship (ALSAMP) and serves as an Honors Ambassador in the Honors College. In addition, she was recently awarded an internship with Johns Hopkins University's Applied Physics Laboratory.


Michaela Dent

Michaela Dent is a Cybersecurity junior entering into her second year with DoD SMART, having completed her first internship with the U.S. Army Combat Capabilities Development Center (CCDC) Aviation and Missile Center (AvMC) at Redstone Arsenal.

Savannah Baron is an Honors Mechanical Engineering student in her junior year who has been awarded an undergraduate scholarship with MDA. Through her upcoming MDA summer internships, she is confident this experience will help her find some answers about her career path. Her interest in the Defense industry is the primary contributing factor to her acceptance of the SMART scholarship, and she is looking forward to learn more about this entering into this job market, whether within government or branching out to private industry.


Savannah Baron

STUDENT ORGANIZATIONS

Students in the Department of Civil & Environmental Engineering (CEE) brought home three firsts, two seconds, one third and one fourth in recent American Society of Civil Engineers competition at the virtual ASCE Southeast Student Conference.

"The success of the students in the ASCE competitions highlights a dedication to the practice of civil engineering and the ability to take what is taught in the classroom and transfer that knowledge to real projects," says Dr Michael Anderson, CEE department chair and associate dean of graduate education and research.

Dr. Anderson assists in the advising of the UAH ASCE Student Chapter with Dr. Ashraf Z. Al- Hamdan, a clinical associate professor of Civil Engineering focusing on geotechnical and geo-environmental engineering.

AMERICAN SOCIETY OF CIVIL ENGINEERS
THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

First Place Awards:

USEI Surveying—Leader: Zeb Maze; Members: Alden Gordon, Conner Twyman

Sustainable Conference—Leader: Connor Moore; Members: Nate Brinkman, Rebecca Ibsen, Kait Neese

Pykrete—Leader: Nate Brinkman; Members: Sarah Puchner, Callahan Diercks, Connor Moore

Second Place Awards:

Concrete Cornhole—Leader: Conner Twyman; Members: Connor Moore, Callahan Diercks, Luke Childress

Concrete Horseshoes—Leader: Alden Gordon; Members: Sarah Puchner, Kelly Campo

---

Department of Mechanical & Aerospace Engineering (MAE) students brought home first and third places in team competition and a third in the undergraduate category at the virtual American Institute of Aeronautics and Astronautics (AIAA) Region II Student Conference. MAE Associate Chair and Associate Professor, Dr. Brian Landrum, serves as faculty advisor to the UAH AIAA Student Branch.

"One university placing two teams in the top three in this category is unusual. Placing in the Undergraduate category is also a significant accomplishment," he says. "This just confirms the quality of our MAE students and program. All our student participants were great representatives of UAH."

AIAA STUDENT BRANCH
REGISTERED STUDENT ORGANIZATION

AIAA
SHAPING THE FUTURE OF AEROSPACE

Team Category

First Place– "Proposal for austere light attack aircraft – Project Aardvark," Joseph Hayes, Andrew Heath, Brady Alexander, Spencer Grady, Jorge Velasco, Noah Jorgensen, Veronica Rodriguez and Joshua Richardson.

Third Place– "Kestrel Aeronautics: KA-Ranger," Madison Smith, Jason Burke, John McDonough, Lindsey Dow, Connor Hawkins, Nathaniel Matthews, Thomas Key and Wyatt Dritz.

Undergraduate Category

Third Place– "Developing a Flapping Gear System for Butterfly-Inspired Motion," Frederick Schulze and Chang-Kwon Kang.

COLLEGE FACTS

Bachelor of Science

Aerospace Engineering (BSAE)
Chemical Engineering (BSCHE)
Civil Engineering (BSCE)
Computer Engineering (BSCPE)
Cybersecurity Engineering (BSCYB)
Electrical Engineering (BSEE)
Industrial & Sys Engineering (BSISE)
Mechanical Engineering (BSME)

Master of Science in Engineering (MSE)

Chemical Engineering
Civil Engineering
Computer Engineering
Electrical Engineering
Industrial & Systems Engineering
Mechanical Engineering

Master of Science in Aerospace Systems Engineering (MSASE)

Master of Science in Software Engineering (MSSE)

Master of Science in Operations Research (MSOR)

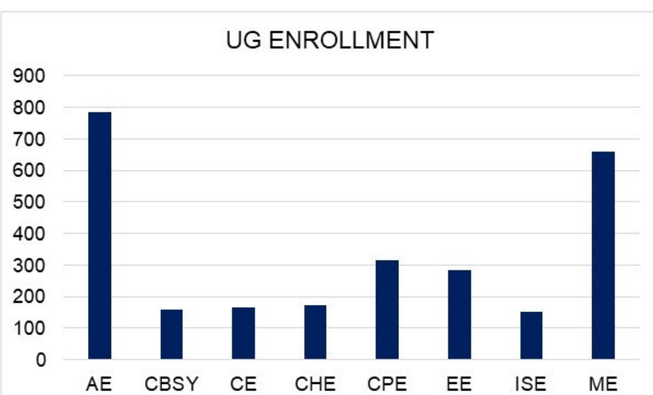
Doctor of Philosophy (PhD)

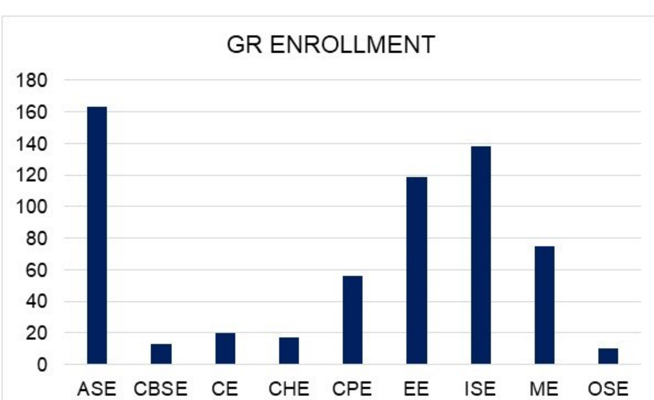
Aerospace Systems Engineering
Civil Engineering
Computer Engineering
Electrical Engineering
Industrial & Systems Engineering
Mechanical Engineering

Interdisciplinary Degrees

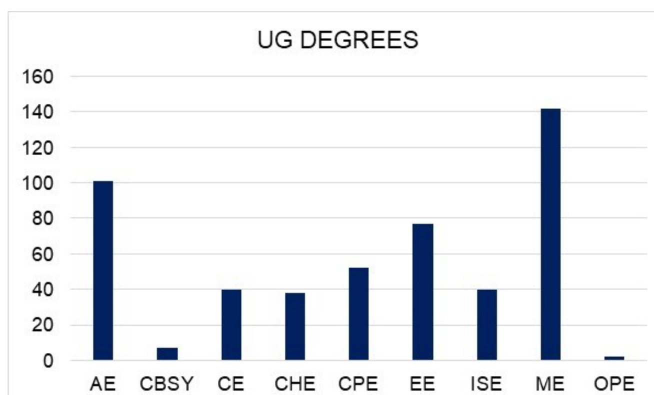
MS in Cybersecurity
PhD in Biotechnology
MS and PhD in Materials Science
MS and PhD in Modeling and Simulation
PhD in Optical Science and Engineering

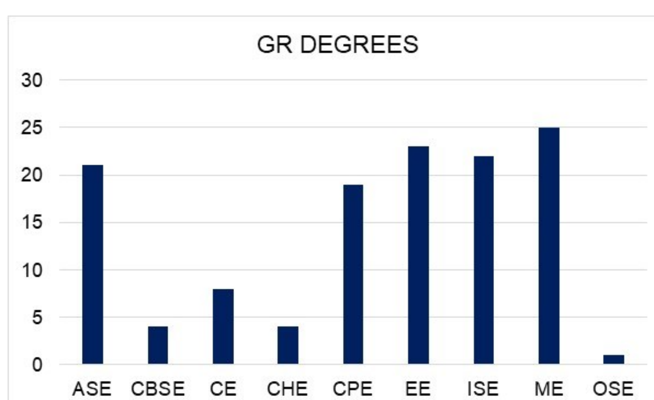
Enrollment: Fall 2021





Degrees Awarded: 2020-2021





ENGINEERING ADVISORY BOARD

The College of Engineering extends a sincere thank you to each of our EAB members for their service.

Dr. Richard Amos
President & COO
Colsa Corportation

Dr. Tim Barton
Dynetics Group CTO
Sr VP, Leidos

Mr. Lance Cooper
Sr. VP Government Operations
Aegis Technologies

Dr. Patti Dare
Executive Director, Huntsville Site
Raytheon Technologies

Mr. Alan "Wade" Doss
Director of Engineering
US Army Engineering & Support Center

Dr. Richard Goodson
Chief Technology Officer
Adtran, Inc

Mr. Sami Habchi
Executive Vice President
CFD Research Corporation

Mr. Joe Hill
Chief Technology Officer
Torch Technologies

Mr. John Honeycutt
Program Manager
SLS

Mr. Todd Hutto
U.S. Army Value Engineering Manager, Continuous Process Improvement Division
AMCOL-MC

Dr. Marc Kimpe
Sr. VP Research and Development
Adtran, Inc.

Mr. Bob McCaleb
Corporate Lead Executive
Northrop Grumman Corporation

Mr. Steven Noojin
Director of Engineering
The Boeing Company

Dr. Enrico Poggio
Chief Scientist
deciBel Research, Inc.

Mr. Reggie Spivey
Vice President
Teledyne Brown Engineering

Mr. Tim Thornton
President & CEO
nLogic

Dr. Louis Weiner
President
Delta Research

ENGINEERING STUDENT ORGS

American Institute of Aeronautics and Astronautics
American Institute of Chemical Engineers
American Society of Civil Engineers
American Society of Mechanical Engineers
Electric Vehicle Club
Engineers for Global Action
IEEE
Institute of Industrial Engineers
National Society of Black Engineers
Optical Society of America
Reverse Engineering Club
Society of Asian Scientists and Engineers
Society of Hispanic Professional Engineers
Society of Military Engineers
Society of Women Engineers
Space Hardware Club
Tau Beta Pi

College of Engineering

The University of Alabama in Huntsville

301 Sparkman Drive, EB 102

Huntsville, AL 35899

Find us on Instagram: @uah_engineering

Non-Profit
Organization

US Postage Paid
Huntsville, AL

Permit #283

THE UNIVERSITY OF
ALABAMA IN HUNTSVILLE

PART
OF THE
University of
Alabama System