Georgia Tech Daniel Guggenheim School of Aerospace Engineering

Fall 2020

How We Learn

It's the theme that puts this past year in context, and it's also what gives me optimism – amidst continued uncertainty – for the future.

As every engineer knows, we learn from being challenged. That fairly well describes the AE School's situation during the COVID-19 pandemic: we have been challenged. When the campus cleared out in mid-March, the shadow of failure loomed over all of us. Newly appointed associate chair, Prof. **Karen Feigh**, immediately began identifying opportunities for essential research to continue under new safety guidelines. Her colleague, Prof. **Claudio Di Leo** began tutoring his fellow faculty on remote teaching technologies, the foundation of our current hybrid teaching model. Doctoral student **Lee Whitcher** took a detour from his studies to initiate Atlanta Beats COVID, an all-volunteer non-profit that organized Atlanta-area maker spaces to design and fabricate PPE for healthcare providers, first responders, and other essential personnel. Communications officer **Kelsey Gulledge** worked overtime to produce a live video version of our Commencement Ceremonies. And dozens of AE students followed through on their commitment to summer internships, even if the work was now being done remotely.

Over the last six months, the AE School has also responded to a renewed call to correct racial injustice in our world. A new standing committee on Diversity, Equity & Inclusion will guide our efforts to make opportunity a real goal for all who seek it. We also welcomed the efforts of student groups like the Women of Aeronautics & Astronautics, which hosted video forums that invited the entire AE community to look at issues like microaggressions and workplace discrimination.

We are taking these steps not because we know we will meet immediate success, but because it puts us on a road to success. And along this path, we will learn.

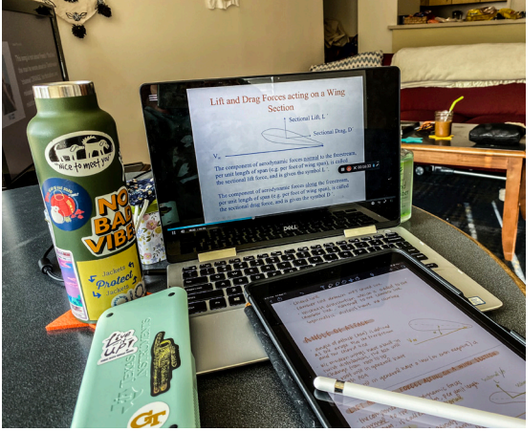
If I've suffered any doubts about this, the example set by students like **James Kenny** is quick to correct me. Deployed to East Africa before the semester began, James was the first AE student to answer our call for photos showing "How We Learn" - the cover of this report. His shadowy photo shows us the inside of an aluminum container box that served as both home and classroom for James, a master's student. A modest laptop is filled with equations from his Fundamentals of Solid Mechanics class, but it's the banner to the left that says it all: **Keep A Good Thought.**

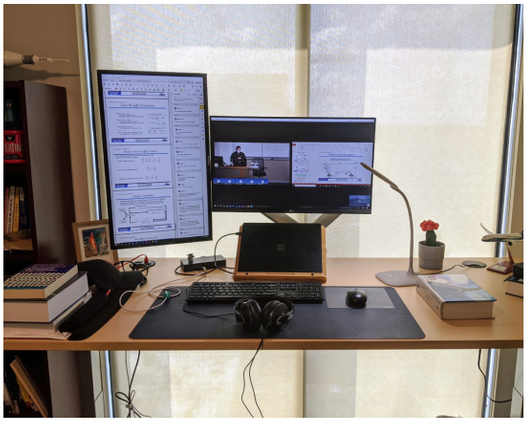
Great point, James.

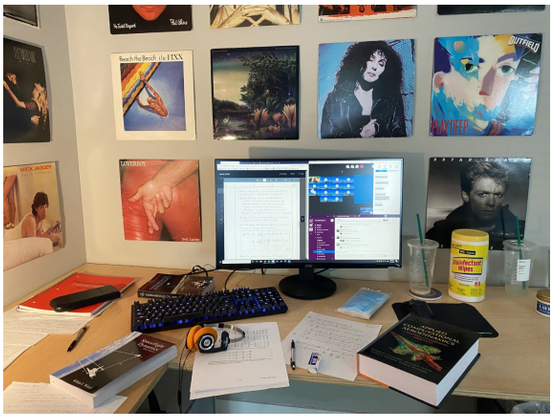
That, too, is ***how we learn.***

Mark F. Costello

Mark F. Costello
William R. T. Oakes Professor and School Chair



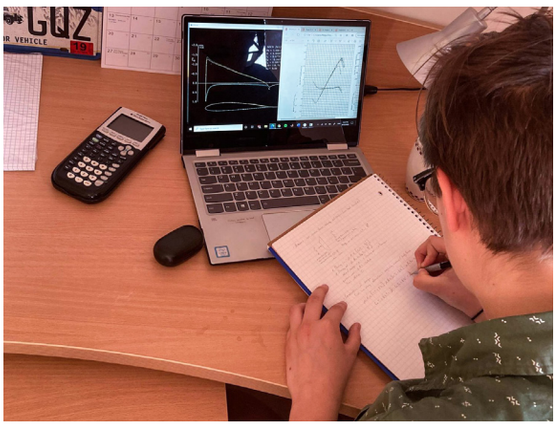


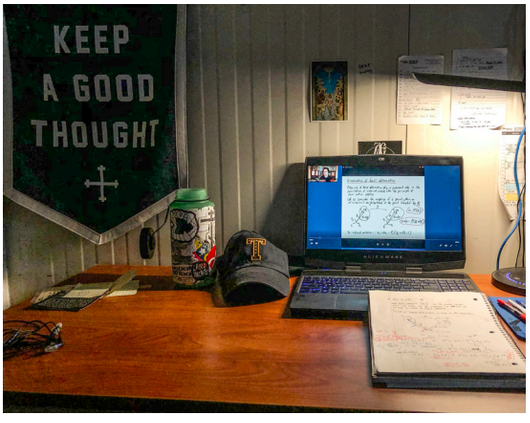


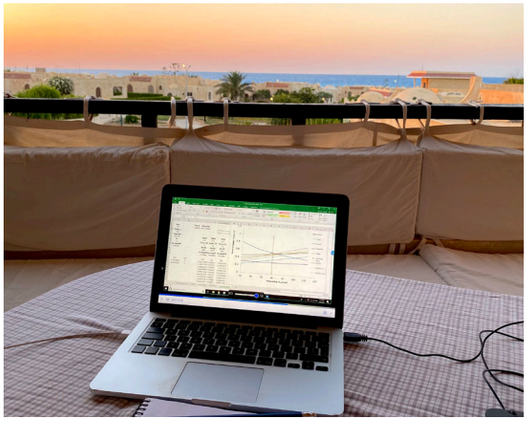
HOW WE LEARN

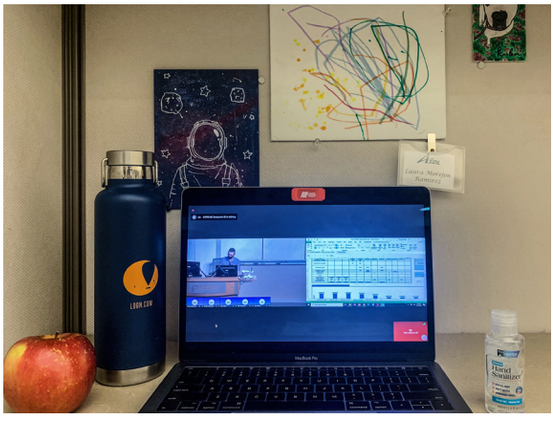
THE 2020 ANNUAL REPORT

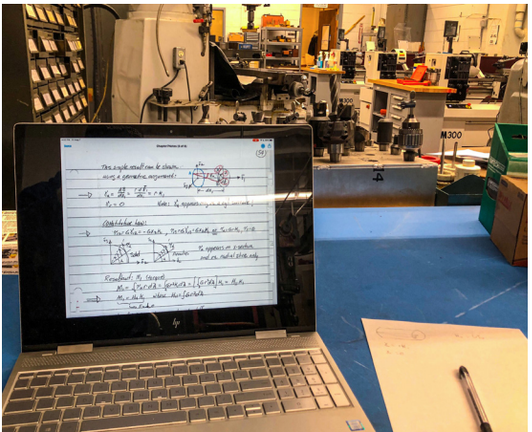
Georgia Tech | Daniel Guggenheim School of Aerospace Engineering

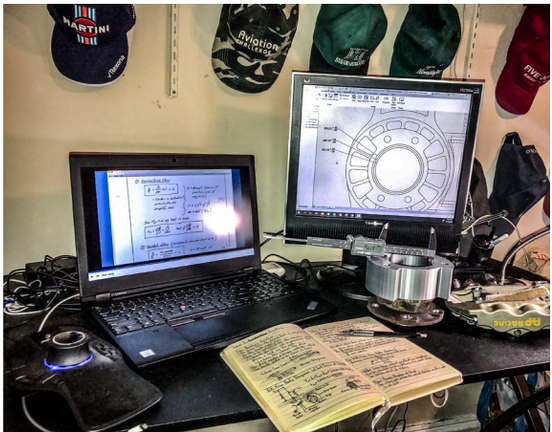












EXPANDING AE LEADERSHIP

The newest member of the School of Aerospace Engineering leadership team, Prof. **Karen Feigh**, was appointed to the position as associate chair for research programs two days before the COVID-19 crisis put the entire campus into a quarantine-induced lock-down. For a time, it looked like the School's $30+ million research program would be impacted.

Not under the watch of Karen Feigh.

A renowned expert in the field of cognitive engineering, she put together a plan that balanced safety with rigor.

“I immediately started going through each faculty’s research, to determine if it met the Institute’s guidelines for being classed ‘essential’ and therefore allowable on campus,” said Feigh.

“It was a busy time, and I will say it was an odd way to start this position – asking all non-essential on campus research asked to pause. But it also reinforced something I’ve always known about the academic research enterprise at Tech: it’s not grounded in the buildings or the campus. The process of knowledge creation, of knowledge discovery, is something that continues outside of that."

"And over the last few months, I’ve been impressed by how much we’ve been able to move online, by how much we’ve been able to continue projects, and begin new ones, all while staying within the COVID guidelines.”

Feigh is constantly looking beyond the current crisis to the next opportunity to expand the School’s impact. She sees a lot of promise in the Post-Doc program she created, which offers two-year positions to top AE graduate students.

“This program is addressing several areas - all of them, critical," she said. “It’s increasing the number of well-trained, motivated research faculty that we can bring into our labs and classrooms, which is great for our research efforts. The Post-Docs are able to teach classes, oversee lab work, help with reporting requirements, and mentor students. That gives our

faculty enormous freedom to do more deep work while also pursuing new research opportunities, meeting with sponsors, and networking – things that all take significant time.”

The Post-Doc program is also a meaningful way for the AE School to make good on its commitment to strengthen and diversify the teaching profession.

"Our Post-Docs are all potential faculty members. But many underrepresented minorities and women are uncertain if they can be successful as a faculty member," Feigh said. "The Post-Doc Fellows program allows them to try on the role for two years and to gain some confidence."

They also build a resume that will propel their careers.

“Our Post-Doc Fellows get the chance to develop an undergraduate course and teach it for two semesters. That’s a confidence-builder, but it’s also one less thing they’ll have to do when they land a faculty position. And, also, when they are applying for positions, they will have two additional letters [of recommendation] from Tech to bring to their candidacy.”

WELCOMING NEW FACULTY

PROF. CHRISTOPHER E. CARR


Prof. Christopher Carr

Joining the Aerisoace Engineering School's Space Systems Design Lab this fall is Prof. **Christopher E. Carr**, an engineer and scientist with training in aero/astro, electrical engineering, medical physics, and molecular biology.

Carr's research interests include space instrument development, space missions and systems seeking, the support of life beyond Earth, from microbes to humans; astrobiology, genomics; single molecule detection; machine learning; microbial adaptation and evolution; origin of life; planetary protection.

Carr serves as the principal investigator (PI) or science PI for several life detection instrument and/or astrobiology/ space biology projects. He is broadly interested in enabling a sustainable human future while searching for, and expanding the presence of, life beyond Earth. He previously served as a research scientist at MIT and a research fellow at the Massachusetts General Hospital.

PROF. JüERGEN RAULEDER

Prof. **Jüergen Rauleder** will be joining the Aerospace Engineering School's extensive research efforts in vertical lift and aeromechanics.


Prof. Jüergen Rauleder

Rauleder's research interests include experimental and applied numerical aerodynamics, with a focus on interactional aerodynamics, coupled aerodynamics with flight dynamics, as well as active, shape-adaptive rotating and fixed wings.

His basic research is applied to the aerodynamic design and understanding of current and future vertical lift configurations, including advanced urban air mobility and UAS, pilot training, and simulators. Rauleder's research is sponsored by the U.S. Army, Navy, NASA, ONR, NATO, the EU, and by industry. He serves on the Vertical Flight Society (VFS) Board of Directors, on the AIAA Applied Aerodynamics Committee, and is the chair of the VFS Aerodynamics Technical Committee.

Prof. Claudio Di Leo: Defining the Intersecton of Mechanics & Chemistry

When Prof. **Claudio Di Leo's** Multiphysics Mechanics of Materials Lab (M3Lab) started trying to improve the performance and safety of nextgen lithium batteries, they opened up a number of interesting problems. Their work has been generating answers ever since.

"We received an NSF grant to develop nanoarchitected battery electrodes, which is big, because we need batteries that are safe but also have high energy density," he said. "But at the heart of our work is the coupling between chemistry and mechanics – something that occurs in many engineering systems, not just batteries. The problems we tackle at the microstructure level make it a lot more complex."

Initially, their work started with the replacement of traditional graphite electrodes with ones made from amorphous silicon -- a material that can store 10 times more lithium.

That solution begat another problem: the high-capacity silicon electrodes tended to deform and expand when bombarded by lithium ions. That deformation caused mechanical degradation.

For this, they found another solution: manipulate the microstructures that make up silicon electrodes, such that their eventual deformation caused nanoarchitected lattices within them to buckle inward instead of out. Findings from this work were summarized in "Electrochemically Reconfigurable Architected Materials" an article that appeared in the *Journal Nature* in 2019.

The more they focused on architecture, the more they saw possibilities. For instance, different lattices can prevent or allow waves of a different frequencies to pass through them.

Prof. Claudio Di Leo

"An important aspect of our work is then understanding how different designs influence the manner in which the nanoarchitected lattices deform due to electrochemical stimuli. We envision creating a nanoarchitected material that has tunable properties. You might want to do this to stop the degradation of a material or to stop the degradation of a material that is behind it."

A grant from the US Air Force is allowing Di Leo and Georgia Tech collaborators to investigate another chemistry-meets-mechanics conundrum: hydrogen embrittlement - the process by which a metal alloy is weakened when diffused hydrogen collects along crystal boundaries. Di Leo is simulating different microstructure qualities - like grain distribution, volume, and size - that will predict a particular material's susceptibility to embrittlement.

"Ultimately, they all fail, but when we have more data, we'll be able to leverage it to create less susceptible alloys and forestall that failure."

Find out more: *https://m3lab.gatech.edu/*

Prof. Evangelos Theodorou: Engineering A More Effective Method of CPR

Prof. Evangelos Theodorou

Prof. **Evangelos Theodorou** and his graduate students, **Manan Gandhi** and **Alex Oshin** worked alongside a team led by University of Minnesota physician, **Demetris Yannopoulos** to invent an automated method of delivering CPR. Their design was found to be more effective for long-duration CPR (30 minutes) than those administered by either humans or by mechanical chest compression devices (the LUCAS machine), routinely used when the heart has stopped beating.

“The guidelines for performing CPR had not changed, really, since the procedure was created in 1960,” said Theodorou, who heads up the AE School’s Autonomous Control and Decision Systems Laboratory. “But we knew it was possible to use our expertise in controls and machine learning to automate the process so that it could quickly interpret new data and use it to improve the blood flow into the heart. From there, we would close the loop through feedback controls until we could steer the heart into a desirable blood perfusion range.”

Ultimately, any automation of this life-saving procedure had to be able to control chest compressions at an optimal rate and depth. The problem Theodorou pointed out, is that there is no standard-issue human body size, shape, or condition. Every heart incident needs to be addressed by a rapidly changing stream of data - a process that is well-suited to the control and learning algorithms Theodorou's team is able to develop.

"Right now, we're looking at using this on Earth. Think about health-care delivery in remote places or environments that are not easy to access. Ultimately, this automated technology together with other health-care monitoring systems could be used for medical support in space missions."

Find out more: *https://sites.gatech.edu/acds/*

Prof. Jonathan Rogers: Employing MOOCs for a Mechatronic Revolution

There was no way that Prof. **Jonathan Rogers** could have anticipated how a world pandemic would usher in a critical demand for new, relevant online learning methodologies in 2020. He was engineering those very methodologies long before.

Working with doctoral student **Siavash Farzan**, Rogers launched a new MOOC (Massively Open Online Course) in 2020 that includes an optional lab kit - an innovation that allows students the chance to build a fully functional robot, not just read about it. That class - Mechatronics Revolution: Fundamentals and Core Concepts - quickly attracted more than 10,000 students from 150+ countries around the globe.

A hybrid of mechanical engineering, electrical engineering, and robotics, mechatronics is the engineering science behind many 'smart gadgets': devices and machines that routinely use microcontrollers, sensors, and actuators to deliver goods and provide services.

"Mechatronics skills are highly marketable in every corner of the world. If you have them, you are immediately very employable," he explained. "Now I'm working on a follow-up MOOC that will focus on control systems implementation."

Rogers' class delivers fundamental concepts, terminology, and discipline knowledge to students via a series of video-taped lectures that can be viewed at any time. If they wanted to earn the certificate upon completion of the coursework, students can pay fees for the lab kit and to have their work evaluated by Rogers and Farzan.

With the lab kit, students build remote-controlled, obstacle-avoiding robots. Barely a pound in weight, the tiny 6"-by-6" vehicle has to be able to detect obstacles around it and automatically avoid bumping into the ones in its path. Students build motor driver circuits that regulate its speed and learn to program the development board that allows it to sense obstacles using an analog distance sensor and six bump switches. The robot is controlled by receiving remote commands through a PC/laptop via serial communication protocol.

Prof. Jonathan Rogers

"At the time, I don't think there was another MOOC out there that offered this hands-on mechatronics experience. I thought the most effective way to teach this subject was to have students learn the fundamentals of mechatronics by building a system, making mistakes, and spending whatever time it takes to track down the bugs. I still think it's the best way."

The material covered is introductory, as far as mechatronics go. Rogers teaches some fundamentals of embedded C++ programing and focuses on open-loop design as well as simple closed-loop systems such as finite state machines.

"The next step from here is more advanced closed-loop system implementation, where feedback is used in more advanced control algorithms," he said. "That's a class for students who are comfortable with advanced math. We're working on that MOOC now."

"When it's their turn to physically put the integrated circuit on the circuit boards or connect up the motors, that's when they cement their knowledge. That's when they know they can join the mechatronics revolution."

Find out more: *http://ireal.gatech.edu/*

Prof. Koki Ho: Space Systems Optimization Group Takes on Space Safety

It's been a busy year for Prof. **Koki Ho**, who joined the AE faculty in the Fall of 2019 and immediately forged ahead with several research projects through AE's Space Systems Design Lab (SSDL) and as head of the newly formed Space Systems Optimization Group (SSOG).

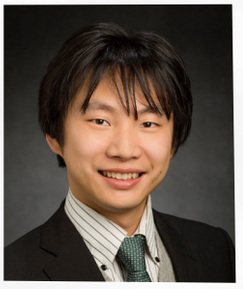
Under the auspices of a $500K Defense Advanced Research Projects Agency (DARPA) Young Faculty Award, Ho and his team are employing network-based simulation concepts to optimize logistics design for on-orbit, servicing, assembly, and manufacturing (OSAM) missions. These so-called OSAM missions will become critical as space exploration increasingly depends on the deployment of reusable assets –refueling, maintenance, and operational infrastructure -- for more complicated, long-term missions.

"Traditional astrodynamics research often focuses on the trajectory design perspective of space mission design," he said. "But if you are trying to service a problem on a satellite, it is more complex. We are creating an optimization method for planning and scheduling of those servicing missions."

Ho said his research introduces a new perspective to space mission planning, one that borrows from the network-based terrestrial logistics used by Amazon and FedEx. On the ground, he says, transportation is seen as movement between a network of nodes - cities, transportation hubs, trains, cars, and trucks.

To move packages from one place to another, they optimize the travel between those points in a network. Though the terrain and environment in space are different, this approach can be adopted to space travel, he said.

A three-year $600K Early Career grant from NASA will support Ho's research group in the development of algorithms that will enable space vehicles to select safe landing zones with systems-level parameters and uncertainties. The algorithms currently used to select safe landing zones are based on simple rules on the terrain features in the digitized elevation maps. Ho proposes using an integrated systems-based approach that will employ a novel deep-learning-based framework. This will enable the onboard algorithms to quickly detect hazards and identify safe landing zones with inflight diversion maneuvers.



Prof. Koki Ho

In February, Ho received a five-year, $500K National Science Foundation CAREER grant to support his research proposal, "Designing Flexible Complex Systems with Coupled and Co-Evolving Subsystems under Operational Uncertainties."

"We want to reduce the impact that uncertainty has on the successful functioning of long-term, large-scale, complex systems," he explained.

Think: Setting up a colony on the moon. Meeting world-wide food, water, and energy needs.

The NSF project seeks to create new engineering design methodologies to make large-scale systems more adaptable to change and less susceptible to uncertainties that play out over time. Central to his work will be a study of the staged deployment of coupled subsystems, a move that is expected to enhance flexibility and mitigate uncertainties.

And, finally, a Mitsubishi Electric Corporation-sponsored project will enable Ho's group to mitigate the risk that space debris poses to single and swarm satellite constellations. The 21/2-year grant will support their work to develop systems to reduce the amount of debris generated by satellites, remove existing debris, and avoid debris that could cause serious damage.

Find out more: *https://ssog.ae.gatech.edu/*

Distance Learning MSAE Enrollment Jumps Up by 50%

The Daniel Guggenheim School has long recognized the efficacy of using new teaching technologies to make aerospace engineering education accessible to students around the world. Over the last 16 years, our Distance Learning program has conferred more than 170 master's degrees to students like **Mike Ceriello**, *right,* a Distance Learning student who was working in industry when he noticed...

"Many, if not all, of my new colleagues were coming in with master's degrees. It was too early in my career to be shown-up by entry-level engineers. I had to get a master's."

We were glad to accommodate the ambitions of Mike and many other aspiring aerospace engineers this year. We're committed to being there for the next generation of online learners as well.

FIND OUT MORE: ***ae.gatech.edu/msae-distance-learning-program-option***

MSAE DL Student

FACULTY HIGHLIGHTS

Professor **Mitchell L. R. Walker, II** was one of five expert panelists invited to explore the future of space propulsion systems at the American Astronautical Society's inaugural John Glenn Memorial Symposium. Walker was later appointed to serve a three-year term on the Technology, Innovation and Engineering Committee of the NASA Advisory Council...Prof. **Marilyn J. Smith** and her team developed an unsteady aerodynamics simulation suite of codes that permits the real-time predictions of highly dynamic vehicles without relying on expensive wind tunnel tests, flight tests, or computational fluid dynamics. Smith was also selected to serve a two-year term as the technical director of the Vertical Flight Society (VFS) and elected to the status of Fellow by the Royal Aeronautical Society... Prof. **Julian J. Rimoli** was selected to fill the Pratt & Whitney Professorship. His research on lattice-architected materials for planetary landing vehicles led to a *Wall Street Journal* article that explored the use of those materials in running shoes...Prof. **Vigor Yang** was promoted to the status of Regents Professor by the Georgia Board of Regents. He also received an honorary doctorate from Taiwan's National Cheng Kung University, one of the largest and most influential universities in Asia...

Prof. Mitchell L. R. Walker

Prof. Marilyn J. Smith

Prof. **Timothy Lieuwen** was elected as a Foreign Fellow to India's National Academy of Engineering (INAE). Already a member of the U.S. NAE, Lieuwen was also invited to give a research presentation before the INAE's annual convention held in Jaipur, India... The Combustion Insitute selected Prof. **Joseph Oefelein** to join the 2020 class of CI Fellows. The Institute commended Oefelein for "pioneering research on large-scale multiphysics simulations of supercritical fluid phenomena and combustion."...Prof. **Wenting Sun** joined "Fueling a Human Mission to Mars," a multidisciplinary NASA project to develop a renewable, liquid, storage-stable rocket propellant that can be produced and burned on Mars... Prof. **E. Glenn Lightsey** was selected as the AE School's new David Lewis Professor of Space Systems Technology. The head of the AE School's Space Systems Design Lab, Lightsey was also selected by the NSF to collaborate on the Virtual Super-resolution Optics with Reconfigurable Swarms (VISORS) mission, where he will design and deploy a distributed space telescope that will allow researchers to obtain high-resolution imagery of the sun's surface without leaving Earth orbit...Prof. **Adam Steinberg** was part of a team of researchers and industry professionals recognized with the 2019 AIAA Propellants and Combustion Best Paper Award for their work, "Influence of Cross-Frequency Interactions on Nonstationary Thermoacoustic Oscillations in a Rich-Burn Gas Turbine Combustor at Elevated Pressure"...For the third time in as many years Prof. **Joseph H. Saleh** was named Professor of the Year by the students of Sigma Gamma Tau. Meanwhile, Saleh's research article, "Statistical Reliability Analysis for a Most Dangerous Occupation: Roman Emperor," was named The Nerdiest Study of 2019 by *Fast Company* magazine....Prof. **Yongxin Chen** was selected to receive a NSF CAREER Award for his project, "Towards a Principled Framework for the Modeling and Control of Non-equilibrium Thermodynamic Systems." The five-year, $500,000 grant will support Chen's development of a unified theoretical framework for understanding non-equilibrium thermodynamics.... Prof. **Kyriakos Vamvoudakis** was selected to co-chair the 9th International Conference on the Internet of Things. More than 100 information technology experts from academia and industry joined him in Spain to focus on the potential economic and social value of instrumenting and connecting devices on the Internet. Vamvoudakis and his AE colleague, Prof. **Mark Costello** joined an $8M NASA University Leadership Initiative grant that seeks to develop a novel integration of secure and safe autonomous systems used on unmanned Advanced Air Mobility (AAM) aircraft with the goal of advancing their technical readiness level and making them ready for use by industry... Prof. **Panagiotis Tsiotras** joined "Assured Autonomy for Aviation Transformation," a multi-university NASA project that seeks to improve the performance of autonomous systems on advanced air mobility (AAM) missions...Prof. **Dimitri Mavris** was asked to spearhead the ASDL's involvement in Clean Sky 2, the largest research program in Europe to develop innovative technology to reduce CO_2 gas emissions and noise levels produced by aircraft. The collaboration - the Overall Air Transport System Vehicle Scenarios (OASyS) project - will forecast future scenarios to inform Clean Sky's Technology Evaluator- thus enhancing its modelling capability to estimate the impacts of potential scenarios that include advanced configurations like urban air mobility vehicles and supersonic transport aircraft within the global fleet...Prof. **Brian Gunter** and his students from the Space Systems Design Lab wrapped up their work on the Orbital Calibration ("OrCa") mission, a 12U small sat that was designed, built, and tested with GTRI researchers in a little more than six weeks and launched by the United States Space Force as payload aboard the Atlas V Rocket in March. It was equipped with optical calibration capabilities to improve the tracking and identification of natural and man-made objects (e.g. satellites, orbital debris).

Prof. E. Glenn Lightsey

Prof. Joseph H. Saleh

Prof. Yongxin Chen

Prof. Kyriakos Vamvoudakis

Prof. Dimitri Mavris

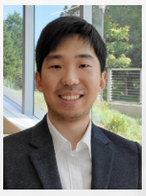
Prof. Brian Gunter

HONORING A SHINING STAR

In 2020, the Daniel Guggenheim School granted the request of Prof. **Dewey Hodges** to retire, closing a chapter of teaching and research excellence that will not be duplicated any time soon. His colleagues at the American Institute of Aeronautics and Astronautics honored Hodges with the publication of "Asymptotic Analyses, Dynamics and Aeroelasticity," a special section in the AIAA journal. The 31-paper festschrift entered into the written record the many and fervent praises that Hodges received in 2018, when the AIAA hosted a tribute to his career during Sci-Tech and featured the presentation of 18 technical papers that focused on the longtime researcher's interest in these three areas. Fifteen of those papers -- and another 15 fresh manuscripts - were included in the compendium. Hodges remains with the AE School as a Professor Emeritus.

Prof. Dewey Hodges

STUDENT HIGHLIGHTS



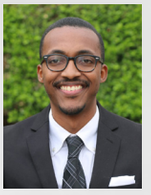
Hang Woon Lee

Doctoral student **Hang Woon Lee** was selected by the American Astronautical Society to receive two honors: the Molly K. Macauley Award, for his paper, "Regional Constellations as Alternative Business Strategy: Overcoming Startups' Challenges in the Space-based Communications Industry," and the John V. Breakwell Award for his submission, "Binary Integer Linear Programming Formulation for Optimal Satellite Constellation Reconfiguration"... Doctoral student **Naia Butler-Craig** was chosen by a consortium of industry, academic, and equity leaders to receive a 2020 Modern-Day Technology Leader Award for demonstrating outstanding performance in science, technology, engineering, and mathematics. Butler-Craig has been awarded the much-coveted 2020 NASA Space Technology Graduate Research Opportunities grant to support her proposed research project, "Characterization of Inner Front Pole Cover Erosion in Center Mounted Cathode Hall Thrusters using Thompson Scattering." NASA praised Butler-Craig for her "exceptional background and potential for research...to develop groundbreaking, high-risk/high-payoff, early stage space technology"...**Mayank Bendarkar**, an ASDL doctoral student, received AIAA'S 2020 William T. Piper, Sr. General Aviation Systems Graduate Award for his research, "Evaluation of Off-Nominal Performance and Reliability of a Distributed Electric Propulsion Aircraft during Early Design"....Fourth-year undergrad **Matthew N. Corrado** received a 2020 NSF Graduate Research Fellowship to support his research proposal, "Effects of Mass Flowrate on Plasma Oscillations in a Hall Effect Thruster Discharge Channel." Corrado was also selected to receive AIAA's Wernher von Braun Scholarship..."GPU Acceleration of Extreme Scale Pseudo-Spectral Simulations of Turbulence Using Asynchronism," a technical paper co-authored by doctoral student **Kiran Ravikumar** was selected as one of the Best Student Paper Finalists by the International Conference for High-Performance Computing, Networking, Storage, and Analysis... Doctoral student **Johnie Sublett** was selected to receive the 2019 Zarem Graduate Student Award for Distinguished Achievement for his paper, "Design and Testing of a Fault-tolerant Space Suit." The same paper also took home first place in the graduate student paper competition at the 70th International Astronautical Congress... Doctoral student **Benjamin Leon** received the Robert L. Lichten Award from the Vertical Flight Society for a paper he co-authored with his advisor, Prof. **Julian Rimoli**, "Ground and Flight Tests of a Cable-Driven Four-Bar Linkage Robotic Landing Gear for Rotorcraft." Leon was also selected to receive the United Technologies Corporation Fellowship for his myriad research contributions to rotorcraft research...MicroStructPy, a software package developed by doctoral student **Kenneth Hart** was accepted into the NASA repository, an open-source library that is used by scientists around the world. An article he co-authored about the software, "Generation of Statistically Representative Microstructures with Direct Grain Geometry Control" was published in the journal *Computer Methods in Applied Mechanics and Engineering*...Doctoral student **Petro Junior Milan** was selected to attend the 2019 Argonne Training Program on Extreme-Scale Computing, an annual event for high-achieving academics sponsored by the U.S. Department of Energy's Argonne National Laboratory and funded by DOE's Exascale Computing Project...Doctoral students **Christopher Roper** and **David Jovel** were selected to receive the Southern Regional Education Board's State Doctoral Award, a competitive scholarship that will allow each to pursue unsponsored research in the area of electric propulsion...Second-year student **Benjamin Breer** was the first author on, "Energetic Ion Dynamics in the Perturbed Electromagnetic Fields near Europa" an article that was published in October 2019 by the *Journal of Geophysical Research: Space Physics*...Postdoc **Miad Karimi** was selected to receive the 2019 National Research Council postdoctoral fellowship to begin new research with the Air Force Research Laboratory in Dayton, Ohio...Third-year undergrad **Paul Farmer** was named Undergraduate Researcher of the Year by the Georgia Tech Research Institute, where he contributed to the Air National Guard Program Office Mission through his co-ops at GTRI's Electronics Systems Lab....Undergraduates **Saba Shaik**, **Sanjana Tewathia, Rachel Thomas,** and **Kinjal Ruecker** got a jump-start on their careers, thanks to the 2020 Brooke Owens Fellowship, which matched each student with two professional mentors and a summer internship at an aerospace-related company...Undergraduates **Harrison Delecki** and **Abhishek Khandal** were likewise selected for both internships and professional mentorships through the Matthew Isakowitz Fellowship...Four ASDL graduate students were part of a 15-person GT team that placed second in the inaugural Virtual RobotX (VRX) Competition in Singapore...Doctoral student **Paola Zanella** was selected as the winner of Georgia Tech's 2019 Three Minute Thesis (3MT) competition with her talk, "Mitigation of Helicopter Accidents Related to Loss of Tail Rotor Effectiveness." ...In the spring, when competitions went to a virtual format, AE's MISSION Mars team placed first in the category of "Best in Theme" and second for "Best Overall" in NASA's Revolutionary Aerospace Systems Conepts Academic Linkage (RASCAL) competition...And the report submitted by the ASDL team in AIAA's 2020 Design Build Fly competition placed second out of 101 submissions...A talk given by AE post-doc **Hisham Ali**, "Experimental Investigation of Magnetohydrodynamic Energy Generation in Conditions and Configurations Relevant to Planetary Entry" was selected as the best student oral presentation at the16th International Planetary Probe Workshop in Oxford, England. The talk focused on different ways to use re-entry plasma to generate energy and control the vehicle.

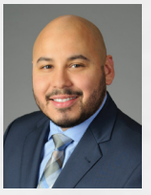
Naia Butler-Craig

Matthew Corrado

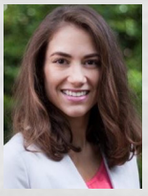
Kenneth Hart



Christopher Roper



David Jovel



Paola Zanella

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