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UNDERGRADUATE
ENGINEERING
AEROSPACE ENGINEERING
DAYTONA BEACH, FLORIDA CAMPUS

U.S. News & World Report

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Aerospace Engineering Alumni Share How Their Careers Have Taken Flight

- Collin Anderson (BSAE '18) works for the FAA's Office of Commercial Space Transportation as a safety inspector.
- Benjamin Canfield (BSAE '82) retired from The Boeing Company in March 2021, after a 38-year career in engineering. He spent the majority of his career in aerospace engineering at McDonnell Douglas/Boeing with more than 27 years in engineering management.
- Tyler Grinnell (BSAE '08), a member of Embry-Riddle's College of Engineering Industry Advisory Board, now serves as Virgin Orbit's vice president of flight and launch. He joined Virgin Orbit after spending 12 years at SpaceX. Prior to SpaceX, he held roles at both Boeing and NASA at Kennedy Space Center.
- Daniel Harris (BSAE '10) is an automation safety engineer at Boston Dynamics.
- Wanjiku Chebet Kanjumba (BSAE '20, MSAE '21) is the first Kenyan graduate of the Project PoSSUM scientist-astronaut program and co-founder of a company called Vicillion.
- Rob Keane (BSAE '16) is chief operating officer (COO) of Velontra, a veteran-owned start-up company focused on hypersonic unmanned flight.
- Vivek Lall (MSAE '91), the Chief Executive of General Atomics Global Corporation, was presented with a lifetime achievement award at the Ritossa Family Summits in Dubai. The award was in recognition of his "outstanding vision, dedication and success."
- Bao Rasebolai Mosinyi, Ph.D. (BSAE '99, MSAE '01) is the new chief executive officer of the Civil Aviation Authority of Botswana. Mosinyi is an aerospace engineer with more than 20 years of experience.

Message from the Chair

2021 was another turbulent year affected by COVID-19, but it was also one with many successes. Like 2020, we offered a combination of face-to-face and online classes, and students again responded positively in their teaching evaluations.

The Department of Aerospace Engineering (AE) continues to grow and is the largest in the nation with 1,897 bachelor's, 91 master's and 42 doctoral students as of Fall 2021 — another record year for enrollment. Particularly noteworthy: 12.3% of our undergraduates are honors students, while the rest of the Daytona Beach Campus has 5.1% honors students.

I am also proud to report the undergraduate AE program continues to rank very highly at No. 5 (tied) in the country, according to U.S. News and World Report rankings (September 2021). This is a significant accomplishment and demonstrates the program quality. Our program offers unique experiential learning opportunities through various competitions throughout the year and yields excellent results, including a third-place finish (second among U.S. schools) in the AIAA Design Build Fly competition in April 2021.

The graduate program also continues to thrive, ranking No. 25 (tied) in March 2021 and first (tied) in Florida. Thanks to a Graduate Assistance in Areas of National Need (GAANN) grant from the Department of Education, we are able to support 8 to 10 Ph.D. students (U.S. citizens) per year.

Researchers and students at the Eagle Flight Research Center (EFRC) are continuing to work on advancing manned and unmanned flight, with a current focus on green aviation, electric and hybrid-electric propulsion, noise reduction, advanced and urban air mobility and the controls that guide those aircraft.

Research expenditures also continue to increase significantly. Sample grants that were active in 2021 include: "Active Control of Jet Noise Via Bi-Modal Excitation" (ONR, PIs: Mankbadi, Golubev); "Holistic Representation of Ship-Airwake-Rotor Interactions for Naval UAS Operations" (Vertical Lift Research Centers of Excellence-subcontract from Georgia Tech, PIs: Leishman, Gnanamanickam); "Improving Image Processing for Orbit Estimation" (Air Force, PI: Henderson); "Reduction of Collateral Damage of Warhead Shrapnel" (AFOSR, PI: Bevilacqua); "Mitigating GPS and ADS-B Risks for UAS" (FAA, PI: Moncayo); "Cyberinfrastructure for Pedestrian Dynamics-Based Analysis of Infection Propagation Through Air Travel" (NSF, PIs: Ashok Srinivasan, UWF, Namilae, and Mathew Scotch, ASUI); "A Data Analytics Framework for the Application of Pedestrian Dynamics to Public Health" (NIH, PI: Namilae) and "Integrated Flight and Propulsion Controls for Rotorcraft" (FAA, PIs: Collins, Anderson).

Many of these research endeavors are detailed in the forthcoming pages. I hope you enjoy this edition of *AeroNews*.

Best Regards,

A Lyrintzis

Dr. Tasos Lyrintzis
Distinguished Professor, Department Chair

IN THIS ISSUE

College of Engineering Welcomes Dr. James W. Gregory as New Dean

Aerospace engineer James W. Gregory, Ph.D. – a highly accomplished scholar whose many awards have included the Frank G. Brewer Trophy for significant contributions to aerospace education – joined Embry-Riddle as dean of the College of Engineering in Fall 2021.

Dr. Gregory, who once led an autonomous drone team that set world speed and distance records, previously served as professor and chair of the Department of Mechanical and Aerospace Engineering at The Ohio State University.

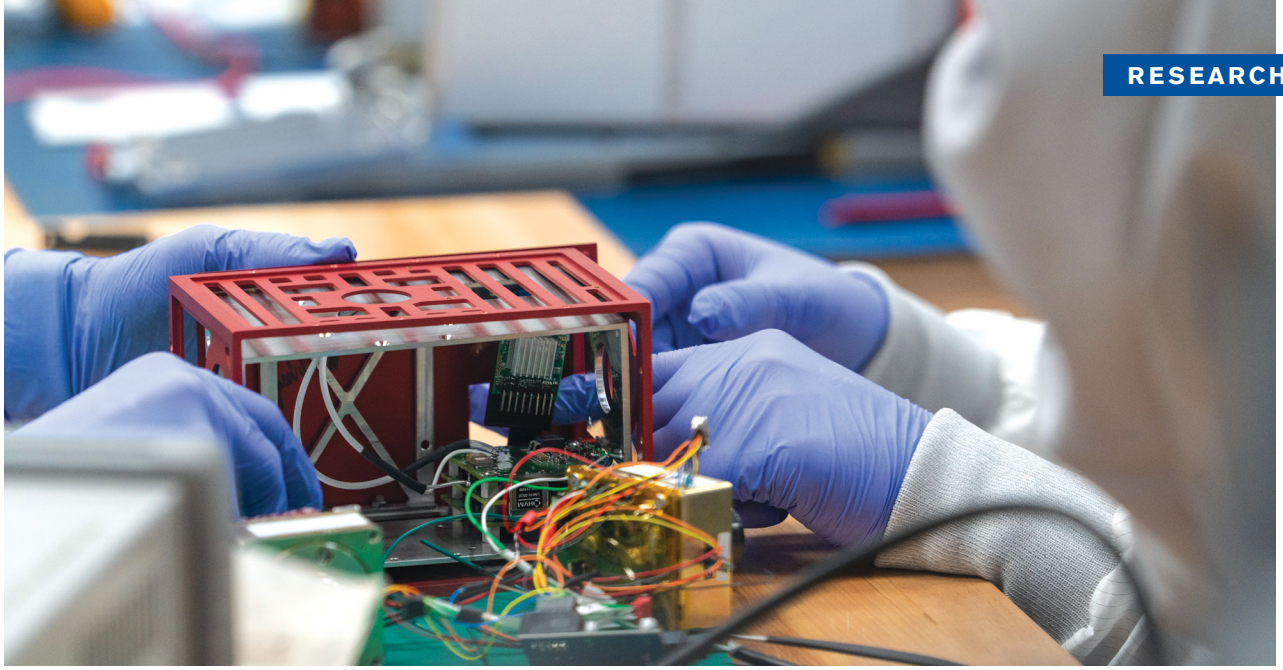
"I'm honored and excited to assume a leadership role with Embry-Riddle," Dr. Gregory said. "Without question, Embry-Riddle is a global leader in aviation and aerospace education, with highly motivated students and outstanding engineering faculty across a wide range of areas."

Dr. Gregory has deep expertise in Unmanned Aircraft Systems (UAS), or drones, as well as unsteady aerodynamics. In the latter area, his work has encompassed flight testing of vehicle performance, systems integration studies, robust flight of UAS in windy, icy and other weather conditions, and more. Since 2008, he has obtained $20 million in external funding for his research, including a Young Investigator Award (2011) from the U.S. Army Research Office.

A fellow of the Royal Aeronautical Society and associate fellow of the American Institute of Aeronautics and Astronautics, Dr. Gregory's efforts to improve student success and make engineering more accessible have included a popular video lecture series on the Science of Flight, in collaboration with Great Courses and the Smithsonian Institution's Air & Space Museum. Using his recorded lectures to "flip" the instructional mode for a large engineering course, Dr. Gregory has reported significant improvements in student performance. His other instructional innovations have included design projects and labs incorporating international collaboration to detect buried landmines by air and to launch high-altitude balloons.

Dr. Gregory received his Ph.D. and Master's degrees in Aeronautics and Astronautics from Purdue University (2005 and 2002). He earned his undergraduate degree in Aerospace Engineering, with highest honors, from Georgia Tech (1999).

In addition to the Brewer Trophy, Dr. Gregory has received The Ohio State College of Engineering's McCarthy Engineering Teaching Award, the Department of Aerospace Engineering Outstanding Professor Award, and the SAE Ralph R. Teeter Educational Award.



Eagles Complete CubeSat Construction; Next Stop: the Moon

Dr. Troy Henderson

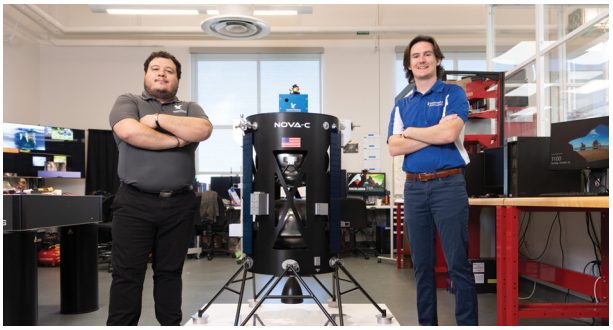
In preparation for an upcoming moon mission, a team of engineers at Embry-Riddle has completed construction of a miniature satellite camera system. The 1.5U CubeSat, known as EagleCam, was delivered to Intuitive Machines' headquarters, in Houston, Texas, in November 2021.

EagleCam has passed all integration tests, confirming that the payload will accept power and commands, as well as relay images and other data back to the lander via WiFi antennas. This lab testing was the final step before EagleCam was bolted onto the Nova-C Lunar Lander ahead of its eventual launch to the Moon.

EagleCam will take the world's first third-person image of a spacecraft as it makes an extraterrestrial landing and will become the first university student project to land on the moon. The multi-disciplinary project was led by Dr. Troy Henderson, associate professor of Aerospace Engineering. The project team was primarily composed of Aerospace Engineering students.

"The development of this equipment has been a great opportunity for our students to get hands-on experience with a real spaceflight, applying theory from the classroom to hardware," said Henderson.

Intuitive Machines' founder, Embry-Riddle alumnus Steve Altemus ('87), challenged his alma mater to engineer the out-of-this-world selfie when he visited the university in 2019.



From left, EagleCam team members Daniel Posada and Chris Hays

The private company is one of several NASA has enlisted as a Commercial Lunar Payload Service provider to explore and test technologies ahead of the United States' crewed return to the moon in 2024.

The Nova-C, which will transport NASA and commercial payloads, will launch aboard a SpaceX Falcon 9 Rocket. As the Nova-C approaches the moon, EagleCam will launch about 30 seconds before landing and freefall to the moon's surface in time to capture a "selfie" of the Nova-C as it touches down.

Three wide field-of-view cameras will capture the landing from three sides of the CubeSat, and then send the photos back to the lander via WiFi – a technology never before used on the moon and engineered entirely by Embry-Riddle students and faculty.

EagleCam will also demonstrate an electrodynamic dust shield developed by NASA Kennedy Space Center. The shield will use an electric field to remove the fine lunar regolith from two of EagleCam's camera lenses.

Understanding Human Movement Key to Guiding Public Health Strategies

Dr. Sirish Namilae (Funded by the National Institutes of Health)

Backed by a new $395,000 grant from the National Institutes of Health (NIH), Embry-Riddle Aeronautical University researcher Sirish Namilae will model human movement and interaction in complex settings to help provide public health strategies for reducing viral infection spread, enhancing walkability of public spaces and planning for safe evacuations of the elderly.

Namilae, an Aerospace Engineering associate professor, plans to combine pedestrian dynamics, which is based on the movement of particles, such as molecules, with tracking data from cell phone apps.

"We hypothesize that combining location-based service data with pedestrian dynamics modeling can uncover movement patterns of people in complex situations with many public health applications," Namilae said. "Pedestrian mobility models could help in the design of public spaces and policies that reduce contacts to mitigate disease spread or encourage walking to improve health outcomes."

The grant is the first awarded by the NIH to Embry-Riddle, according to Associate Provost for Research Dr. Remzi Seker.

"Our research efforts are expanding and being recognized at a national level," added Embry-Riddle Provost Lon Moeller, citing the real-world impacts of the university's ongoing research efforts.

In previous work, Namilae combined pedestrian dynamics and infection spread modeling. Scaling such work to an entire public space, such as an airport, he said, is difficult because of the variability in how humans move and interact. The data from cell phone apps to be used in the current research will augment the models that were previously developed and help researchers to understand the "fine-scale" movement and interaction patterns of people.

Namilae's goal is to create data-driven computational software and provide it to such decision-makers as civil engineers and public health professionals. The users' feedback would then be used to improve the system design.

The research will involve Embry-Riddle students at the graduate and undergraduate levels.

Photo Credit: The Bevilacqua Family

Eagles Work to Reduce Collateral Damage in Air Force Warhead Shrapnel Study

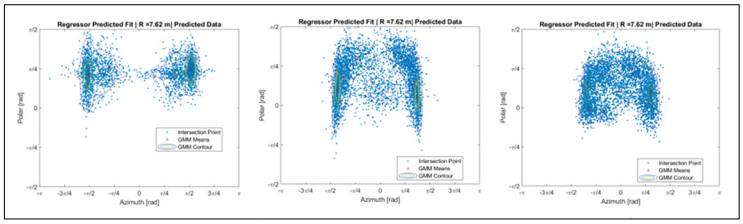
Dr. Riccardo Bevilacqua (Funded by the Air Force Office of Scientific Research)

Dr. Riccardo Bevilacqua, professor of Aerospace Engineering at Embry-Riddle Aeronautical University, and Katherine Larsen, a graduate student at Embry-Riddle, are working to simplify one of the most difficult problems faced by weapon designers and operators: fragment fly-out prediction.

They hope to develop better methods to predict where fragments from a warhead strike will fly, reducing the chance of collateral damage.

Thanks to a $442,508 grant from the Air Force Office of Scientific Research (AFOSR) Testing and Evaluation Program, Dr. Bevilacqua and Larsen will merge data from static tests with advanced simulation capabilities, considering such factors as the speed and orientation of a warhead and using artificial neural networks and other machine learning tools to provide better estimates.

The grant represents the largest single-investigator Air Force award received by the department.



Increasing warhead speed

Currently, predictions of how warhead fragmentation will occur are determined using static tests in which trial warheads are detonated in the desert with no flight involved. Although some numerical simulations have also been used as predictors of warhead fragmentation, they often do not consider such factors as gravity and aerodynamic forces.

“Being able to predict how these systems behave is a way to save money and be more precise,” Bevilacqua said. “Having a better model of where the fragments will go will add safety for innocent people.”

Bevilacqua said the technology being developed could also eventually be applied in the case of collisions or explosions in space that shoot off fragments of space debris. Being able to predict where that debris will go could protect active satellites from being damaged.

Larsen, who is earning a master’s degree in Aerospace Engineering and continuing for her Ph.D. degree, will be assisting with the research.

Dr. Bevilacqua has collaborated with the Department of Defense for over a decade, participating in five Air Force Research Lab Summer Faculty Fellowships to define research strategies addressing some of the most pressing defense problems. The AFOSR project is the result of an ongoing collaboration with Eglin Air Force Base started in summer 2019.

Eagles Aim to Make sUAS Flight Safer with FAA Backing

Dr. Hever Moncayo (Funded by the Federal Aviation Administration)

A research team at Embry-Riddle has been tapped by the Federal Aviation Administration (FAA) to assess the risks involved in flying small unmanned aircraft systems (sUAS) and to help develop safety protocols as sUAS are increasingly integrated into the national airspace.

Led by Dr. Hever Moncayo, the research team includes Ph.D. students Tatiana Gutierrez and Andrei Cuenca, as well as undergraduate Brock Steinfeldt.

Moncayo and his team are investigating the role that GPS and "ADS-B In" – or the receiving portion of an Automatic Dependent Surveillance–Broadcast system – play in safety and security risks.

During sUAS operations, unvalidated or unavailable data can jeopardize navigation and "Detect and Avoid" operations. GPS data that drops out or is erroneous, jammed or spoofed can result in incorrect aircraft position and flawed navigation. Such data can also result in fly-aways outside of radio control or dangerous flights into controlled airspace or infrastructure.

Similar issues with "ADS-B In" data can lead to automated sUAS being unable to detect and avoid other aircraft or the false detection and avoidance of illusionary aircraft.

By investigating different strategies to mitigate the risks associated with sUAS operations, the research team will be able to propose methodologies that can increase the safe use of sUAS as package delivery and aerial taxi services, as well as in urban environments.

Certain small UAS "Beyond Visual Line of Sight" (BVLOS) operations, such as structural inspection, may also be in close proximity to structures that are collision hazards for manned aircraft. These types of operations that are both in close proximity to manned aviation flight obstacles and that provide significant protection from conflicts and collisions with manned aircraft are known as "shielded" operations. Moncayo's and his team's research is instrumental to identifying risks and recommending FAA solutions that enable shielded operations.

A number of sUAS operations will ultimately benefit from this research, as the FAA will be better able to develop or enhance policies and standards for safe and secure sUAS flights with an emphasis on low-cost and easy-to-implement technologies.

Embry-Riddle One of 11 Universities Globally Selected for U.S. Space Force Challenge

Dr. Troy Henderson, Dr. Riccardo Bevilacqua and Dr. Sirani Perera

The United States Space Force for the first time has opened its Hyperspace Challenge to include university teams. Embry-Riddle Aeronautical University was one of only 11 institutions of higher learning selected from across the globe to participate.

"This early immersion in research that will minimize risks and optimize the effectiveness of Space Force is the kind of discovery-driven education that sets our aerospace engineers apart when they enter the workforce," said Embry-Riddle President P. Barry Butler, Ph.D. "Our selection reflects Embry-Riddle's growing prominence as a space-focused research institution."

The Embry-Riddle team, led by Dr. Troy Henderson, associate professor of Aerospace Engineering, will compete in the program's Rapid Initial Orbit Determination topic and the AI-Based Remote Sensing of Space topic. Embry-Riddle was the only team accepted for more than one topic.

The team's goal is to understand when objects in space are too close to one another, putting them in danger of collision (or "conjunction analysis"), then come up with a method of completing this analysis quickly and with sparse data. A secondary goal is to develop machine learning methods of sensor tasking for optimal coverage.

"One major benefit to those involved has been the connections they make with program managers in the Air Force Research Lab and Space Force, along with meeting new potential partners in small business," Henderson said. "This experience will not only give the team hands-on experience working on space-related research but also a direct line to key stakeholders in government and in industry."

Faculty members Dr. Riccardo Bevilacqua, Aerospace Engineering, and Dr. Sirani Perera, associate professor of Mathematics, are also on the team.

"This accomplishment by Dr. Henderson and his team is not only in line with our mission and values, but also indicative of the purposeful nature of our research enterprise," added Dr. Remzi Seker, Associate Provost for Research.

Launched in 2018, Hyperspace Challenge was designed to accelerate collaboration and foster contracts between startups and university teams, and government space agencies.

HYPERSPACE SUMMIT

EFRC Drives AAM Innovation

The College of Engineering's Eagle Flight Research Center (EFRC) is a leading-edge aeronautical research institution. The mission of the EFRC is to advance manned and unmanned flight through the fusion of theoretical and hardware-based research related to alternative propulsion, flight control, autonomy and the development of novel aircraft.

In 2021, the EFRC devoted many research hours to air vehicles that utilize electric motors and thus require onboard electric power storage, generation or both. The vehicles and the operations they will perform are generally referred to as Advanced Air Mobility (AAM).

In November 2021, the United States Congress enacted the Advanced Air Mobility Coordination and Leadership Act, further underscoring the importance of research like that described below and undertaken at the EFRC.

Hybrid-Electric Power Plants

Before electric cars became fully viable, automobiles relied on hybrid systems that bridged the gap between electric and gas power, providing increased fuel economy while battery technology continued to develop.

A similar trend is now emerging in aviation. Until the energy density of batteries reaches a point where electric-powered aircraft can achieve a significant range that includes FAA-stipulated reserves, hybrid systems may be able to bridge the gap.

The EFRC has researched electric and hybrid-electric aircraft for several years. The conversion of gasoline energy to electrical energy in the form of a hybrid-electric power generation system presents an opportunity to deliver specific energy and specific power that are higher than any battery system currently available.

Under a $2.5M grant, the EFRC recently designed, built and tested a functioning hybrid power plant testbed codenamed PHOENIX. The system is capable of producing 88 kilowatts (kW) of continuous electric power with no battery drain and up to 120 kW peak electric power with the assistance of a 415-volt Lithium-ion battery pack. The hybrid system is based around a four-cylinder turbocharged gasoline aviation engine. The engine power is transmitted at 1:1 RPM to a high-performance generator with 12-turn windings to match engine output, all controlled by an inverter. The system was designed to be incorporated into an Electric Vertical Take-Off and Landing (eVTOL) vehicle to provide power to distributed electric rotor systems.

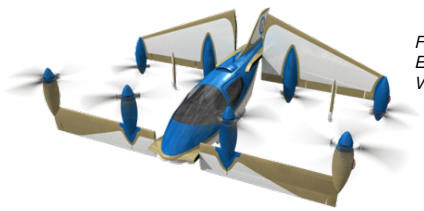


Figure 1: Distributed Electric Propulsion Vehicle Concept

Tests were performed with PHOENIX attached to programmable DC loads of a 950-pound multi-rotor AAM vehicle flying a simulated trajectory in turbulence.

The resulting power versus time profile was replayed to see how well PHOENIX could perform using a load-following controller developed by Embry-Riddle engineers and graduate students.

The EFRC is now building a 70+ kW hybrid-electric power generation system using a rotary engine and a three-phase AC permanent magnet generator and inverter. This project – codenamed VOLTRON – will attempt to show an increase in specific power over the PHOENIX system due to the higher power-to-weight ratio of the rotary engine.

Integrated Propulsion and Flight Controls

Distributed electric propulsion (DEP) has increased the design space for aerospace vehicles like eVTOL. This new class of vehicles not only looks different from the typical airplane or helicopter – it also functions differently. To certify these aircraft for private and commercial operations, a greater understanding of how the vehicle is controlled in both nominal and off-nominal modes is required. The EFRC is conducting research to assess how the various methods of DEP thrust control scale to the sizes required for eVTOL vehicles, as well as how well the methods perform in normal and degraded modes of operation.

Many eVTOL configurations use a thrust control system identical to that of hobby-size drones, which involves changing RPM. Generally speaking, faster RPM generates more thrust. Another strategy is to govern RPM at a desired speed and then change the collective pitch of the prop-rotor blades to change thrust or drag. With this method, there can be differences in thrust response time depending on how fast the pitch of the blades can change.

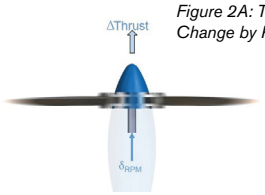


Figure 2A: Thrust Change by RPM Only

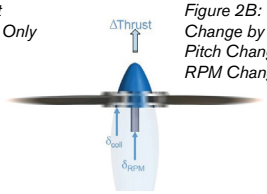


Figure 2B: Thrust Change by Collective Pitch Change and/or RPM Change

A DEP unit being developed at the EFRC utilizes not only collective pitch control, but also cyclic pitch control applied to a hingeless prop-rotor. This provides each DEP unit with the ability to create both thrust and control through longitudinal and lateral moments.

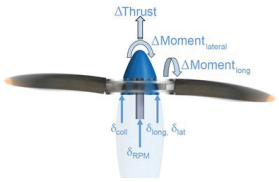


Figure 3: Thrust and Moment Control Using RPM, Collective Pitch, and Cyclic Pitch Change

A recent $600,000 grant from the FAA will enable the EFRC to continue this research via the development of a hardware-validated flight dynamics simulation. The simulation will evaluate a mission task element approach using system- and flying-quality assessments to inform specific certification testing at the vehicle level.

Embry-Riddle Researches Active Control of Supersonic Jet Noise

Dr. Reda Mankbadi and Dr. Vladimir Golubev (Funded by the Office of Naval Research)

Jet noise is a significant problem for both military and commercial aircraft. Embry-Riddle is investigating ways to reduce this noise with work sponsored by the Office of Naval Research.

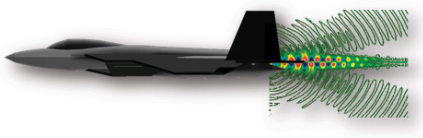
As the principal investigator, Distinguished Professor of Aerospace Engineering Dr. Reda Mankbadi and his team aim to implement active control in rectangular jets in order to reduce their noise. Large-scale structures are the dominant source of jet noise, but these structures can be manipulated by exciting the whole jet.

The involved excitation amplitudes are small, allowing for minimal impacts on aircraft performance, but Mankbadi hopes to demonstrate that by exciting a jet at a fundamental frequency – as well as a harmonic or subharmonic frequency – energy from the fundamental mode is transferred to the subharmonic or harmonic mode. This transfer results in a reduction of the jet's noise.

High Fidelity Large Eddy Simulation (LES) can be used to compute noise sources via the modification of a code originally developed by the Air Force Research Laboratory, which uses high-order numerical schemes. However, it can take weeks to obtain LES results even when using a supercomputer.

Choosing the wrong excitation parameters can result in zero noise reduction or noise enhancement, which makes identifying the correct parameters key. To better predict these parameters, Mankbadi is using a Reduced-Order Model (ROM).

Inputs to the ROM can come from linear methods, and once the ROM is set up, a set of nonlinear differential equations can be solved numerically. This takes seconds and does not require the use of a supercomputing cluster. Using these results, Mankbadi can observe the damping effect on the dominant noise source, and parameters can then be chosen as inputs into LES.



Currently, researchers are focused on performing LES on a Mach 1.5 planar jet, which approximates the flow in the minor plane of a rectangular jet. This will allow researchers to validate open-loop control using ROM results.

Future work will involve performing LES on a three-dimensional rectangular jet in order to better approximate a real jet.

Dr. James Ladesic Retires After 46 Years of Service

For many in academia, our teaching career begins soon after the ink dries on our dissertation signature page. The dissertation is often theoretical, and, if we are lucky, the research is funded by a government agency – rarely by industry.

As faculty members, we tend to model ourselves after our former professors in our scholarly activities. We pursue low TRL (or technology readiness level) research projects – the type of research valued by promotion and tenure committees.

Although universities have encouraged and valued innovation in recent years, research in academia is not geared toward industry needs or with an eye toward its application. But having taught mathematics while in graduate school, and as an engineering Ph.D. student with eight years of industry experience under his belt, Dr. James Ladesic could see what was wrong with this model. During his sterling career, he has tried to bring change with noteworthy success.

Dr. J, as students knew him, served as a professor of Aerospace Engineering for 40+ years, teaching design and engineering courses while taking leadership roles in many successful national student projects and educational innovations before advancing to the Dean's Office in 2011.

As Associate Dean for Industry Relations and Outreach, a position created specifically for him, he established two novel master's degree programs: the Multidisciplinary Master of Science in Engineering and the new Master of Science in Airworthiness Engineering.

Throughout his 46 years, Dr. Ladesic has left a legacy of working with industry, forging lasting strategic relationships, and fostering the idea that "to teach engineering, one should do engineering." His research has almost exclusively arisen from industry needs, and in most cases has resulted in the issuance of patents. A Professional Engineer (PE) and an FAA structural-designated engineer representative (DER), his work has had profound impact on general aviation in the U.S.

Faculty Accomplishments

- **Dr. Riccardo Bevilacqua was elected as Co-Chair of the International Academy of Astronautics (IAA) Committee on Space Debris.**
- **Dr. Hever Moncayo was named an Associate Fellow of the American Institute of Aeronautics and Astronautics (AIAA).**
- **Elsevier has created an international list of the world's top 2% of scientists recognized for their scholarly impact (excluding self-citations):** elsevier.digitalcommonsdata.com/datasets/btchxktzyw/3

The following faculty are recognized in the list (1,109 researchers are in the Aerospace Engineering sub-list):

Dr. J. Gordon Leishman #30
Dr. Mark Balas #41 (visiting)
Dr. John Ekaterinaris #202
Dr. Tasos Lyrintzis #495
Dr. James Gregory #514
Dr. Reda Mankbadi #677

- **Dr. Richard Anderson was profiled in a Vertiflite leadership profile (Jan.-Feb. 2021 issue).**

New Faculty

The Aerospace Engineering department welcomed three new faculty members in 2021:

Dr. Riccardo Bevilacqua, Professor

Dr. Riccardo Bevilacqua holds a Ph.D. in Applied Mathematics (2007) and a M.Sc. in Aerospace Engineering (2002) from the University of Rome, "Sapienza," Italy. Dr. Bevilacqua is the recipient of two Young Investigator Awards from the Air Force Office of Scientific Research (2012) and the Office of Naval Research (2013), the Dave Ward Memorial Lecture Award from the Aerospace Control and Guidance Systems Committee (2014), and five Air Force Research Lab Summer Faculty Fellowships (2012, 2015, 2019, 2020 and 2021). His research interests include spacecraft formation flight, space robotics and warheads/spacecraft fragment fly-out predictions. He is an AIAA Associate Fellow, IAA Full Member and AAS Fellow, as well as the founder and chair of the IAA Conference on Space Situational Awareness.

Dr. Hancheol Cho, Assistant Professor

Dr. Hancheol Cho holds a Ph.D. in Aerospace Engineering from the University of Southern California, Los Angeles (2012). He has also held postdoctoral positions at the University of Liege in Belgium (2015-2017) and Sandia National Laboratories in Albuquerque, New Mexico (2017-2019). His research interests include robust adaptive controls, astrodynamics, optimization and robotics. He directs the Autonomous Spacecraft and Robotic Systems Research Group at Embry-Riddle, where he and his students are studying autonomous adaptive control strategies for the relative motion of multiple spacecraft with equality/inequality constraints.

Dr. Jennifer Smith, Professor

Dr. Jennifer Smith holds a Ph.D. in Electrical Engineering from Utah State University. Prior to joining Embry-Riddle, she was a tenured full professor at Weber State University (WSU) in Ogden, Utah. She was recruited by WSU to help create their Electrical Engineering program and eventually became Director of the Center for Aerospace Technology, which specializes in the creation of small spacecraft projects for engineering education. Dr. Smith's research interests include quantum field theory engineering as it relates to electromagnetic gravity. She is the faculty advisor for Hermes, a student CubeSat project, and is a consultant for the EagleCam project.

Faculty Awards

- Dr. Sirish Namilae was named the College of Engineering's Researcher of the Year.
- Dr. Lakshman Narayanaswami received the 2021 Embry-Riddle Aerospace Engineering undergraduate teaching award.
- Dr. Richard Prazenica received the 2021 Embry-Riddle Aerospace Engineering graduate teaching award.

Photo Credit: Joseph Ayd

Eagles Win Third Overall in AIAA "Design, Build, Fly" Competition

Embry-Riddle students scored big at the American Institute of Aeronautics and Astronautics' (AIAA) Design, Build, Fly competition, which pits university students from across the world against each other in challenges meant to test their skills in fabricating and demonstrating electric-powered, radio-controlled unmanned aerial vehicles (UAV).

Comprised of 25 Aerospace Engineering students, the Eagle team's design featured a towed sensor — a torpedo-like tube with tail fins for stability that is stowed inside the aircraft and can be deployed in flight. The team won third place overall, second in the United States, marking the best finish ever for an Embry-Riddle team at this event.

"The annual AIAA competition teaches our students about the essential engineering trade-offs in aircraft design to meet specific flight performance and mission requirements, similar to the actual aeronautical design problems faced by the industry," said Dr. J. Gordon Leishman, distinguished professor in the Aerospace Engineering Department and the team's faculty advisor.

The team was forced to make many operational adjustments due to restrictions imposed by the COVID-19 pandemic. Most notably, time in the lab was limited which, according to recent graduate Caleb Reeves, the team's chief engineer, was the biggest obstacle to overcome.

"Despite the circumstances, we were still able to design, build and successfully fly the first iteration of the aircraft in record time: only 8 weeks," Reeves said. "Typically, it takes 10-11 weeks."

And that dedication pays off — not least of which by helping students land high-paying jobs after graduation.

"Design, Build, Fly allows us as engineering students to break down a problem, design a solution and build a working product just as would be done in the industry," said current team leader Joseph Ayd.

The range of skills learned through the competition will serve students long after they graduate, according to Leishman.

"Students must develop an extensive range of skills to succeed in this competition," he said. "What is particularly difficult is that the Design, Build, Fly mission changes every year, and each team has to start with a fresh aircraft design — albeit with the advantage of a growing knowledge base and lessons learned from the previous years."

Photo Credit: Grace Robertson

Astronaut Scholar Program Taps First Eagle Innovator

Through a combination of leadership, research excellence and a desire to change the world with science, Embry-Riddle Aeronautical University senior Grace Robertson has been named to the 2021 class of Astronaut Scholars, an organization that deems her "among the best and brightest minds in STEM."

"Hearing that I was officially Embry-Riddle's first Astronaut Scholar was truly galvanizing," said Robertson, an Aerospace Engineering major.

The Astronaut Scholars Program awarded recipients from universities throughout the country scholarships up to $15,000, membership in the Astronaut Scholar Honor Society and various mentoring opportunities from astronauts, scholar alumni and space industry executives.

For Dr. Troy Henderson, associate professor of Aerospace Engineering who nominated Robertson for the scholarship, it is her willingness to contribute, tackle new challenges and innovate that sets her apart.

"She has a deep passion for commercial spaceflight and a tremendous work ethic," Henderson said. "And she is a leader in multiple humanitarian, environmental and outreach events as part of the Honors Program."

Those projects, however, are in addition to Robertson's core area of interest: commercial spaceflight. When she found out that Henderson was a principal investigator in work to build EagleCam, she jumped at the chance to be involved.

"As a junior and one of the youngest team members, Grace took over the payload integration and management for a suborbital flight that will test launch environment vibrations; joined the sensors team and has contributed to calibration and analysis; and became involved in testing hardware," Henderson added. "Her organizational skills and motivation have greatly increased productivity and shortened the duration of every task in which she has been involved."

Office of Undergraduate Research Director Wes Lewis added that Robertson's win reflects Embry-Riddle's mission to develop the next generation of leaders in STEM.

"Embry-Riddle creates an environment to inspire students to be part of the discovery and innovative process during their undergraduate careers," he said. "Students are encouraged to excel inside the classroom and outside by actively leading research projects, disseminating their findings to the greater community and building confidence in their abilities to apply their theoretical knowledge to solve real-world problems."

ASTRONAUT SCHOLARSHIP FOUNDATION
CREATED BY THE MERCURY 7 ASTRONAUTS

Aerospace Engineering Ph.D. student Nicholas Zhu

Four Aerospace Engineering Students Earn Scholarships from the U.S. Department of Defense

When Kayann Coote, a junior in Aerospace Engineering, found out she had won a U.S. Department of Defense (DoD) scholarship that would support her through her bachelor's and master's degree programs at Embry-Riddle, she remembers breathing a sigh of relief.

"This scholarship will make a huge difference in my life," Coote said. "Now I can focus more energy into my classes, as well as gain experience through internships while I am still in school."

Through her DoD-sponsored Science, Mathematics, and Research for Transformation (SMART) scholarship, Coote will work summers on satellite structures at the Space Vehicles Directorate at Kirtland Air Force Base in New Mexico. In addition to being awarded full tuition for two undergraduate and two master's program years, she will receive a stipend and full-time employment with the DoD after graduation in 2021.

Coote is one of four Aerospace Engineering students to receive scholarships from the DoD in 2021. The others are Ph.D. students Chris Hays, David Zuehlke and Nicholas Zhu.

Zhu, who conducts research on experimental aerodynamics in Embry-Riddle's subsonic wind tunnel, is working to better understand and eventually model ship aerodynamics. Navy ships generate unsteadiness and turbulent airflow, he said, making rotorcraft take-offs and landings extremely challenging on windy days.

Resiliency in multi-agent aerospace systems has become the new pinnacle of autonomy. Hays' research focuses on embedding resiliency into multi-agent navigation frameworks by identifying necessary navigation information and constructing trajectories that allow the necessary information to be obtained. His research has applications in the area of collision avoidance, task allocation, information fusion and state estimation and consensus.

Zuehlke's research involves autonomous tracking and imaging of satellites.

"By automating the process of tracking satellites, we reduce the risk of collisions and allow for the safe operation of the thousands of satellites currently in operation and thousands more soon to be in orbit," he said.

Zuehlke said his National Defense Science and Engineering Graduate (NDSEG) fellowship will allow him "to focus exclusively on my research for the remainder of my time at Embry-Riddle, and build relationships with experts in the Department of Defense that will undoubtedly shape my career."

Unlike the SMART scholarships, Zuehlke's NDSEG fellowship does not require recipients to work for a certain number of years for the DoD after graduation. The fellowship lasts for three years and pays for full tuition. It also provides a monthly stipend.

Aerospace Engineering Student Named 2021 Brooke Owens Fellow

In the winter of 2021, **Katrina Ternus** was awarded a prestigious Brooke Owens Fellowship, joining 43 other talented undergraduates who were selected from among more than 800 applicants.

As a winner of the fellowship, Ternus was connected to an executive-level mentor, attended the annual Brooke Owens Summit and became part of the network of more than 150 "Brookie" alumni in areas of space and aviation. Ternus was also awarded a paid professional internship at Ball Aerospace in Boulder, Colorado.

"The selected fellows have demonstrated their desire to pursue a career in aerospace, a record of leadership, a commitment to their communities and their inexhaustible creativity," said this year's victory announcement from the fellowship organization.

Ternus attributed her success at least partly to the communities she has been able to connect with at Embry-Riddle through hands-on projects.

"I've been part of teams that spend their free time launching rockets, building tools for NASA and designing satellites," said Ternus, a senior in Aerospace Engineering on the Daytona Beach Campus. "When Embry-Riddle supports these initiatives, it enables us to share our knowledge and motivation with each other, and it only amplifies the resultant achievements."

Three Eagles Earn National Fellowships, Aerospace Internships

After a rigorous selection process, three Embry-Riddle undergraduates received paid internships, professional mentoring and grants of $2,000 in the inaugural year of the Patti Grace Smith Fellowship competition, which was established to help "bring long-overdue diversity to the U.S. aerospace industry," according to a statement from the organization.

In letters of congratulations to the three honorees, Embry-Riddle President P. Barry Butler called the students "rising stars," citing one of the co-founders of the fellowship, Col. B. Alvin Drew, Jr. (USAF, Ret.), a two-time Space Shuttle astronaut, who earned his master's degree at Embry-Riddle.

"I'm confident that, like Col. Drew, you will discover there is no limit to what you can accomplish," Butler said. "You have already made an impressive start."

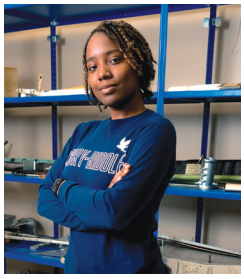
"The Patti Grace Smith Fellowship exists to serve extraordinarily talented students who possess everything that is needed to thrive in aerospace, but who come from a community where talent has long been overlooked by our industry," said Drew, who was quoted in the release announcing the winners.

Kyle Kingsberry, an Aerospace Engineering student and one of three recipients, said his fellowship will be an enormous help as he heads toward his career, allowing him "to start networking with industry professionals and gain practical experience through internships, while also receiving professional mentorship through every step of the process."

Kingsberry interned as an engineer at Blue Origin.

THESE STORIES WERE ORIGINALLY WRITTEN BY MICHAELA JARVIS WITH EMBRY-RIDDLE'S NEWS TEAM

Blood Condition Only Fuels Eagle's Dreams of Outer Space



Being an engineer was never the plan for Embry-Riddle sophomore **Maya Benson**.

Instead, she wanted to be an astronaut. But, being diagnosed with sickle cell beta thalassemia meant that she was unable to take part in strenuous activities. So, over time, her dreams began to change shape. Now an Aerospace Engineering major, she has found a new way to play a key role in space missions. She strives to help others travel outside of Earth's orbit and into outer space.

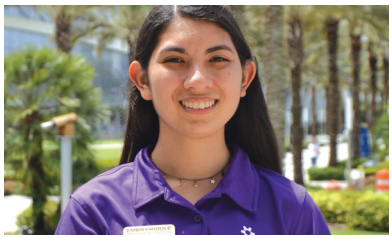
"I love designing parts as well as other things in CAD (computer-aided design) software," she said. "Something about being able to create my idea and actually see it makes me happy."

After graduation, she envisions moving on to graduate school and possibly earning her Ph.D. to further hone those design skills. From there, a job at NASA or JAXA (the Japan Aerospace Exploration Agency) is the goal — maybe she will even launch her own engineering firm specializing in robotics and deep-space flight.

"What drives me to pursue my dreams is knowing that there are other people out there who have a much harder life than I do, and they are obtaining their dreams," she said. "I just need to ignore whatever excuses I make for myself and continue on."

Benson was one of 13 high school students chosen to be part of the 2020 Boeing Scholars cohort.

Advice from a First-Generation Student: 'Never. Give. Up.'



Aerospace Engineering junior **Elena Djudaric** grew up watching her father sacrifice for the betterment of their family.

He moved to the United States from former-Yugoslavia, worked multiple jobs and always kept the end in mind, reinforcing to her once she began considering college that "it's better to cry for four years than cry for 40." That adage would go on to guide her as she endeavored to become the first in her family to earn a college education.

The biggest challenge she faced in starting her college career was simply knowing where and how to find help. That's where the Discover Embry-Riddle program came in.

"The program gave me a feel of community with other fellow first-gen peers, and a place to ask for help," Djudaric said. "Now, two years later, I have become a mentor and team lead for this program."

As such, she shares her experience transitioning from high school to college with freshmen.

"A piece of advice I would give to incoming first-gen students is to take opportunities, apply for that scholarship or job, make some new friends, take care of yourself and, most importantly, never be afraid to ask for help," Djudaric said. "There are others who have felt or may be feeling the exact same way as you and, eventually, they got through it. Never. Give. Up."

THESE STORIES WERE ORIGINALLY WRITTEN BY MIKE CAVALIERE WITH EMBRY-RIDDLE'S NEWS TEAM

Eagle Earns USRA Distinguished Undergraduate Award

Sarah Ketchersid, an Aerospace Engineering student, was awarded the Universities Space Research Association (USRA) Distinguished Undergraduate Award.

Ketchersid was one of five students selected from a competitive pool of 96 applicants. The USRA Distinguished Undergraduate Awards are granted to students on the strength of their academic accomplishments and leadership skills, as well as their interest in an aerospace engineering, space research or space science education career.

To Ketchersid, who will receive a one-time $5,000 scholarship from USRA, "The award is validation for the steps I've taken in my career and academic path… Receiving this award means not only am I on the right path to reach my goals, but others recognize the work and effort I've put into my projects, academics and work."

Dr. Tasos Lyrintzis, Distinguished Professor and Chair of the Department of Aerospace Engineering, added, "This is a very prestigious award and I believe it is the first time that an Embry-Riddle student is receiving it."

Ketchersid hopes to one day design a spacecraft for deep space exploration. "This award will help connect me with aerospace professionals, expand my network and get my foot in the door to companies in the space industry," she said.

THIS STORY WAS ORIGINALLY WRITTEN BY CAROLINE DUDA

Student Clubs

CubeSat Club: The CubeSat Club has three small-satellite projects under development:

- EagleCam (see page 3 for more information).
- Project Hermes, which investigates and predicts solar storms that affect Earth's weather.
- Project ERORA (Embry-Riddle Orbital Research Association), a new student-led project based on a CubeSat design. The team is currently discussing mission design.

Experimental Jet Engine Propulsion (XJEP) Club: XJEP participants design, build and test student-inspired propulsion devices.

As of Fall 2021, the club is focused on the use and modification of a JetCat P200 turbojet engine. The group has secured nearly $20,000 in internal funding, and is actively designing a mobile test stand, developing a modular afterburner and investigating noise-reduction methods. Near-term plans include work on hybrid engine concepts and redesigned engine components. The group is also working toward the submission of conference publications and securing external funding.

ERFSEDS: The Embry-Riddle Future Space Explorers and Developers Society is engaged in multiple initiatives:

Competitions: Project Artemis is a two-stage rocket built to fly to 30,000 feet in the Spaceport America Cup. Current work includes designing the first stage recovery system, developing a second-stage ignition system with igniters from commercial sounding rockets and employing topology optimization to design a vehicle payload.

Project Pathfinder is a competition launch vehicle built to fly to 10,000 feet. The Pathfinder X, currently under development for the FAR 1030 competition, is designed to carry a 2.2 pound payload and utilize a reefed parachute.

Research Projects: Project Harbard is developing a static-fired liquid engine to increase liquid propulsion knowledge.

Project Hummingbird has a goal of recovering a rocket utilizing autorotation, and has finished designing and constructing its flight vehicle for an upcoming test flight.

Project Zephyr focuses on supersonic deceleration. This rocket will be accelerated to Mach 1.5, where a parachute will be ejected to study the effects of high speeds on recovery devices.

Support Teams: Cerberus is an electronics and avionics project support team.

Launch Initiative refits old launch vehicles in order to provide new members with training in system integration and high-power rocketry.

Prometheus is a solid rocket motor support team that maintains ERFSEDS' current motor hardware and mixes solid rocket motors.

Ph.D. Graduates Secure First Tenure-Track Faculty Positions

Three AE Ph.D. graduates have recently accepted tenure-track aerospace engineering faculty positions. Dr. Seyyed Saman (Sam) Salehian joined Tuskegee University in Tuskegee, AL in November 2020. Dr. Neil Sullivan joined Embry-Riddle's Prescott Campus in August 2021 and Dr. Madhur (Maddy) Tiwari joined the Florida Institute of Technology in Melbourne, FL in August 2021.

Dr. Salehian obtained his Ph.D. in August 2020. He earned his master's degree in aerospace engineering from Embry-Riddle in May 2016, graduating with distinction. His research areas of interest include computational aerodynamics, aeroacoustics and multiphase flows. He is currently involved in research activities funded by NASA and the Department of Defense at Tuskegee University and also collaborates with research carried out by the AE Department at Embry-Riddle as a visiting research scholar.

Dr. Sullivan earned his Ph.D. in 2021. His research areas of interest include fluid mechanics and heat transfer, specifically in supercritical fluid flows. At the Prescott Campus, he teaches courses related to spacecraft propulsion and is a faculty mentor for the Rocket Development Lab. He is also mentoring undergraduate research funded by the Arizona Space Grant and Undergraduate Research Institute.

Dr. Tiwari earned his Ph.D. in 2021. His area of focus at Embry-Riddle was spacecraft robotics and controls. He was part of the Spacecraft Technologies Lab. He was also part of the EagleCam team. As an Assistant Professor of Aerospace Engineering at Florida Tech, his research focus is on developing autonomous systems. He has recently established his research lab and mentors several graduate and undergraduate students.

Ph.D. Program Update

In 2018, the Aerospace Engineering Ph.D. program received its first Graduate Assistance in Areas of National Need (GAANN) grant from the U.S. Department of Education. The GAANN program provides fellowships to assist Ph.D. students with excellent academic records who demonstrate financial need.

In 2021, five additional Aerospace Engineering Ph.D. students received GAANN fellowships: Scott Bender, Benjamin Malczewski, Nicholas Reed, Frederick Schill and Paul Winner. This brings the total number of GAANN fellowship recipients at Embry-Riddle to 16.

In October 2021, the program was renewed for three more years with a total funding of roughly $1.5M (not including cost-share).

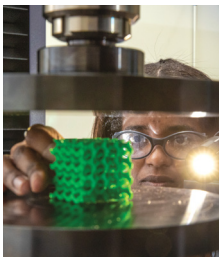
AIAA Region I Student Conference

Aerospace Engineering students won two awards at the 2021 AIAA Region II Student Conference:

- First place in Freshman/Sophomore Open Topic for Seshan Jayapregasham's paper, "Effect of Varying Reynolds Number On The Aerodynamic Design of Lifting Surfaces."
- Second place in Outstanding Branch Activity for the "Meet the Geeks" speed networking event during Engineers Week.

Congratulations to all!

3D Printing Could be the Key to Building Better Aircraft



Testing experimental aircraft wing designs has historically been a difficult task. Models must first be built — usually from metal, fiberglass and wood — then evaluated in a wind tunnel and, finally, iterated, making the endeavor both costly and time-consuming.

But that could all soon change, thanks to research conducted at Embry-Riddle.

In an attempt to advance the study of fluid-structure interactions, Aerospace Engineering Associate Professor Dr. Ali Tamijani, along with recent doctoral graduate **Rossana Fernandes**, a native of Angola, Africa, are pioneering the use of additive manufacturing (3D printing) to develop higher-quality and more complex aeroelastic models, which are then put to the test in Embry-Riddle's subsonic wind tunnel.

"Aircraft structures are strong and lightweight, but they deform during flight," said Tamijani. "We are using additive manufacturing to fabricate high-quality models with aeroelastic deformations to allow their behavior to be studied in the controlled-flow environment of the wind tunnel."

Fernandes has always had a love for airplanes and been fascinated with space exploration. Pursuing those fields as a career, however, almost seemed like a fantasy growing up in her home country.

"My passion led me to embrace the ambitious dream of becoming one of the first Angolan women to pursue a degree in Aerospace Engineering," she said. "I decided to apply to Embry-Riddle because it offered the top Aerospace Engineering program."

Tamijani and Fernandes recently put their research to the test with a 3D-printed generic supersonic fighter wing with a unique internal construction. Unlike conventional construction methods, additive manufacturing allowed them to test the wing with an advanced structural concept in the wind tunnel.

Left: 3D printed wing model without lower skin attached. Right: The wing mounted inside the wind tunnel test section.

THIS STORY WAS ORIGINALLY WRITTEN BY MIKE CAVALIERE WITH EMBRY-RIDDLE'S NEWS TEAM

Eagle Alumna Wins Prestigious National Science Foundation Research Grant

Janice Cabrera ('19) is one of three Eagles to win a National Science Foundation (NSF) Graduate Research Fellowship this year. Cabrera, who earned a bachelor's degree in Aerospace Engineering, is currently pursuing a Ph.D. at the Georgia Institute of Technology.

Cabrera credits some of her primary school teachers with helping her cultivate her love of math and science.

"I have fond memories of my middle-school teachers, who nurtured my interest in pursuing a STEM career by simply having conversations about the different career paths within STEM," she said.

When Cabrera took a career quiz, aerospace engineering stood out to her and, soon after, she researched the kinds of engineering problems that come up in that field.

"The astronautics aspect of aerospace engineering really captured my interest. I knew I would always be working on an exciting new problem every day," she said.

At the Georgia Institute of Technology, Cabrera is a member of the High-Power Electric Propulsion Lab with a primary research interest in high-speed plasma diagnostics.

THIS STORY WAS ORIGINALLY WRITTEN BY MICHAELA JARVIS WITH EMBRY-RIDDLE'S NEWS TEAM

Marwan Al-Haik
Professor
Ph.D., Florida State University

Richard Anderson
Professor & Director of Eagle Flight Research Center
Ph.D., University of Central Florida

Magdy Attia
Professor
Ph.D., Texas A&M University

Mark Balas
Visiting Distinguished Professor
Ph.D., University of Denver

Riccardo Bevilacqua
Professor
Ph.D., Universita degli Studi di Roma La Sapienza

Hancheol Cho
Assistant Professor
Ph.D., University of Southern California

Kyle Collins
Research Assistant Professor
Ph.D., Georgia Institute of Technology

K. Merve Dogan
Assistant Professor
Ph.D., University of South Florida

John Ekaterinaris
Distinguished Professor
Ph.D., Georgia Institute of Technology

William Engblom
Professor
Ph.D., University of Texas

Habib Eslami
Professor
Ph.D., Old Dominion University

Ebenezer Gnanamanickam
Associate Professor
Ph.D., Purdue University

Vladimir Golubev
Professor
Ph.D., University of Notre Dame

James Gregory
Professor & Dean of the College of Engineering
Ph.D., Purdue University

Glenn Greiner
Associate Professor & BSAE Program Coordinator
Embry-Riddle Aeronautical University

Troy Henderson
Associate Professor & Honors Program Coordinator
Ph.D., Texas A&M University

Daewon Kim
Associate Professor & M.S. Program Coordinator
Ph.D., Virginia Polytechnic Institute & State University

Karthik Krishna
Visiting Assistant Professor
Ph.D., Embry-Riddle Aeronautical University

Mandar Kulkarni
Assistant Professor
Ph.D., Virginia Polytechnic Institute & State University

J. Gordon Leishman
Distinguished Professor
Ph.D., Glasgow University

Anastasios Lyrintzis
Distinguished Professor & Chair
Ph.D., Cornell University

Reda Mankbadi
Distinguished Professor
Ph.D., Brown University

Alberto Mello
Associate Professor
Ph.D. University of Texas at Austin

Hever Moncayo
Associate Professor
Ph.D., West Virginia University

Sirish Namilae
Associate Professor & Ph.D. Program Coordinator
Ph.D., Florida State University

Lakshman Narayanaswami
Professor
Ph.D., Georgia Institute of Technology

Morad Nazari
Assistant Professor
Ph.D. New Mexico State University

Eric Perrell
Professor
Ph.D., North Carolina State University

Anish Prasad
Visiting Assistant Professor
Ph.D., Embry-Riddle Aeronautical University

Richard Prazenica
Associate Professor & Associate Chair
Ph.D., University of Florida

Frank Radosta
Professor
Ph.D., University of Florida

Mark Ricklick
Associate Professor
Ph.D., University of Central Florida

Dongeun Seo
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Jennifer Smith
Professor
Ph.D., Utah State University

David Sypeck
Professor
Ph.D., University of Virginia

Ali Yeilaghi Tamijani
Associate Professor
Ph.D., Virginia Polytechnic Institute & State University

Yi Zhao
Professor and Associate Dean
Ph.D., Louisiana State University

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