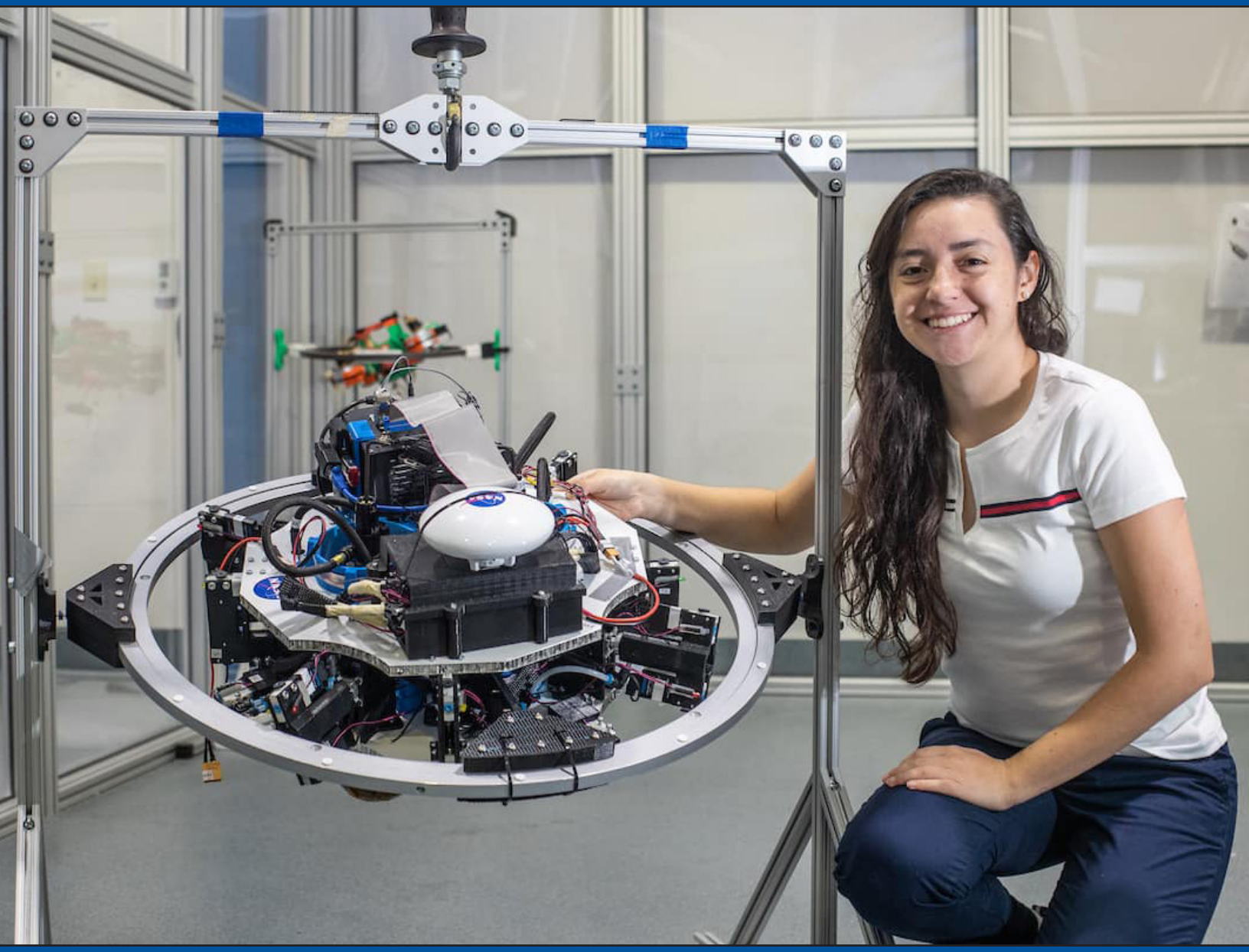
EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

AERONEWS

Department of Aerospace Engineering — Daytona Beach

DECEMBER 2019



2020 Best Colleges From U.S. News & World Report Ranked The Undergraduate Aerospace Engineering Program 4th.

Message From the Chair


Dr. Tasos Lyrintzis

It has been another very exiting year! The Aerospace Engineering Department continues to be the largest in the country with 1,534 B.S., 122 M.S. (including 20 distance students), and 34 Ph.D. students as of fall 2019. It should be noted that about 13.4% of our undergraduates are honors students, while the rest of the Embry-Riddle Daytona Beach Campus has 3.9% honors students. In addition, our certificate in AirWorthiness (1st program of its kind) has 18 students. A MS in AirWorthiness degree has been approved and will start in August 2020.

The undergraduate AE program has moved up from No. 11 to No. 4 (tied) in the U.S. News and World Report rankings announced in September 2019. This is a significant jump from last year and demonstrates the program quality. In Spring 2019 our graduate program was ranked No. 29 (tied), and No.2 in the State of Florida.

The research expenditures keep increasing. Some significant grants that were active in 2019: "Exploiting Non-linear Interactions within Wall Turbulence for Flow Control" (AFOSR Young Investigator Program, PI: Gnanamanickam); "Fidelity Requirements for Ship Air Wake Modeling in Dynamic Interface Simulations" (U.S. Army/NASA/ONR/ Penn State Vertical Lift Research Center of Excellence, PIs: Leishman, Gnanamanickam); "A Self-sustaining Wind Energy Extraction Technique (SWEET) Using Multi-level Control Design Methods" (NSF, PIs: MacKunis (Physics), Golubev, Mankbadi); "Advanced Air-Oil Cooler with Shape Memory Alloy Control Actuation" (Boeing, PI, Ricklick); "Boeing CAV Hybrid Power plant: Phase II (Boeing PIs: Anderson, Mirmirani), "Investigation of Load Path Based Topology Optimization" (AFOSR Young Investigator Program, PI: Tamijani); "Multi-scale Models for Transportation Systems under Emergency" (Department of Transportation; PIs: Liu, COA, Namilae); "Cyber infrastructure for Pedestrian Dynamics-Based Analysis of Infection Propagation Through Air Travel" (NSF, PIs, Ashok Srinivasan of UWF, S. Namilae, and Mathew Scotch of ASUI); "Integrated Structural Health Sensors for Inflatable Space Habitats" (NASA, PIs: Kim, Namilae). Also, our Department has a grant from the Department of Education, GAANN (Graduate Assistance in Areas of National Need) program to support four to six Ph.D. students/year (U.S. citizens), which is very important for our Ph.D. program.

In addition, we continue to have numerous student projects at both undergraduate and graduate levels. In April 2019 our AIAA design build fly (DBF) team placed sixth (third in the U.S.) among more than 100 teams worldwide. This is our highest placement ever.

Currently, researchers at the Eagle Flight Research Center (EFRC) are working on hybrid and full electric airplanes and have started the ERAU Hybrid Consortium to focus on hybrid electric airplanes. The consortium now includes: Airbus, Textron, Rolls-Royce, P&W, Hartzell and GE. This consortium's vision is to explore the design space for turbine/electric aircraft propulsion systems. In addition, ERAU is now a Charter Member and the only University in GAMA (General Aviation Manufacturers Association) under the new EPIC (Electric Propulsion Innovation & Competitiveness) program for electric and hybrid propulsion innovation.

Finally, the Department has a significant presence in the newly constructed John Mica Center for Engineering and Aerospace Innovation (MicaPlex). Descriptions of the labs can be found at https://erau.edu/micaplex/labs. Aerospace Engineering faculty are involved in the Advanced Dynamics and Control Lab, the Composites Research Lab, the High-Performance Computing Lab, the Materials Research Lab, the Space Technology Lab, the Structures Research Lab, and the Thermal Systems Lab.

Best Regards,

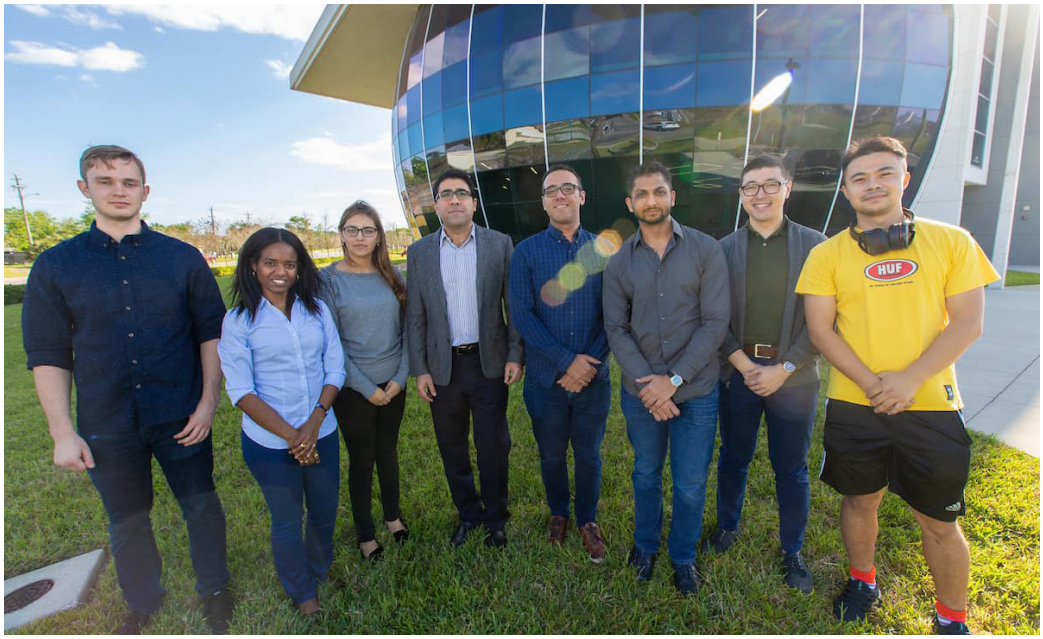
A Lyrintzis

Dr. Tasos Lyrintzis
Distinguished Professor, Department Chair

AEROSPACE

Faculty Earns Coveted NSF Early Career Award for Pioneering Research

(Dr. Ali Yeilaghi Tamijani)



From Left: Lee Alacoque, Rossana Fernandes, Patricia Velasco, Dr. Ali Tamijani, Dr. Kaveh Gharibi (post-doctoral researcher), Chitrang Patel, Aryslan Malik and Zichao Wang, in front of Embry-Riddle's MicaPlex research facility (Photo: Embry-Riddle/David Massey).

Research that could lead to more lightweight, efficient aircraft wings, orthopedic implants, and a host of other consumer technologies, spearheaded by Dr. Ali Tamijani, has received a highly competitive, five-year, $500,000 National Science Foundation (NSF) Early Career Award.

An associate professor, Tamijani in 2017 received another early career faculty award through the U.S. Air Force Office of Scientific Research's (AFOSR) Young Investigators Research Program. That award, recognizing researchers showing exceptional ability and promise in conducting basic research, provided $360,000 in support for three years.

Tamijani's research has been focused on innovative lightweight and efficient structural designs using novel analysis techniques and robust optimization algorithms, coupled with advanced manufacturing processes. His work provides tools for optimizing designs to support many different applications, including aerospace structures, biomedical devices, energy absorbers, heat exchangers and acoustic insulation treatments.

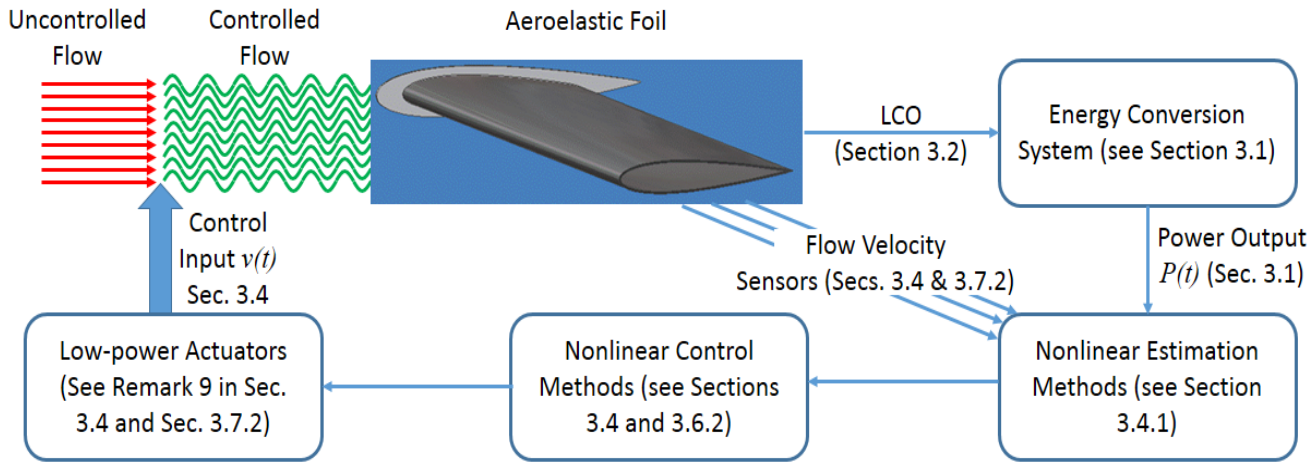
The optimization methods being developed in Tamijani's lab focus on overall structures as well as their cellular components. "Our design approach will permit microstructures to vary in optimal ways throughout the structure, and they incorporate manufacturing constraints associated with 3D printing techniques into the optimization process," he explained. "Our new technique will allow the design and fabrication of innovative structures with unrivaled performance."

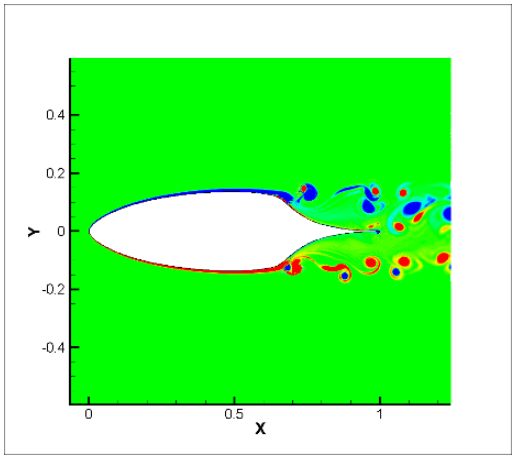
The NSF Early Career Award will also allow Tamijani to introduce young people to engineering, through STEM outreach activities. Toward that end, young people will be introduced to cellular structure design and fabrication concepts, integrating them into interactive learning plans through hands-on demonstrations, visual tools and concept mapping. Last summer, Tamijani offered a four-week educational program for K-12 students that provided hands-on demonstrations and visual tools on structural design and additive manufacturing.

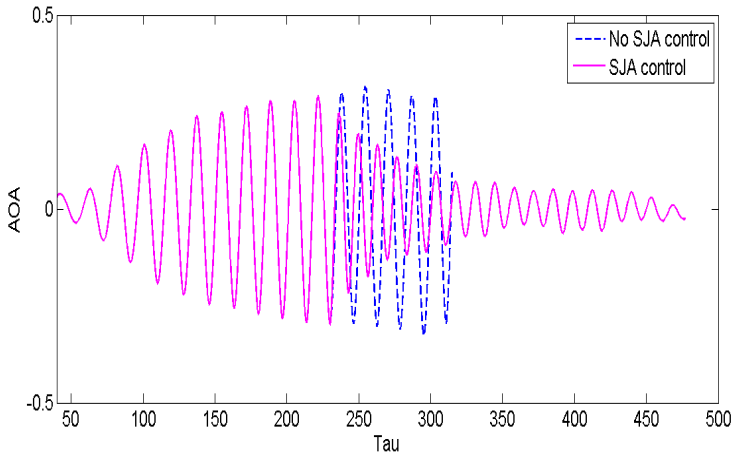
NSF-BSF Grant Award for Self-Sustaining Wind Energy Extraction Technique Using Multi-Level Control Design Methods

(Dr. Vladimir Golubev and Dr. Reda Mankbadi)

This project involves an international collaboration between the ERAU Departments of Aerospace Engineering (co-PIs: Dr. Vladimir Golubev and Dr. Reda Mankbadi) and Physical Sciences (PI: Dr. William MacKunis), and the Israeli Technion University (co-PI: Dr. Oksana Stalnov). The primary scientific objective of the proposed research is to investigate and experimentally validate new physics-based closed-loop active flow control methods that can be utilized to enhance the fluid kinetic energy harvesting capability of oscillating foil-based wind energy harvesting systems. Specifically, some of the challenges addressed in the conducted research stem from the conventional inability to sustain limit cycle oscillations (i.e., plunging and pitching foil displacements) and achieve continual power generation in realistic, time-varying operating conditions. The scientific objective is achieved using a ground-up multidisciplinary approach, which synergistically combines the international collaborative efforts in (1) physics-based mathematical modeling and closed-loop control design and analysis; (2) development of high-fidelity computational fluid dynamics simulations to optimize foil geometry and to test closed-loop flow control methods; and (3) experimental wind tunnel testing and validation of new closed-loop oscillating foil-based fluid kinetic energy harvesting systems under realistic conditions that foils will encounter under atmospheric boundary layer.







Artemis Program - Collaborative Research with Intuitive Machines

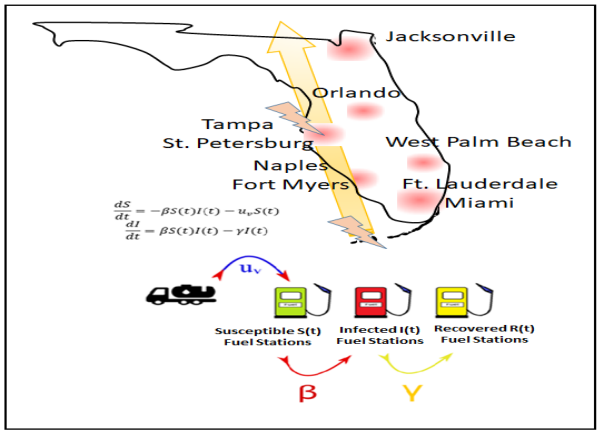
(Dr. Troy Henderson)

Dr. Troy Henderson, Assistant Professor of Aerospace Engineering, has established multiple collaborative research projects with Houston-based Intuitive Machines. On May 31, 2019, Intuitive Machines was one of three companies selected under the Commercial Lunar Payload Services (CLPS) as part of the Artemis Program. The Nova-C lander will launch in August 2021, carrying multiple payloads to the lunar surface. In one project, Dr. Henderson and graduate students are developing hazard detection and avoidance technologies that will be integrated into the navigation system for final descent. In a related project funded separately by the NASA Tipping Point Technologies Program, Henderson, Dr. Richard Prazenica (Associate Professor), and graduate students are developing an open-source vision processing unit which will fly aboard Nova-C, but will also provide future users with algorithms and validated data sets for faster development. Finally, Intuitive Machines issued a challenge to ERAU to obtain a third-person images of the lunar landing. Henderson is leading a team of faculty and students to develop EagleCam, a 360 degree camera system which will be ejected from Nova-C and capture images of the final descent, images of the engine plume, test a dust mitigation system developed by NASA/KSC, and lead to future STEM outreach opportunities of real lunar landing imagery.

Models to Study Fuel Shortage During Hurricanes

(Dr. Sirish Namilae and Dr. Richard Prazenica)

Hurricanes are a persistent problem in Florida. The large-scale evacuations during hurricanes in the Southeastern United States often result in fuel shortages during the evacuation. For instance, evacuation during Hurricane Irma in 2017 created widespread fuel shortage problems days before the hurricane's landfall for most of Florida and especially for South Florida. The fuel shortage problems gave rise to various other issues such as an unpredictable increase in fuel prices that exasperate and hinder evacuees living in low-income areas, traffic congestion on the highways due to stranded vehicles, and difficulties with emergency and medical transportation needs. A team of Embry-Riddle Aeronautical University faculty and graduate student researchers is looking into computational models that can aid in emergency preparedness and help mitigate the impacts of hurricanes. The computational models borrow heavily from particle dynamics, epidemic spread models and optimal control theory. Understanding the characteristics of fuel shortage during hurricane evacuation is crucial to the mitigation of this problem and reducing the casualties caused by an imminent hurricane. The data explosion from social media enables new analysis approaches for this problem. The team uses crowd-sourced data from the social media app Gasbuddy in combination with evacuation data from the department of transportation to model this problem. Results suggest the spread of gas shortage during recent hurricanes is comparable to the spread of an infectious disease like measles with similar reproduction number. The model suggests optimal intervention strategies and fuels shortage predictions for future hurricanes. The research team includes Professors Sirish Namilae and Richard Prazenica of Aerospace Engineering as well as Professors. Scott Parr, Civil Engineering Department and Dahai Liu ,College of Aviation. The research is part of a sub-grant from the Center for Advanced Transportation Mobility, a consortium led by North Carolina Agricultural and Technical State University through the DOT's University Transportation Centers Program.



Infectious Disease Spread in Airports

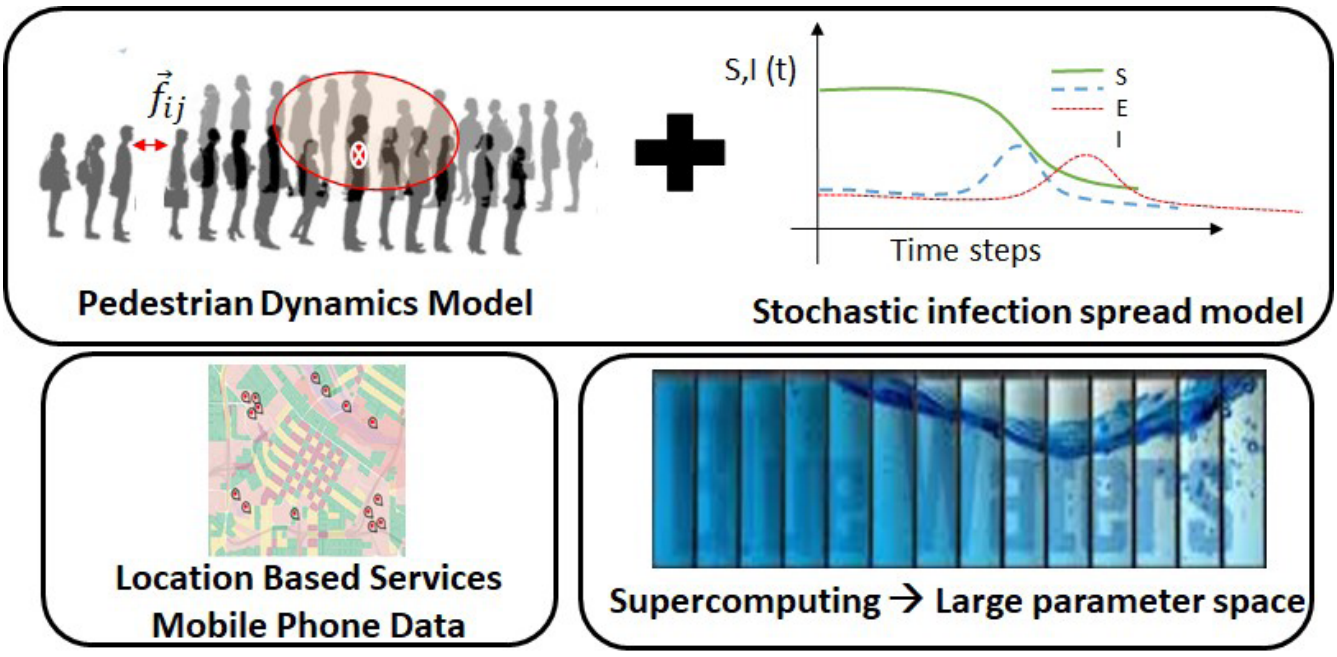
(Dr. Sirish Namilae)

Air travel has been identified as a leading factor in the spread of several infectious diseases including influenza, SARS, tuberculosis, and measles. This has motivated calls for limitations on air travel, for example during the 2014 Ebola outbreak in West Africa. However, such limitations carry considerable human and economic costs. Computational modeling based policy analysis offers promise in mitigating the spread of diseases without disrupting air travel.

Aerospace Engineering's faculty Dr. Sirish Namilae has collaborated with researchers at Arizona State University and the University of West Florida to come up with modeling and software to address this problem. This research is part of a recent NSF collaborative grant to study this multidisciplinary problem. The proposed work involves science drivers from pedestrian dynamics and epidemic modeling with an impact on the critical air-transportation infrastructure.

Dr. Namilae has developed a molecular dynamics based approach to study the movement of pedestrian particles in complex environments like airports. The model utilizes data sources from cell phone use and social media to generate aggregate trajectories of pedestrian particles. This information is used in epidemiological models to estimate disease spread and to find mitigation measures. The approach is highly computationally intensive and requires the use of petascale supercomputing facilities

In addition to external computing facilities, the researchers will use Embry-Riddle's Cray® CS™ cluster supercomputer to generate simulations corresponding to various scenarios. The research team is also organizing an interdisciplinary workshop on this topic in February.



Schematic showing the major components of the research study.

Ford Motor Company and Embry-Riddle Help Advance Safer Batteries for Electric Vehicles

(Dr. David Sypeck)

Preventing electric vehicles from bursting into flames on impact – as happened on Aug. 10 when an electric car driving on auto-pilot slammed into a tow truck in Moscow – is a primary goal of a new Embry-Riddle Aeronautical University project funded by the Ford Motor Company.

Dr. Feng Zhu, assistant professor of Mechanical Engineering at Embry-Riddle, has received a three-year award of up to $150,000 through the highly competitive Ford-University Research Program to study safety issues related to the high-performance lithium-ion battery system used in many electric and hybrid-electric vehicles. Zhu, who recently won a Forest R. McFarland Award from the Society of Automotive Engineers International for his outstanding efforts to enhance the exchange of technical information, noted that transportation safety is the focus of his latest research project. Lithium-ion batteries help make cars lighter and more fuel-efficient because they can store large amounts of energy in a relatively small area, he explained, but the systems are vulnerable in certain situations.

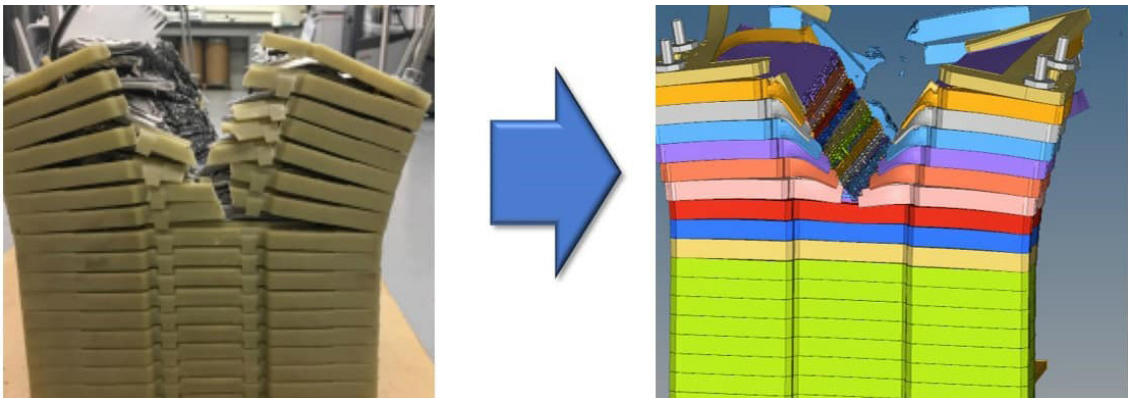
“If it is crushed, a lithium-ion battery can have structure failure, resulting in an explosion and fire,” Zhu said. “We want to better understand the exact failure mechanisms of these battery systems, and particularly, the impact of crushing. What we learn could help guide the development of safer battery packs for vehicles.”

The project to be conducted by Zhu, Aerospace Engineering Professor David Sypeck and their students – will involve running mechanical tests in Embry-Riddle’s Materials Testing and Lightweight Materials and Structures laboratories. The first step will be an assessment of how much energy and what types of loadings can cause a failure in a lithium-ion battery system, Zhu said. That information will then be used to simulate real-world crashes.

“This approach is called traffic accident reconstruction,” he said. “It’s too expensive to crush a whole vehicle with the battery system and it’s not safe. So, we will use computer modeling to repeatedly simulate actual accidents. In that way, we will be able to see things that cannot be measured experimentally.”

The goal of the work is to fully understand the failure mechanism that takes place when a lithium-ion battery system is crushed. For example, Zhu asked, if a crash causes the system to short circuit, what is the event that triggers it, and how can that mechanism be prevented through improved design?

The research will build on a preliminary study Zhu, Sypeck and several graduate students had conducted, with support from the Massachusetts Institute of Technology Battery Consortium, which characterized the mechanical properties of battery cell components.



These side-by-side images show a lithium-ion battery failure following a laboratory test, compared with a computer simulation of the event . (Photo courtesy of Dr. Zhu)

Eagle Flight Research Center

(Dr. Richard Anderson)

Eagle Flight Research Center operates out of a brand new research hangar and office structure adjacent to Daytona International Airport (DAB) and directly connected by taxiway. The building has been outfitted with all fixtures needed for aviation testing indoors and on the apron. By summer 2020, equipment will include 300 kW of electronic load for precise testing of hybrid power systems, an FS Bondtec ultrasonic wire bonder for reliable construction of high technology battery modules, an external dedicated battery test cell, and myriad other electronic and electrical test fixtures to carry out research. Inside are fixed wing and VTOL aircraft, instrumented and undergoing testing in support of hybrid and fully electric flight.

Eagle Flight Research Center is the heart of applied engineering for aircraft systems at Embry-Riddle. This independent unit involves faculty, staff, and students from Aerospace Engineering and other engineering disciplines, united in teams and creating airworthy hardware in a research environment.

There are currently 3 main focus areas – all related to the hottest trend in aviation which is Urban Air Mobility (UAM). Most UAM vehicles, and there are many concepts in the media, rely on battery power for propulsion and typically feature multiple smaller fan blades in various numbers and arrangements. EFRC recognized that above thresholds for size and mission duration, batteries using technology of today cannot meet the need. For this reason, we have concentrated in hybrid propulsion for aircraft application. One project under contract to Boeing has involved the build and test of a full power plant with innovative packaging, advanced controls, and bristling with sensors to truly understand every detail of the system converting gasoline to electricity in terms of mechanical, thermal, electrical and controls. This hybrid power plant is the perfect choice to feed electrical power to 'distributed electric drives' like those found on most UAM concepts.

Alongside the power plant research are two related research areas. First, UAM and the next generation of aircraft will need to understand propeller noise in order to meet consumer demand in new markets. EFRC is working in this area with a full-scale anechoic chamber, hundreds of hours of propeller testing with industry partners employing proprietary controls. From this work, EFRC has secured a U.S. and international patent on this technology that will prove valuable for years to come. Next, fixed pitch propellers are a limitation for passenger-scale craft and EFRC has developed compact, reliable rotor heads with cyclic and collective pitch control that greatly enhance the efficiency and safety of craft using multiple small blades. Advanced control strategies, proven in hardware and in demanding test flights, can be coupled with this unique hardware and applied to new creations.

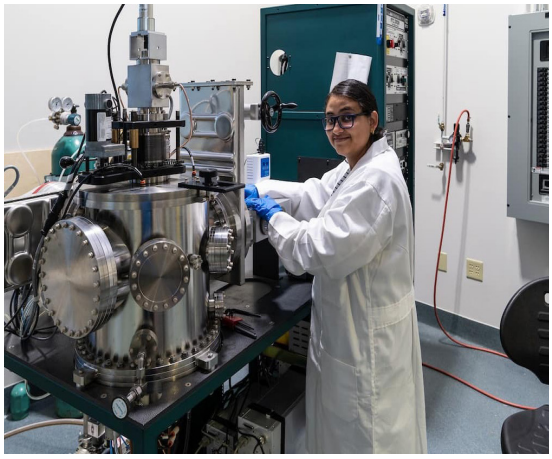
In 2020, investment includes new equipment that will enable research into advanced batteries – both for propulsion and for aircraft backup and supplemental power. EFRC will have up to 300 kW of programmable high-speed DC electronic load, an F&S Bondtec wire bonder for constructing reliable battery modules, and additional equipment coming on line related to all focus areas.

Student Profiles

Smart Composite Materials

(Dr. Marwan Al-Haik and Graduate Student Suma Ayyagari)

Dr. Marwan Al-Haik, with his graduate student Suma Ayyagari, conducted research on the mechanical attributes of zinc-oxide enhanced carbon fiber-reinforced composites (CFRPs) versus CFRPs incorporating nanotubes called buckypaper. Through this research they describe how certain hybrid composite combinations that could lead to the development of highly multi-functional composites with better strength, stiffness, damping and electrical conductivity,



Ayyagari, a Ph.D. candidate who is first author on the paper, used a farming analogy to describe the vapor deposition process. "Basically, you deposit some seeds and add a kind of fertilizer," she said. "You need wet chemistry to grow the seeds." They published their preliminary results in the Journal of Carbon Research, the article, "Mechanical and Electrical Characterization of Carbon Fiber/Bucky Paper/Zinc Oxide Hybrid Composites," was published January 18, 2018,

A native of India who comes from a family of computer scientists, Ayyagari said her passion is "fixing things and understanding what caused the problem." Her work in the lab is painstaking and requires patience, but she said Al-Haik has been an excellent coach. "Before I touch a machine, I know how to use it because he teaches well," she added. "For experimental research, you need help, especially with these new machines, and he's very conscientious in sharing what he knows.

Navigation and Control Systems for Six-Degrees of Freedom Spacecraft

(Dr. Hever Moncayo and Graduate Student Yomary Betancur Vesga)

Yomary Betancur Vesga (see cover page) has been developing and implementing guidance, navigation and control systems for a six-degree-of-freedom spacecraft. The craft, complete with a camera and drill systems, will have the ability to "jump" onto asteroids to collect samples. The work was conducted under the mentorship of Dr. Hever Moncayo, Associate Professor of Aerospace Engineering with expertise in flight dynamics, control, guidance and navigation, with whom she co-authored a paper for the Journal of Aerospace Information Systems. She was responsible for integrating the hardware and software for an Extreme Access System (EASY) spacecraft and testing with a device called an Integrated Gravity Offloading Robotic System (IGOR), which is a piece of large equipment cabled to the ceiling, similar to the machinery that moves automobiles through a factory assembly line. This testing apparatus enabled her to subject the test vehicle to high fidelity, partial-gravity simulations. The entire system weighs about 52 pounds.

Betancur Vesga was born in Bogota, Colombia, where she earned her Bachelor of Aeronautical Engineering from San Buenaventura University in 2015. In Colombia, she interned as a safety analyst in the operations safety department of Avianca Holdings, S.A. Even though she was part of a "family of lawyers," her father worked with members of the U.S. Air Force and, in turn, she developed an early interest in Aerospace Engineering. As an undergraduate, she designed experimental rockets and investigated airflow at different accelerations. Knowing that she wanted to work for NASA, Betancur Vesga set her sights on studying in the U.S. "Everyone knows Embry-Riddle," she said. She was admitted to the Master of Science in Aerospace Engineering program in 2017. Through an eight-month co-op position with Collins Aerospace, Betancur Vesga worked on Traffic Alert and Collision Avoidance Systems (TCAS). She will be continuing her work as a Collins Aerospace Engineer. When she becomes a U.S. citizen, she plans to transition to space-focused projects at Collins.

Master of Science in Airworthiness Engineering Launches August 2020

(Dr. James Ladesic and Associate Professor Glenn Greiner)

The nation's first Master of Science in Airworthiness Engineering (MSAWE) will launch on August 10, 2020 thanks to collaborative efforst between the College of Engineering (COE) and the Department of Industry Relations and Outreach. It will consist of 10 courses (30 credits) that are SACSCOC approved and will be completely online. These courses are part of the Certificate of Study in Airworthiness Engineering (CSAE).

In the Summer of 2018, Dr. Stephen Cook, Northrop Grumman Corporation Airworthiness Fellow and Prof. Glenn Greiner, Director of Industry Relations and Outreach, visited the Federal Aviation Administration (FAA) Headquarters in Washington, DC to discuss further with their administration an opportunity to develop the program. This meeting was to discuss the possibility of courses being offered, in which the FAA would recognize the MSAWE program. In a follow-up meeting in October 2018 on the Daytona Beach Campus, the FAA announced their Deviation Memo allowing Designated Engineering Representatives (DER) applicants to substitute a MSAWE degree for one year of experience. This was exciting news for the growth of the program.

In October 2018, at the Aerospace Industry Associates (AIA) meeting in Arlington, VA. Dr. Cook, Professor Greiner and others were able to present their growing concern of aerospace engineers having a deficit with the knowledge of Airworthiness within the aviation industry. Dr. James Ladesic, COE's Associate Dean, who has been influential from the start of the CSAE program (Summer 2016), coined the phrase that this program can also "educate the educators" and suggested that regulations needs to be implemented into the nation's undergraduate aerospace degrees. Within higher education in most cases, Professors are teaching their students what instructors taught them, and they are then teaching this same information to their students. "Students need to be knowledgeable in regulations, as well as engineering, upon their graduation of a Bachelor of Science in Aerospace Engineering," says Professor Greiner.

In November 2019, the newly formed Program Advisory Board met at the Daytona Beach Campus. Participants from all corners of the aerospace community attended in person for a day long meeting. The main topic was the MSAWE program and the unique opportunity the aerospace community has to tailor its curriculum to the needs of industry. The Program Objectives were finalized to identify what an MSAWE graduate would be able to understand and demonstrate:

1) Exhibit an understanding of civil and military regulations, national and international, and then apply to contemporary issues in air system certification.

2) Perform engineering analysis using acceptable methods for substantiating airworthiness compliance to requirements.

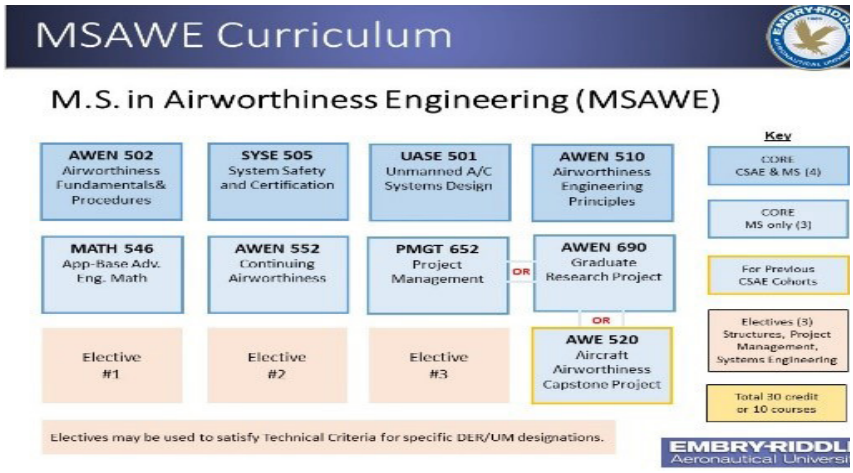
3) Effectively communicate information, both technical and procedural, in written and oral forms to audiences in the aviation and aerospace disciplines.

4) Make use of investigative methods to derive innovative airworthiness compliance solutions over the life cycle.

5) Demonstrate topic mastery of airworthiness engineering principles and processes for selected technical discipline areas in air system certification.

6) Recognize the importance of honest and ethical behavior concerning airworthiness in all their work, their oral statements, and their written artifacts.

The regulations to be part of the MSAWE program include for civil and military 14 CFR, ARP, RTCA DOs, JSSG, MIL-HDBK-516 to mention a few. As the program matures, the future plan is to offer this program thru the Asia Campus located in Singapore. For those not interested in the Master's degree, the CSAE program may be of interest. In order to complete the certificate program, a student would need to take the initial four courses that are offered as part of the master's program.

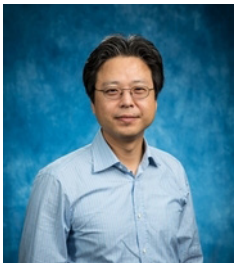


Faculty & Student News

Faculty Awards

Dr. Mark Ricklick

2019: College of Engineering Outstanding Teaching Award.
2019: Aerospace Engineering Graduate Teaching Award.



Dr. Dongeun Seo

2019: Aerospace Engineering Undergraduate Teaching Award .

Dr. Ali Yeilaghi Tamijani

2019: College of Engineering Research Award.

First Graduation Ceremonies for Certificates of Study in Airworthiness Engineering Students

Embry-Riddle held simultaneous bicoastal commencement ceremonies on April 6 for the inaugural graduating class receiving Certificates of Study in Airworthiness Engineering (CSAE) in Melbourne, Florida and San Diego, California. Embry-Riddle and Northrop Grumman Corporation partnered in 2017 to develop the nation's first airworthiness engineering graduate study program designed to meet the anticipated the company's needs.

Northrop Grumman employees in Melbourne receiving the CSAE included:

Lenny Grasso, structural engineer, Melbourne, Florida; Nicholas Meadows, mass properties engineer, Melbourne, Florida; Jose Munoz, mechanical engineer, St. Augustine, Florida, and; Kurt Lawson, engineering manager, Rolling Meadows, Illinois.

Northrop Grumman employees in San Diego included:

Areian Kouros, systems engineer Rancho Bernardo, California, and;Arthur Ozaki, program quality manager for global mission excellence and logistics Rancho Bernardo, California.

AIAA News- AIAA Design Team Projects

In the past year, the Embry-Riddle Daytona Beach branch of the American Institute of Aeronautics and Astronautics has been growing in number and member participation. To this end, the branch is launching two new design team projects, Freeflight and CubeSat, in addition to the previously sponsored Design/Build/Fly team, as well as laying the groundwork for a Women of Aeronautics & Astronautics sub-chapter. These teams are designed to reach and engage a larger portion of the Aerospace Engineering community on campus, as well as stimulating the technical interests of more students in the organization.

The Free Flight design team consists of ten students and focuses on the design, build, and testing of an ultra-lightweight, rubber band powered aircraft. Two members of the team currently hold national records in different classes of free flight aircraft. One of these members designed and built an aircraft that weighs less than a dollar bill and flies for over 25 minutes under its own power. The AIAA student chapter hopes to design and compete with an aircraft that can match and surpass this lighter-than-a-dollar-bill aircraft to claim a national record for the branch. The other new project, the CubeSat Design Project, is the branch's first team to participate in NASA's CubeSat Launch Initiative. This semester, the team proposed two CubeSats for NASA's National Competition. Both address different NASA Strategic Knowledge Gaps and are designed as payloads for the Artemis 2 mission in 2023. The first is Project L.A.R.S., which was designed to determine the radiation protection qualities of artificial lunar regolith in cislunar space. The other is Project S.C.O.R.C.H., which is designed to measure solar weather anomalies in a heliocentric orbit and be used as part of a space weather alarm system in the event of severe solar flares. In October, the concepts of both projects were reviewed by several Aerospace Engineering. professors and a conceptual design report for both was completed two weeks later. In early November, it was decided to continue the design of the S.C.O.R.C.H. Project to the preliminary design phase. Since then, the team has split up into six subsystem teams: Science, Structures/Thermal Systems, Command and Data Handling, Communications, Guidance and Control, and Power. The preliminary design of S.C.O.R.C.H. will be completed in March. An AIAA Design Report will be written and submitted for the 2020 Region II Student Conference in Tuscaloosa, Alabama. Several systems of the proposed CubeSat will be constructed and tested. Should NASA select the team's design it will go into space along with CubeSats from teams at other universities. This project is helping to engage student members interested in Astronautics.

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AIAA News- International Design Build-Fly Competition

In addition to the two new design teams, the Daytona Beach student branch is competing again in the international Design-Build-Fly competition. Every year, AIAA releases a request for proposals for a small UAV that can perform three different missions. In the past, the Embry-Riddle team has been very competitive, placing within the top ten for the past three years. The team consists of 30 undergraduate members and allows the students to participate in a real aircraft design project that expands on the topics learned in the classroom. This year, the competition requires the aircraft to carry as many small wooden passengers as possible and tow a banner in flight. The team scores more points for towing a larger banner and carrying more passengers. The aircraft was designed by a team of students in the Aircraft Preliminary Design course and then manufactured by a team of undergraduate students. The first iteration of the aircraft has successfully flown its first flight test. The team plans to build two more iterations of the aircraft before the competition in April to improve the aircraft and ensure that it can complete the scoring missions as competitively as possible. Last year, the team was awarded sixth overall, (third in the U.S.) and this year is aiming for a finish in the top three.

To bring new knowledge to our general membership, AIAA hosted a speaker on campus, Mr. Basil Hero. An investigative reporter and author, Mr. Hero talked about NASA's management strategies for the moonshot in the 1960s. In addition to Mr. Hero's talk, the chapter also hosted its second Pizza with Professors. At this event, engineering students were encouraged to socialize with their professors while enjoying some free pizza. In this way they could get to know each other in a more casual setting.

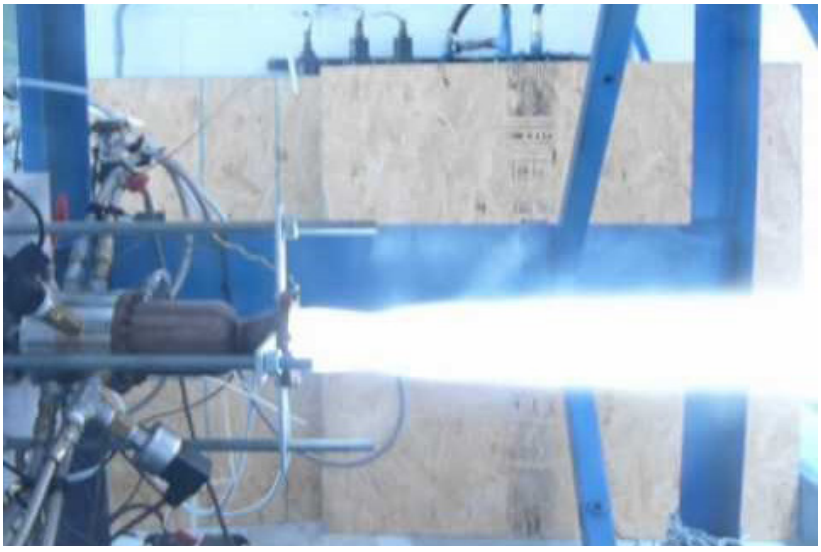
On a regional level, the chapter co-hosted the regional conference with FIT in Cocoa Beach in the spring of 2019. Co-hosting the Region II student conference with FIT was an exciting challenge for the chapter. The conference marked the first time in many years that the Daytona Beach student branch has hosted a conference. This inspired many members to become more active in their research and participation in branch events. In addition to all design teams and official events, the chapter sponsored several fellowship events outside of general meetings between students and professors to get them to engage with each other and possibly get together for future collaboration. The chapter also brought research opportunities to meetings as part of a continuing effort to help students find what they might be interested in. There is energy in the Embry-Riddle Daytona Beach branch of AIAA, and more great things are yet to come as it continues its upward trajectory.

Rocket Engine Design/Build/Test Program by Joint Daytona Beach and Prescott Student Team

Embry-Riddle Daytona Beach's Experimental Rocket Propulsion Labs (ERPL) student organization has resumed development of their liquid bi-propellant rocket engine that first test fired in 2010. In Project Aquila's initial concept demonstration, 300 pounds of thrust were produced for four seconds. Since then, further development has proceeded rather sporadically, limited primarily by test facility availability. Within the last two years though, a test cell has been constructed by Mechanical Engineering students at ERAU's Prescott Campus. They have fired their "Janus" concept demo engine several times.

The Aquila test duration was limited by engine heating. The present design improvement is a "regenerative" cooling jacket to circulate liquid ethanol fuel around the outside of the engine before being injected into the combustor. Tests are planned to show extended firing times, and to gather thermal data to guide future development.

Aerospace Engineering Senior Charles Watson has overseen the fabrication of the new components, and coordinated the technical and administrative efforts of students from both campuses. Watson,graduated in December 2019, hopes to "lay the foundation for a sustainable, collaborative relationship with the Prescott Campus in order to enable more complex projects in the future."



Updates

Embry-Riddle AE PhD Student Named Among 2020 Aviation Week's '20 Twenties

Doctoral Student David Zuehlke has been honored as one of three Embry-Riddle winners of Aviation Week's "Tomorrow's Technology Leaders: The 20 Twenties" Award. Established in 2013, the annual 20 Twenties awards program recognizes a very select group of talented students in their 20s who are on course to change the face of the aerospace and defense industry. The award honors outstanding academic performance, industry and civic contributions and exceptional research. The global aviation, aerospace and defense recognition program, administered in partnership with the AIAA, showcases 20 students worldwide each year earning STEM degrees who are nominated by their universities. Zuehlke is a Ph.D. honors student in Aerospace Engineering focusing on analytical dynamics and orbital mechanics. His passion for astronomy drives his current research focus in space surveillance using small telescopes. In 2018, he was awarded the Florida Space Grant Consortium Masters Fellowship, which supports outstanding students completing their thesis in areas relevant to NASA. He has spent the past two summers performing research with Aerospace Engineering professor and advisor Troy Henderson at the Air Force Research Laboratory in Albuquerque, N.M. He also assists Henderson as a teaching assistant for undergraduate-level Space Mechanics courses. In nominating Zuehlke, Henderson said, "David has expressed a clear passion to perform research in the area of space exploration. He shares this passion and knowledge through volunteer opportunities with STEM activities for the next generation. He has developed the intellect, motivation and skill set required to lead effectively as a faculty researcher or as a project manager in the aerospace industry."

The Aerospace Engineering Department Awards Ph.D. Students The Department of Education GAANN Fellowship Grant

The Aerospace Engineering Ph.D. program received a grant from the U.S. Department of Education, as part of the GAANN program (Graduate Assistance in Areas on National Need). This program provides fellowships to assist graduate students with excellent records who demonstrate financial need and plan to pursue the highest degree available in their course of study at the institution in a field designated as an area of national need.

The GAANN Fellows in 2019 are: Patrick Downs, Francisco Franquiz (graduated August 2019), Nicodemus Myhre, Nicholas Peters, Nicholas Zhu and David Zuehlke.

The AE Ph.D. Program Celebrates Its 5th Year

Five years ago, the Aerospace Engineering Department added the Ph.D. to its degrees offerings, bringing comprehensive aerospace engineering to Central Florida. The program started with 2 Ph.D. students in 2013. The program's progression has been steady and strategic. As of Fall 2019 it has enrolled 34 Ph.D. students and graduated 15 students. The program grew strong not only in enrollment but also in the quality of the admitted students. The average GPA of students admitted to the program in the past 5 years stands at 3.8/4.0 while the average GRE quantitative score is 158/170.

The Ph.D. program is making robust intellectual contributions to the discipline while also meeting significant industry needs. The majority of the graduates are working in R&D at several companies including Airbus, Northrop Grumman, MathWorks, ANSYS, and national research laboratories such as NASA and Argonne National Laboratory.

While relatively young, in 2019 the Ph.D. program was ranked 29th in the nation by the US News &World Report. The Ph.D. program gave significant visibility to our undergraduate program. In 2020 the undergraduate program is nationally ranked 4th (tie with Purdue University) among the Aerospace Engineering programs awarding doctorate degrees. The first three spots went to MIT, Georgia Tech and CalTech.

Aerospace Engineering Ph.D. Graduates in 2019

Boutros Azizi (advisor Habib Eslami)

Pierrot Derjany (advisor Sirish Namilae)

Shibani Bhatt (advisor Ebenezer Gnanamanickam)

Marina Kazarina (advisor Vladimir Golubev)

Francisco Franquiz (advisors Bogdan Udrea, Mark Balas)

Spatika Iyengar (advisor Eric Perrell)

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Alumni Update

Where Are They Now?

Marco Coderoni (‘18, PhDAE) is currently working at ANSYS, Lebanon, NH as a technical support engineer. He received the “rookie of the year” award.

Gregory “Greg” Coll (‘03, BSAE) of Rockville, Maryland Announces Candidacy for Representative of U.S. Congress, 8th District of Maryland. Gregory Coll has entered the primary race to become the next Republican representative from district eight. Gregory works for a government contractor and is located at NASA, Goddard Space Flight Center in Maryland, where he maintains his office, and supervises a large team. He serves on a volunteer board dealing with related issues. He is a fine example of balancing an important career and raising a family with a focus on family values and community participation.

Lauren (Gulley) Cox (‘11, BSAE) and Trey Cox (‘12, BSAE) were married on September 4, 2016 in Nisswa, MN. Lauren is pursuing her Ph.D. in Kinesiology at the University of Houston and Trey works for MEI Technologies as a Project Engineer on NASA’s Human Health and Performance contract. The couple resides in Houston, TX.

Steven Hirshorn (‘86, BSAE) Celebrated his fourth anniversary as Chief Engineer for Aeronautics at NASA Headquarters.

Class Notes are brief news updates from alumni that are published biannually in Lift, the alumni magazine for Embry-Riddle, and in the eagleNEWS, an online newsletter emailed monthly to alumni. To submit a Class Note log in to your online alumni profile and submit your class note online, or email the text and/or a high resolution photo to alumni@erau.edu.

Alumni On The Move

Dr. Michael Nayak (‘10 MAE) In 2018, Nayak installed the only optical telescope currently at the South Pole to better understand how our solar system evolved and, in particular, why Jupiter orbits in an icy realm beyond the asteroid belt. The knowledge gained could overturn popular scientific theory and narrow the search for extraterrestrial life forms. “What we learn through this project could change the way we think about our solar system,” says Capt. Nayak, Ph.D., a scientist with the U.S. Air Force Research Laboratory (AFRL). In many other solar systems, hot Jupiter-like planets spin closely around their stars. “They’re fairly common in all of the exosystems we’ve studied so far,” he notes. That begs the question: Why is our own solar system so different? Nayak’s mission to set up the Long-Duration Antarctic Day and Night Imaging Telescope (LANDIT) promises to provide new clues to this fundamental mystery of planetary science. In addition, observational methods developed for the project supported by the Air Force Office of Scientific Research (AFOSR), the U.S. Air Force Test Pilot School and the National Science Foundation (NSF) might someday suggest a way to peek inside human-made satellites in space, including non-U.S. satellites that could pose a threat to national security.

The effort sprang from a unique agreement, signed by the heads of the Air Force and the NSF, to marry scientific and engineering basic research. With a bachelor’s and master’s degree in Aerospace Engineering from Embry-Riddle and two Earth and planetary science degrees from the University of California, Santa Cruz, Nayak’s expertise and military background were perfect for the mission. Co-directing the project with Nayak is astronomer Ryan Swindle, PhD., an AFRL research physicist. During the Antarctic summer in November and December 2018, Nayak flew to the Amundsen-Scott South Pole Station to install a small prototype telescope, make measurements of the atmosphere, and practice observing Jupiter, as well as Saturn, during continuous daylight hours.

If all goes well, Nayak and Swindle’s Ph.D. student, Embry-Riddle alumnus Cody Shaw (‘15), a space physicist, will return in 2020 to capture the first-ever 100-day set of long-term, or “seismic,” signals from Jupiter and Saturn. These signals’ minute changes in reflected light, uninterrupted by the rising sun, are only possible to observe from Antarctica.

Faculty Roster

Marwan Al-Haik
Professor & Ph.D. Program Coordinator (Ph.D., Florida State University)

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

Magdy Attia
Professor & Associate Chair and M.S. Program Coordinator (Ph.D., Texas A&M University)

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

Shibani Bhatt
Visiting Assistant Professor (Ph.D., Embry-Riddle Aeronautical University)

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

Yechiel Crispin
Professor (Ph.D., Israel Institute of Technology)

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

Bill Engblom
Professor, Joint Appointment with Mechanical Engineering Department (Ph.D., University of Texas)

Habib Eslami
Professor (Ph.D., Old Dominion University)

Ebenezer Gnanamanickam
Assistant Professor (Ph.D., Purdue University)

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

Glenn Greiner
Associate Professor & BSAE, CSAE & MMSE Program Coordinator (M.S., Embry-Riddle Aeronautical University)

Snorri Gudmundsson
Associate Professor (Ph.D., Embry-Riddle Aeronautical University)

Troy Henderson
Assistant Professor & Honors Program Coordinator (Ph.D., Texas A&M University)

Dae Won Kim
Associate Professor (Ph.D., Virginia Polytechnic Institute & State University)

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

James Ladesic
Professor & Associate Dean of Industry Relations & Outreach (Ph.D., University of Florida)

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., 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)

Richard Prazenica
Associate Professor (Ph.D., University of Florida)

Frank Radosta
Professor (Ph.D., University of Florida)

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

Bertrand Rollin
Assistant Professor (Ph.D., University of Vermont)

Virginie Rollin
Associate Professor (Ph.D., University of Vermont)

Dongeun Seo
Associate Professor (Ph.D., University of Texas)

David Sypeck
Professor (Ph.D., University of Virginia)

Ali Yeilaghi Tamijani
Associate Professor (Ph.D., Virginia Polytechnic Institute and State University)

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

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