EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

AERONEWS

Department of Aerospace Engineering at Embry-Riddle Aeronautical University – Daytona Beach

DECEMBER 2018

Snorri Gudmundsson was part of the team behind the Collier Trophy-winning SF50 Vision Jet, the first single-engine general aviation jet with a self-supporting parachute. - page 6

Message From the Chair

Dr. Tasos Lyrintzis

It has been another very exciting year! The Aerospace Engineering Department continues to be the largest in the country with 1404 BS, 119 MS (including 24 distance students), and 33 PhD students as of fall 2018. It should be noted that about 13.1% of our undergraduates are honors students, while the remainder of the Embry-Riddle Daytona Beach campus has 5.5% honors students. Embry-Riddle continues to hold the altitude record- thirty eight miles- for a university student designed and built rocket, despite a number of challenges during the past year. In addition, we continue to have numerous design/build/test projects at both undergraduate and graduate levels.

Our relatively new MS distance program (started Jan. 2017) is doing well and has 24 students currently. Also, our certificate in Airworthiness (1st program of its kind) is continuing; this program now has 18 students. It started in Jan. 2017 as a partnership with Northrop Grumman and is now open to everyone.

The undergraduate AE program has been ranked No. 1 by the US News and World Report for the past 16 years while ERAU at Daytona Beach was classified among the non-PhD granting institutions (2000 - 2015). In 2016, for the first time, US News & World Report moved ERAU's Daytona Beach campus into the PhD-granting category, which includes the most elite universities in the nation. In this new category, our undergraduate program has now (Fall 2018) moved up nationally to No. 11 and 1st in the State of Florida. This is up two spots from last year. In Spring 2018 our Graduate program was ranked No. 27 (tied). Our program moved up eight spots, a substantial rise.

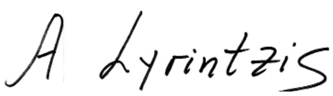
The research expenditures increased significantly for FY18 (7/1/2017- 6/30/18). The expenditures for Aerospace Engineering (AE) were about $1.41 Million (a 117% increase over last year) and for the Eagle Flight Research Center (EFRC) $1.14 Million (a 87% increase over last year). Some significant grants that were active in 2018: Virtual Flight Demonstration of Stratospheric Dual-Aircraft Platform (NASA, PIs: Englblom, Moncayo); Exploiting Non-linear Interactions within Wall Turbulence for Flow Control (AFOSR Young Investigator Program, PI: Gnanamanickam); Fidelity Requirements for Ship Airwake Modeling in Dynamic Interface Simulations; U.S. Army/NASA/ONR/Penn State Vertical Lift Research Center of Excellence, (PIs: Leishman, Gnanamanickam); Time-Resolved PIV System for High Resolution Flow Measurements; ONR, DURIP (Defense University Research Initiative Program) (PIs Leishman, Gnanamanickam, Zhang); Free-Flying Unmanned Robotic Spacecraft for Asteroid Resource Prospecting and Characterization (NASA, PIs: Moncayo, Prazenica); Low-Cost Miniaturized Control System for Autonomous Flight (DARPA, PIs: Prazenica, Moncayo, Henderson); 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 (Aviation), Namilae); Integrated Structural Health Sensors for Inflatable Space Habitats, (NASA, PIs: Kim, Namilae). Also, our Department obtained a grant from the Department of Education, GAANN (Graduate Assistance in Areas on National Need) program to support 4-6 PhD students/year for 3 years (US citizens), which is very important for our PhD program.

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.

ERAU was selected to be a Boeing top-tier focal University -Engineering Accelerated Hiring Initiative (EHAI). With this selection, we are joining an elite group of about 15 highly ranked universities. By being on this group, our students have a greater chance for internships and jobs at Boeing and our faculty will have a better chance to be involved in Boeing R&D projects.

Finally, the Department has a significant presence at the newly constructed John Mica Center for Engineering and Aerospace Innovation Center (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. Also, a new state-of-the-art wind tunnel was commissioned in the summer of 2018 (details can be found in page 3).

Best Regards,



Dr. Tasos Lyrintzis
Distinguished Professor, Department Chair

AEROSPACE NEWSLETTER

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New Facilities

Wind Tunnel (MicaPlex) (Dr. J. Gordon Leishman)

The summer of 2018 saw Embry-Riddle Aeronautical University (ERAU) commission its long-awaited new wind tunnel facility. The Director of the facility is Dr. J. Gordon Leishman, a Distinguished Professor of Aerospace Engineering. Taking five years from inception to completion, the ERAU wind tunnel is a large, state-of-the-art, closed return type, atmospheric pressure, subsonic wind tunnel (Figure 1), capable of reaching flow speeds of up to almost Mach 0.4. The installation of the new wind tunnel at ERAU commenced in January 2018 and was commissioned in June. The entire installation process of the wind tunnel took over three months, and proceeded concurrently with the completion of the building in which it is housed.

Figure 1: A view of the new ERAU wind tunnel and the test section, which sits in a dedicated 16,000 square-foot building.

The test section for the new wind tunnel (Figure 2) is 6 ft wide and 4 ft high with tapered corner fillets, and is 12 ft long. Measured flow speeds of up to 420 ft/s (286 mph, Mach 0.38) have been obtained in the test section with the 1,200 hp (0.9 MW) motor driving its 8 ft diameter, 10-bladed low noise fan. Turbulence levels in the test section are uniformly less than 0.1% of flow speed below 150 ft/s and 0.25% at 350 ft/s. Made of aircraft grade aluminum, the test section is about 65% optical-grade glass by surface area. Replaceable ceiling plates allow for either windows or other mounting fixtures for instrumentation or models. A secondary (larger) test section is located upstream of the primary test section before the contraction, which can be used to accommodate larger test articles, albeit at lower wind speeds.

Figure 2: The test section of the wind tunnel is comprised of more than 65% optical grade glass, and is reached from elevated work platforms on two sides. The windows on both sides can be opened giving unimpeded access.

The primary test section is equipped with a comprehensive set of complementary instrumentation. A high accuracy, research-quality 6-component balance sits under the test section, the balance is mounted on a seismically isolated concrete foundation to minimize any vibrations. The balance has a remotely controlled two-axis model positioning system in pitch and yaw. On the top of the test section is a work platform, which includes an instrumentation traverse that can be used with appropriate probes and other devices. The traverse carriage sits on a rails so that measurements can be made almost anywhere inside the test section

Other available instrumentation at the wind tunnel include high-resolution multi-channel pressure measurement systems, 5-hole and 7-hole pressure probes, multi-channel hot wire anemometry systems, and advanced optical flow diagnostic systems including Particle Image Velocimetry (PIV), all providing a set of powerful measurement capabilities. The large area of glass in the test section allows almost unimpeded optical access for the lasers and cameras needed to undertake PIV. One of the first PIV tests in the wind tunnel is to study the temporal evolution of the turbulent airwake produced by a ship model (Figure 3), which is sponsored as part of the Vertical Lift Research Center of Excellence (VLRCOE) program.

Many custom features were included in the design of the new wind tunnel. These include a reconfigurable and/or replaceable test section, low-noise fan, a variable frequency drive (VFD) motor system, seed/smoke injection ports as well as a smoke purge system, removable 6-bank turbulence screens, noise suppressors at the test section, and a powerful heat-exchanger. The heat exchanger allows precise control over the temperature of the flow in the tunnel, and can maintain constant temperatures and flow properties during testing.

Wind Tunnel Cont. (MicaPlex)

(Dr. J. Gordon Leishman)

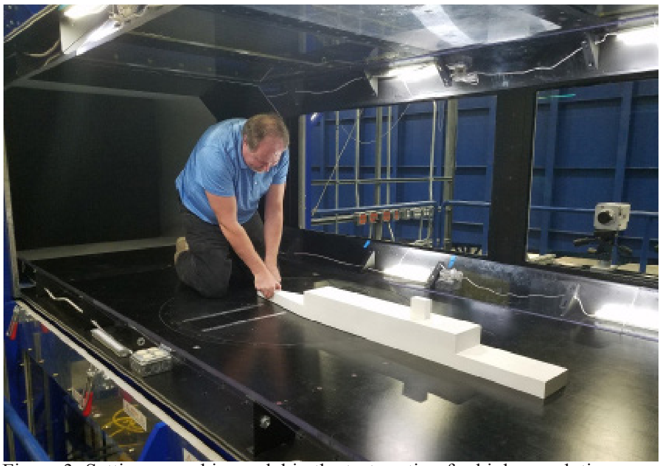


Figure 3: Setting up a ship model in the test section for high-speed, time-resolved PIV flow measurements of the downstream airwake.

The ERAU wind tunnel is located in a dedicated 16,000 square-foot building (Figure 4) that is part of the John Mica Engineering and Aerospace Innovation Complex (MicaPlex). This new building was designed around the wind tunnel and its operational infrastructure, allowing for high levels of functionality and productivity for both research and teaching. This building contains a well-equipped control room with operator and engineer locations (Figure 5), a conference room, student workroom, a model shop, an instrumentation lab, as well as a dedicated guest suite with a laboratory and an office.

Figure 4: A northward facing view of the wind tunnel building, which sits just south of the main ERAU campus at the John Mica Engineering and Aerospace Innovation Complex.

Figure 5: The entire wind tunnel and all of its systems as well as data acquisition are operated remotely from a fully equipped and functional control room.

The wind tunnel is controlled using a custom-designed computer interface, which networks to all of the tunnel systems, including the VFD. The flow speed can be set using direct fan control, or by close-loop control in flow speed or dynamic pressure, along with the required flow temperature. Besides the operator's control page, the software allows a process diagram display of the wind tunnel and all of its sensor readings, a real time plotting capability of any accessible parameter, system status and alarms pages, automatic logging of all events and tunnel running time, as well as full system diagnostics.

Hurricane Evacuations and Fuel Supply

(Dr. Sirish Namilae)

Figure 1: Vega; ERAU's four-cabinet Cray CS400™, with 3,024 cores and estimated performance of 3 Tera FLOPS.

On June 13, 2018 reporter Brittany Jones from Spectrum News 13 interviewed Dr. Sirish Namilae and his graduate student Sabique Islam on his research to model hurricane evaluations in Florida and how fuel shortages affect the evacuation process.

Embry-Riddle researchers are hoping to improve hurricane evacuations and fuel supply for future storm seasons.

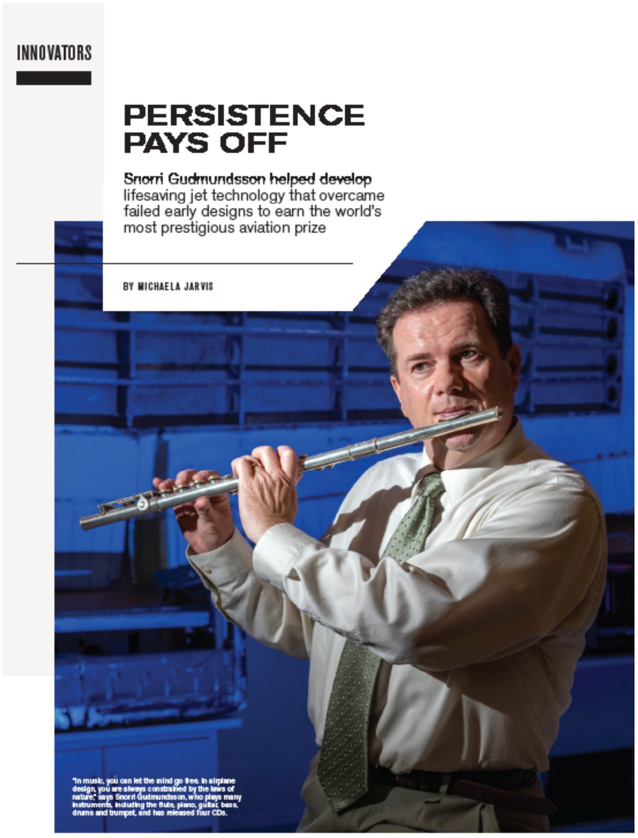
The research comes after millions hit the roads to evacuate from Hurricane Irma, where roadways were jammed and gas stations were out of gas. Now the university's study is expected to help change that. "This is the rate at which gas stations run out of fuel," said Sabique Islam. Islam remembers how difficult it was for him to evacuate during Hurricane Irma. Gas was a big problem. "It is actually pretty devastating because I was one of those people traveling to Atlanta at that time, and I saw a lot of people on I-95 and I-75 just stuck,' Islam said. It looked like a parking lot as millions of Floridians headed away from the storm. He was prepared with extra gas but felt sorry for others. ''I planned ahead, and I had two big gallons of fuel. But there was no way that I could help them; I had my family with me, and I was trying to get out of harm's way," Islam said.

Now, the U.S. Department of Transportation has granted Islam and other graduate students and ERAU professors the opportunity to help. The team is working on a study to improve gas availability and traffic during storm evacuations. "We can run 3,000 scenarios simultaneously," said Dr. Sirish Namilae, Asst. Professor of Aerospace Engineering. With the university's super-computer (Figure 1) helping them calculate massive data, the team is using predictions and codes to figure out fuel issues, traffic jams and gas locations. "We can predict at what rate more and more gas stations are going to run out of fuel. Knowing that rate, we can predict what time we have to start refueling gas stations," Islam said. For example, he said at least 39 percent of gas stations in Orlando were out of fuel the day Irma hit. "The very interesting thing is the pattern it follows is just like a regular mix of mathematics," Namilae said. It's an equation they hope to solve; what he's doing now will make the process smoother for evacuees in the future. "It's putting people's lives in danger so at the end of the day the main goal is to help people," Islam said. The study will run in Feb. 2019, and the professor hopes they'll be able to extend that. They say if this hurricane season is very active, then they'll have real time data to track.

Research News

The Aerodynamic Design of a Collier Trophy Winning Jet Led By Dr. Snorri Gudmundsson

As a boy growing up in Iceland, Snorri Gudmundsson thought a lot about how airplanes could fly. During many trips to a nearby airport in Reykjavik with his father, he would ask "How can something made of metal become airborne? It's heavy. How can it lift off?" If he wanted to understand, Gudmundsson's father told him, he needed to read a lot and do mathematics. "I remember that disappointed me," Gudmundsson says, "because it would take time away from soccer." Luckily, at age 12, Gudmundsson found a simple book on aeronautics, and the musings of a boy began to transform into understanding and ability. He was fascinated by a basic aerodynamics equation: lift/drag = weight/thrust. "It's a simple concept," Gudmundsson says, "but it really got me."



INNOVATORS

PERSISTENCE PAYS OFF

Snorri Gudmundsson helped develop lifesaving jet technology that overcame failed early designs to earn the world's most prestigious aviation prize

BY MICHAELA JARVIS

"In music, you can let the mind go free. In airplane design, you are always constrained by the laws of nature," says Snorri Gudmundsson, who plays many instruments, including the flute, piano, guitar, bass, drums and trumpet, and has released four CDs.

AWARD-WINNING WORK

Some decades later, Gudmundsson's fascination with flying and his considerable skills have led to his being honored, along with a team he worked with at Cirrus Aircraft, with the 2017 Robert J. Collier Trophy, the world's most prestigious aviation prize. Now on the Embry-Riddle faculty, Gudmundsson worked at Cirrus from 1995 to 2009, serving as the chief aerodynamicist on the Collier Trophy-winning plane: the SF50 Vision Jet, a single-engine seven-seater equipped with a parachute capable of lowering the entire plane to the ground.

After the award was announced, former students of Gudmundsson's expressed their pride. "It truly is a remarkable achievement, awarded only to the biggest achievers in the aviation industry," says Sumit Shibib, who currently works for Rockwell Collins. "To know that someone who taught you face-to-face in college has been a part of the team that designed a Collier Trophy winning airplane is amazing."

The SF50 Vision Jet is not the first aircraft with a self-supporting parachute, although it is the first single engine general aviation jet to have one. If an emergency landing is required in the SF50, Gudmundsson explains, the pilot pulls a handle in the cockpit, which ignites a rocket.

The rocket shoots out of the back of the fuselage, pulling the parachute with it. The airplane's original design was developed by architect and designer Mike Van Staagen. "It's not like a magical device that's going to save all situations," Gudmundsson says. Nonetheless, as of May 1, there were 88 parachute deployments on record, with more than 150 people saved. The chute technology, which was developed at Cirrus for two previous aircraft that were not jets, required considerable trial and error, Gudmundsson says. To test the forces the chute would be subjected to, a Cirrus team assembled a 3,000-pound pallet of concrete-filled barrels and pushed it out of a military cargo plane with the chute attached. Over and over, the parachute disintegrated. "It looked for a while like this would be impossible," Gudmundsson says.

It was only after Chief Engineer Paul Johnston developed a solution — a nylon disk on the lines between the plane and the chute itself — that the parachute survived. "It's a very simple aerodynamic device that keeps the parachute somewhat closed until the plane slows down, and then it slides forward and slowly but surely opens it up," says Gudmundsson, sounding, at age 54, just as excited as ever by aeronautics — and slightly less so about his own achievement. "I'm of course immensely proud of the Collier Trophy," he says, "but I don't want anyone to think I was the No. 1 person on this. It's Cirrus that received the award for an airplane that I and many other individuals were involved in."

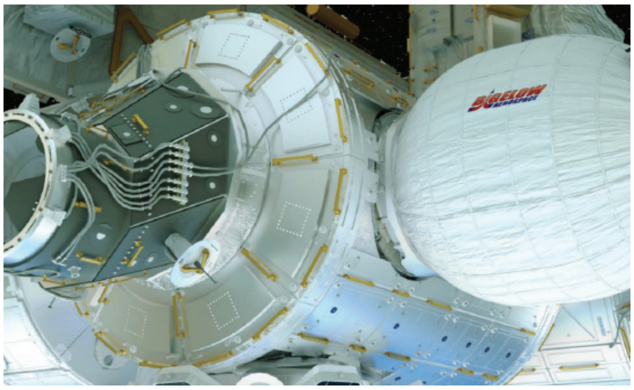
Embry-Riddle Aeronautical University Researcher Fall 2018 Research.erau.edu
Michaela Jarvis pp. 24-25 and front cover

Sensors In Space

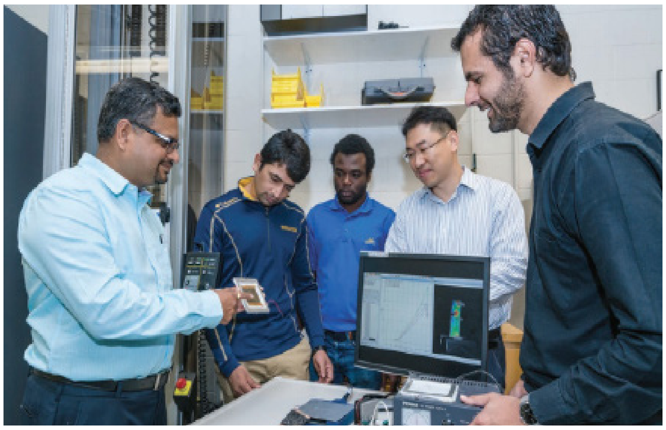
Keeping Space Habitats Inflated (Drs. Sirish Namilae and Daewon Kim)

The expandable structure currently docked at the ISS, built by Bigelow Aerospace, is made of several sheets of flexible Kevlar-like materials with closed-cell vinyl polymer foam between the layers. In a configuration like this, the structural shell is expected to provide excellent Micrometeoroids and Orbital Debris (MMOD) impact and radiation protection, superior to existing metal structures in space. LUNA began modifying its patented high-definition fiber optic strain sensors to be embedded into one of the multiple interior company walls of a space module. The Embry-Riddle researchers began work on their carbon nanotube sensors to cover multiple outer layers. NASA requested sensors that could detect and pinpoint the impact of MMOD up to 3 millimeters in diameter traveling up to 6 miles per second. Graduate students Jiukun Li and Sandeep Chava helped design, build and test the impact sensors. Three other grad students, Muhammad Anees, Yachna Gola, and Audrey Gbaguidi, worked on space applications of the sensors. In static tests, the team successfully demonstrated dynamic impact detection with the sensors. LUNA and the Embry-Riddle research team have now begun Phase II testing, having received an additional $750,000. Their goal this time is to increase the capabilities of the sensing technologies. “Our biggest current challenge is embedding these smart sensors into a flexible and compliant material that can expand as the modules are inflated in space,” Dr. Kim says.

Dr. Namilae is also developing a computational modeling algorithm to gather data from the sensors when an MMOD impact occurs, including its severity and the exact location on the sensing layer. Soon, a crucial test will take place at the University of Dayton Research Institute’s Hypervelocity Impact Facility: 3 mm projectiles will be fired at hypersonic speeds (3 to 5 miles per second) at the sensor array, which will be embedded in multiple impact-resistant layers separated by vinyl polymer foam — materials similar to what’s being used for the ISS module. “We also have to show that our sensor materials are space-worthy and figure out how much power the sensor array will use,” Namilae says. The ultimate goal is a possible Phase III grant to commercialize the sensor technology with NASA and NASA affiliates, but the research also offers more down-to-Earth benefits. “We hope that our work will lead to applications of our sensors in space, but the thing I value most in this process is our students having an opportunity to learn and grow as scientists and create new knowledge,” Dr. Namilae says.



Inflatable space habitat



PhD students Audrey Gbaguidi, Sandeep Chava and MS student Anees Mohammad working with Drs. Daewon Kim and Sirish Namilae

Eagle Flight Research Center - Urban Air Mobility (UAM)

(Dr. Richard Anderson)

The Eagle Flight Research Center (EFRC) continues to push the edge of technology in the emerging area of Urban Air Mobility (UAM). For a number of years, the center has been working on independent threads of technology that have turned out to be the pillars, the fundamentals, of UAM. For years, the focus area of the Eagle Flight Research Center (EFRC) has been flight controls and autonomy, Unmanned Aerial Systems (UAS), alternative propulsion including electrified propulsion and FAA certification. All of these technologies have now converged to allow for the rapid advancement of the understanding of the UAM design space.

The "Trojan Horse" for the confluence of all of these technologies has been electrified propulsion which is either fully electric aircraft propulsion or hybrid electric propulsion. Electric propulsion was seen, early on, as a technology that could lower emissions, lower direct operating costs and enhance safety. In Europe, there was a movement to fly electric aircraft and design commercial aircraft with this technology. The crux of electric propulsion implies non-traditional methods of controlling the propulsion system; fly-by-wire. Conventional methods of control make little sense in the realm of electrified propulsion. Thus, in the enthusiasm wave for electric propulsion, the ability to certify modern aircraft controls was baked into the new regulatory landscape. The embrace of automation then drew in the third generation technology Unmanned Aerial Vehicles (UAV). It is becoming accepted that UAV or UAS may be either manned or unmanned which is clearly strange since "unmanned" is the main part of a title. However, once the vehicle is autonomous, whether it is manned or unmanned is irrelevant. Now, the research into unmanned vehicle is spilling over into the people transportation sectors. An example of this is UAS Traffic Management (UTM). This was stood up by NASA as a method of separating and controlling UAVs. Now that manned autonomous aircraft are behaving like their unmanned counterparts, the UAV technology has also been folded into Urban Air Mobility. As seen, the UAM market has brought together three independent columns of research, i.e. controls, UAVs, and electrified propulsion into a single thread by leveraging the desire for electrified propulsion, the "Trojan Horse."

Electric propulsion is the second major disruption in aircraft propulsion after the jet engine. Similar to the step to the jet age there are early configurations that we are all comforted seeing that look like the airplanes we know. However, like the evolution of the jet the real advantage of electrified propulsion is not replacing an existing engine in an existing airframe, but rather the design of an airframe that takes advantage of the unique characteristics of the electrified propulsion. This dichotomy has led to two emerging paths in electrified propulsion: thin haul and Urban Air Mobility. Thin haul is the idea that electric propulsion can take an existing short range commuter aircraft and reduce the emissions and direct operating cost much in the same way as a hybrid or fully electric plug-in car. This category of electric airplane designs looks much like the aircraft we have known for years. The reason that this is a "thin haul" is because it was understood early on that the limitations of a battery powered aircraft where significant. Early battery powered aircraft would be small, slow, and range challenged. It is thin on every aspect. This category emerged first because it does not require much imagination to envision this class of aircraft. This will be a viable class of aircraft when the weight of batteries comes down. This class of aircraft is in the future, because current state-of-the-art battery technology does not support it. It is clear to all aircraft designers that in aircraft design weight is king. Right now the equivalent weight of energy of batteries is 70 times greater than aviation fuel. When one considers that the propulsion system of an electric aircraft is significantly more efficient, this drops to 20:1. The good news is that batteries get better every day and gas does not. So, we can predict using the average advancement of battery specific energy the likely year of viability of thin haul. Using these predictions this should happen this century but not this decade.

The other branch of electrified propulsion is not as obvious as thin haul. This obscurity is due to the novel nature of the technology: a technology that is only possible through electrified propulsion. For thin haul it was discussed that minimizing emissions and direct operating costs were the motivation. The path that really takes advantage of the novel aspects of electrified propulsion is enabling missions that are not possible with conventional propulsion; they are only possible with this new technology. Also, when discussing direct operating cost and emissions, something funny happens. You may be comparing the UAM aircraft, not to another aircraft but to a car or truck. This opens the control volume of what is "good" to a different level. In future aircraft design classes it may be necessary to analyze surface transportation as the competitor to your design. It is interesting to note that the division between thin haul and UAM also falls along the lines of top level hybrid electric architectures. Thin haul designs will likely employ parallel hybrid architectures whereas UAM will deploy serial generators. As the entire design space is yet to be understood, the state-of-the-art technology actually supports UAM architectures and business models with thin haul will have to wait for the advancement of battery technology.

There is, however, one question that has not yet been addressed here. What is the mission of the UAM that cannot be flown by existing aircraft or helicopters? What does electrified propulsion enable that allows for the urban air mode of travel? The answer is simple: noise. The public is unlikely

Eagle Flight Research Center - Urban Air Mobility (UAM) Cont.

(Dr. Richard Anderson)

to accept thousand or tens of thousands of helicopters to operate in a city because of the noise implications. The deployment of electrified propulsion comes with the promise of flying vehicles that have the same noise signature as a car. Clearly one component of this is electric motors tend to be quieter than gas engines. But more importantly, the ability of a propulsive electric motor to turn a rotor at low RPM with the required high torque makes the rotor quiet, very quiet, car-like quiet. When all of this technology is added together, UAS technology, automation, electrified propulsion, the result is a flying vehicle that competes with a car stuck in traffic with respect to noise, emission and cost.

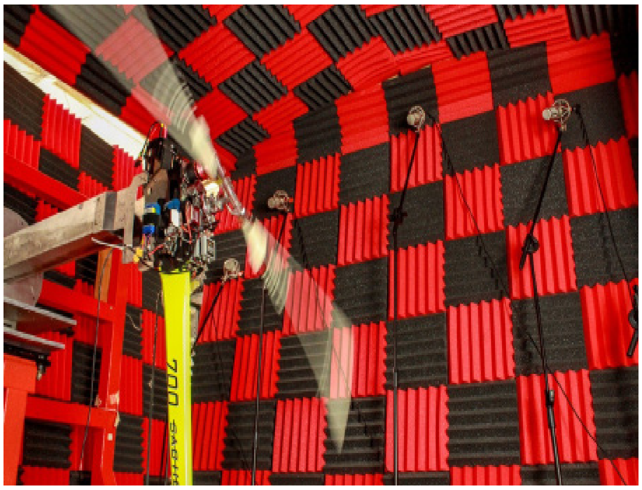
The Eagle Flight Research Center is addressing research in both the thin haul and UAM design space. The thin haul research is based predominantly on incrementally modifying existing airframes and waiting for battery experts to increase the specific energy of batteries beyond certain easily definable thresholds. UAM, on the other hand, has a clean slate, where we see rapid evolution and the ability to leverage existing technologies right now into viable vehicles. While both are being studied, much of the novel research focuses on the UAM vehicles.

Current areas of research at EFRC are the mission enabling reduction in noise and the scalability of solutions. Noise has become a problem because it has not been used in ours traditional aircraft design cycle. While we all know that reducing the tip Mach number of a rotor decreases noise, complex multi-rotor configurations with boundary-layer ingestion are difficult to solve in a design cycle timeline. The process of accurately assessing noise of complex configurations needs to be at the forefront of the conceptual design process. Tools to do this do not currently exist. Scaling is another interesting problem. Many look at UAM vehicles as scaled up commercial drones like octocopter or quadcopters.

In the area of noise, EFRC has started a program to develop design cycle, noise estimating tools for complex UAM configurations. This is two-prong effort with an experimental component and a two-prong theoretical investigation. The theoretical investigations seek to find the lowest level of computational fluid dynamics (CFD) that can be applied to the problem and still result in useful findings. Instead of a full CFD solutions that require days or weeks on high powered computers, this research is to find solutions that are viable on a PC in minutes. The experimental component employs a prop-rotor in an anechoic chamber with instrumentation and sound measurements (see figure below). These two efforts together seek to find computationally efficient and experimentally validated coding strategies that can be deployed in the conceptual design of a UAM vehicle.

The scaling of a UAM is an interesting problem and one that is confounding some investment capital. In the past a successful sub-scale demonstrator would likely lead to a successful full scale aircraft. The Boeing 747 for example enjoys a very low empty weight fraction and drag coefficient when compared to smaller but similar jets. This is not so in UAM. The now classic example of this is the desire to upscale a multicopter to a large manned vehicle. This would be nice because fully electric is easy and attitude control through RPM changes in individual motors is easy as well. If fact we now see high school students building successful hoverbikes in their garages.

It has been posed that these vehicles can be scaled up but that is not the case. The current limitation is that batteries are not scalable to light weight high energy operations and fixed pitch propellers with electric motors drop off in thrust to weight ratio with increasing size. Both of these limitations are being studied at EFRC. The good news is that battery electric systems can be replaced by hybrid systems that will work today and fixed pitch rotor can be replaced by rotor systems. With the deployment of both of these technologies, the UAM vehicle is scalable. But, these technologies no longer support simple garage solutions. They are back in the realm of aerospace professional. While the hoverbike is golf cart, the scaled UAM aircraft is a Prius: much more complex.



Rotor noise test at the EFRC

Hybrid Aircraft Earns Embry-Riddle's First-Ever European Patent

(Dr. Richard Anderson and Associate Professor Glenn Greiner)

Detailed plans for an eco-friendly hybrid aircraft capable of switching back and forth between an electric motor and a traditional internal combustion engine has earned Embry-Riddle Aeronautical University its first-ever patent from the European Patent Office (EPO).

The invention, a "hybrid aircraft and method for in-flight operation," developed by inventors with Embry-Riddle's Eagle Flight Research Center (EFRC), had previously received two U.S. patents.

Under European patent number 2-964-524, the EFRC's hybrid gasoline-electric propulsion system will be protected across Germany, France and the United Kingdom.

The invention encompasses a parallel hybrid aircraft propulsion system.

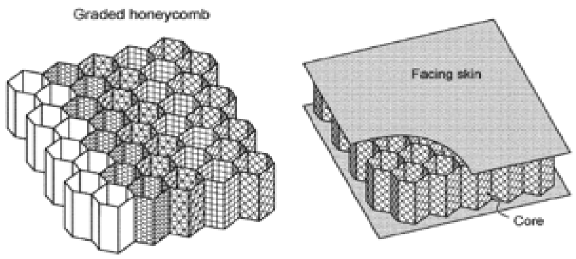
"With this design, an internal combustion engine allows a propeller-driven aircraft to climb to a cruising altitude before an electric motor takes over," said Richard "Pat" Anderson, lead inventor and EFRC Director; and Professor of Aerospace Engineering. "A hybrid clutch assembly interconnects the internal combustion engine propeller flange to the propeller drive shaft, which makes it possible to transfer power smoothly from one system to another."

Inventors named on the patent are Anderson, Embry-Riddle graduates Lori Costello, Charles N. Eastlake and Matt Gonitzke, and Associate Professor of Aerospace Engineering Glenn P. Greiner.

Highly Vented Honeycomb Patent

(Dr. David Sypeck)

Professor David Sypeck was awarded United States Patent US 9,845,600 B2 for Highly Vented Truss Wall Honeycomb Structures. Fabrication and testing occurred in the Department of Aerospace Engineering's Lightweight Materials & Structures and Materials Testing Labs.



Faculty & Student News

New Faculty

Dr. Alberto Mello is a new Associate Professor of Aerospace Engineering at Embry-Riddle Aeronautical University, Daytona Beach Campus. Dr. Alberto Mello concluded his Ph.D. studies in Aerospace at the University of Texas at Austin. He received his masters and bachelor degrees in Aeronautics from Aeronautical Institute of Technology ITA, Brazil. He worked as Postdoc and Visiting Professor at Purdue University, School of Aeronautics and Astronautics, from 2014 to 2018. He mentored the Brazilian Air Force – BAF Structural Integrity Group, being involved in all BAF structural integrity and aircraft life extension programs from 1990 to 2014. Dr. Alberto Mello was the manager of the Brazilian Satellite Launcher VLS-1 Project and the head of the Brazilian Space Projects Branch at Institute of Aeronautics and Space – IAE, Brazil (2011-2014). He served as part-time professor of Fatigue and Fracture Mechanics at ITA from 2004 to 2014. Topics of research: physics of fatigue crack initiation, microscale plastic strain accumulation, fracture mechanics, experimental mechanics, mechanics of adhesion and interfacial fracture, structural analysis and aeronautical fatigue, damage tolerance analysis, and aircraft fatigue life extension.

Faculty Awards

Dr. Troy Henderson received the 2018 Embry-Riddle Aerospace Engineering graduate teaching award

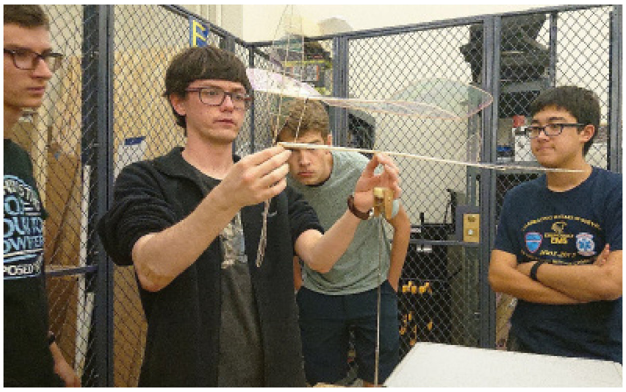
Dr. Mark Ricklick received the 2018 Embry-Riddle Aerospace Engineering undergraduate teaching award

Dr. David Sypeck in conjunction with Assistant Professor Zhu (ME) received the Lithium Ion Battery Research Award from SAE International. The experimental portion was conducted at the Lightweight Materials & Structures and Materials Testing Labs using state-of-the-art instrumentation obtained through prior NSF, NASA, FSGC, and ERAU grants. This research is part of an ongoing collaboration with the Impact and Crashworthiness Lab at MIT (Wierzbicki), and more recently, Ford Motor Company.

AIAA News - AIAA Design Team Projects

This year the Embry-Riddle Daytona Beach branch of the American Institute of Aeronautics and Astronautics hopes to grow in numbers and member participation in the organization. To this end, the branch has started two new design team projects, in addition to the previously sponsored Design/Build/Fly team, as well as an additional recruitment event, in an attempt to reach a larger number of the aerospace engineering community on campus. The two new projects, the Lunar Lander and Free Flight design teams, are efforts to meet the 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 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. AIAA hopes to design and compete with an aircraft that can match and surpass this to claim a national record for the branch's.



AIAA Team Members preparing for competition

The other new project, the Lunar Lander Design Project, is the branches first team to participate in the Undergraduate Team Space Systems Design Competition sponsored by the national branch of AIAA. The team aims to develop a design for a lunar lander in line with competition rules provided by the national branch. This lander is intended to travel back and forth between the Moon and proposed Deep Space Gateway. Within the group, there is a combination of design and educational work being undertaken. All members are introduced to different spacecraft subsystems and are given a functional knowledge of the subsystem while allowing them the freedom to explore and conduct design work in their subsystem of interest. In addition, a large emphasis is placed on systems engineering in this project. This combination of elements is intended to prepare members for a more holistic design experience both this year and for years to come.

In addition to the two new design teams, the Daytona Beach student branch has begun developing the aircraft intended to compete in this years Design/Build/Fly competition. Design/Build/Fly is an annual design competition involving the designing, manufacturing, and flying of a radio controlled aircraft that best meets the mission parameters described by that years competition rules. The competition this year simulates the design of a naval aircraft. The aircraft must take off in less than ten feet, carry a "Radome" that must spin under its own power in flight, and must individually deploy a minimum of four foam darts that simulate a bomb drop. The 2018-2019 competition year marks the branch's sixth year participating in the competition. The Embry-Riddle Daytona Beach aircraft has ranked top ten out of over one hundred teams for the previous two years (8th in 2017 and 9th in 2018).

To recruit the membership required to sponsor so many design teams the branch also sponsored a new recruitment event. The event, called "Meet the Geeks", is a collection of booths hosted by many of the professional organizations and design teams in the College of Engineering. Meet the Geeks featured booths from AIAA, SWE, IEEE, ASCE, and many more organizations. This event not only served as a means to recruit many new students in a professional manner, but also served as a way for the professional societies to show each other their most recent projects and plan future collaborative events or designs. Meet the Geeks was an incredible success, and the branch plans to continue sponsoring it in future years.

In addition to all the design teams and recruitment events the branch has started this year, one more involvement initiative has been started. At each of the branch's general meetings there is a unique research opportunity presented to the members. Previous research opportunities have been presented by the Formula SAE design team, the Eagle Flight Research Center, and the Office of Undergraduate research. This initiative aims to provide members with the opportunity to find research that best matches their individual interests.

The most exciting challenge that the AIAA student branch is taking on this year is co-hosting the Region II student conference with FIT. This is the first time in many years that the Daytona Beach student branch has hosted a conference. The conference has inspired many members to become more active in their research and participation in branch events as they prepare for the challenge of hosting a conference.

There is a lot of energy in the Embry-Riddle Daytona Beach branch of AIAA, and more great things are yet to come.

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Micro-Gravity

As part of the Micro-g Neutral Buoyancy Experiment Design Teams (Micro-g NExT) challenge, undergraduate students designed, built and tested various tools that address an authentic, current space exploration challenge. The space tools were tested this week at Johnson's Neutral Buoyancy Laboratory (NBL), which includes a 6.2-million-gallon indoor pool used to train NASA astronauts for spacewalks. Micro-g NExT, which is sponsored by NASA's Human Exploration and Operations Mission Directorate, is designed to encourage research and development in new technologies and engage students in real-world engineering and problem-solving concepts that may be needed on future exploration missions.

"NASA Microgravity Project provides a unique out-of-class learning experience for our students dealing with the aerospace environment," said Sathya Gangadharan, Ph.D. professor of Mechanical Engineering and co-advisor on the project with Pedro Llanos, Ph.D., assistant professor of Spaceflight Operations and Payload and Integration Lab Supervisor. Gangadharan said the team had to develop a successful proposal and design, fabricate, integrate, and test their innovative idea, while working closely since the fall with a NASA mentor and Embry-Riddle advisors. In addition to conducting the experiment, the team had to write a professional report to NASA with the results of their project, participate in a successful fund-raising campaign and work closely with K-12 students to raise awareness of STEM education as it applies to the aerospace industry.

The Embry-Riddle Micrograviity Club chose to construct an Under Ice Sampling Device, which was one of the four design challenges. NASA is currently working on ways to explore underneath the ice-covered surface of so-called "Ocean Worlds" such as Jupiter's Europa and Saturn's Enceladus. According to NASA, these ice-structures may potentially be places where microbial life could thrive. The challenge required the sampling device, which has to collect, seal and store at least one core sample, to interface with a NASA engineered submersible vehicle to obtain a subsurface ice sample in an underwater environment.

Constructed on campus, the 3D Printing Club helped with the inner support structure and the Embry-Riddle Future Space Explorers and Developers Society constructed the fiberglass cylinder, which holds the stainless steel drill bit. "The device was required to be stored in a 3"x 6" cylinder, not including the aluminum mounting plate," said Cory White, Microgravity Club president and Aerospace Engineering major. "The purpose of the device is to extend the drill bit 5 inches from its stored configuration to the surface of the ice and then another 3 inches into the ice to collect a half inch core sample." An electrical short during testing, prevented the Embry-Riddle device from collecting a core sample. But White said the challenge was valuable for giving the team a chance to gain real-world experience by working on an actual challenge faced by NASA. "The opportunity to use these skills outside of the classroom is supplemental and incredibly beneficial to our learning here at Embry-Riddle," White said. The Aerospace Engineering students who participated in the challenge in addition to White were Merit Bibawy, Richard Excell, Delaney Hancock, Hunter Hatchell and Justin Randall.

Undergraduate team members of the Micro-g Neutral Buoyancy Experiment Design Team (Micro-g Next) challenge

Student Innovations

Every year the American Astronautical Society (AAS) hosts a number of events and technical conferences throughout the US focused on the growth of the space community. This past February, ERAU Aerospace Engineering Ph.D. Candidate Francisco J. Franquiz (advised by Profs. Udrea and Balas) won 1st place in the student paper competition of the 41st Annual AAS Guidance and Control Conference (February 1st-7th) in Breckenridge, CO.

Each year, the student competition admits a total of 8 student papers selected from over 100 applicants in different fields related to applied spacecraft dynamics and control. The competition criteria consider the impact and relevance of the work, the quality and correctness of the written paper, and the quality of the technical presentation at the conference. The papers are judged by outstanding members of the aerospace industry and academia. This year, Francisco competed against authors from the University of Colorado Boulder, University of Arizona, the Naval Postgraduate School, the Air Force Research Laboratory, and others.

Francisco received the 1st prize for his paper on "Optimal Range Observability Trajectory Planning for Proximity Operations Using Angles-Only Navigation" in which he researched, analyzed, and verified maneuver planning methods which minimize range uncertainty (loss of depth perception) when using cameras to perform close proximity operations and rendezvous between satellites. Through his work, Francisco found a solution for a well-known problem affecting current and past missions and interest has already been expressed to make his method a part of routine mission planning operations. The research has also direct applications to the fields of space situational awareness, a crucial aspect of maintaining space superiority, and can be of great benefit for satellite formation flying, an area of great interest for upcoming space missions.

National Society of Black Engineers Attend Convention and Receive Awards and Job Offers

(Embry-Riddle Newsroom Deborah Circelli /April 11, 2018)

Embry-Riddle Aeronautical University students from the National Society of Black Engineers (NSBE) Daytona Beach chapter including many Aerospace Engineering majors recently returned from the 44th Annual Convention in Pittsburgh, Pennsylvania with good news. Amidst the workshops, visits to the exhibition hall and collegiate competitions, 14 of the 25 Embry-Riddle NSBE members attending the convention secured interviews during the convention with companies such as Delta Airlines, United Airlines, Lockheed Martin, Boeing, BAE Systems, General Electric, Microsoft, Rockwell Collins, the U.S. Navy and U.S. Air Force. Seven students received job or internship offers.

Embry-Riddle junior Naia Butler-Craig, who is majoring in Aerospace Engineering, also received the Region III Executive Board Member of the Year Award."The NSBE executive board created workshops and events throughout the year that developed our members academically, socially and professionally, keeping NSBEs missions statement to heart," said William Wanyagah, president of the Embry-Riddle NSBE chapter and an aerospace engineering junior. "I am happy overall with the determination and perseverance of NSBE members who attended the 44th annual conference in Pittsburgh. Naia Butler-Craig, a NASA Pathways intern for the NASA Glenn Research Center, served as the 2017-2018 Region III Membership Chair overseeing membership activities for Region III, which includes members in Florida, Georgia, Alabama, Kentucky, Tennessee, Mississippi, the Caribbean and South America. The award is given to a regional executive board member who went above and beyond what was required.

Payton Boliek, vice president of the Embry-Riddle chapter, was promoted at the convention to the board for Region III and will oversee members of all chapters as the 2018-2019 Region III Membership Chair, succeeding Butler-Craig. The region has about 3,000 members, Butler-Craig said. Co-advisors for the Embry-Riddle chapter, who helped students prepare for the convention, are assistant professor Dr. Leroy L. Long III and Kenneth E. Hunt, director of Embry-Riddle's Office of Diversity and Inclusion.

Rocket Club Update

The ranks of Embry-Riddle Future Space Explorers and Developers Society (ERFSEDS) have grown to 140 active members. Likewise the club's list of projects has become longer and more ambitious, from the ongoing high power certification workshops for new members, to national flight competitions, to research projects aiming to expand the limits of rocket engineering.

Project Gryphus focuses on researching and developing methods to design, build, and test a solid fuel ducted rocket in order to further study thrust augmentation and air-augmentation. Students on this project are working to demonstrate the increase of specific impulse and thrust on rockets and launch multiple times.

Last year's rocket used low cost, low impulse commercial solid motors. Since the project's start in the Fall of 2017, the team has been able to finish construction on two test vehicles, currently manufacturing a third, larger test vehicle. This project has made incredible progress with data showing 10% increase of ISP during ascent using a solid propellant motor, 6 flights in a single semester, the first usage of a "fly-away rail guide" in ERFSEDS, and integration of flush-body air inlets.

Project Hummingbird started from an idea to make a helicopter-based recovery system. Funded by Blue Origin, this project tasks students with the challenges of designing a rotor-system that can be stored during rocket flight, deploy from the rocket at apogee, slow rocket descent, manipulate rotor and blade pitch in order to guide the rocket to a landing location, and land the rocket booster upright. The team is currently working on manufacturing a rocket to test the design that have been developed over the past three years.

Pathfinder is our introduction to high powered rocketry. Pathfinder's mission is to completely design and manufactured a sounding rocket to reach an altitude of 10,000 ft, only purchasing a few commercial parts. The Pathfinder project gives students the experience of designing, building, testing, revising, and then launching their own part or system on the rocket. This project acts as a gateway to our upper level project Artemis. Both projects plan on implementing a student researched and developed (SRAD) motor made by our members in our project Prometheus.

Artemis, a new project this year, has the goal of creating a two stage 30,000 ft apogee rocket to compete in the 2019 Spaceport America Cup 30k SRAD division this summer. Similar to Pathfinder, Artemis is designed and manufactured by members in ERFSEDS. The team continues the research with their work with the club's filament winder; the team aims to manufacture the rocket's entire airframe utilizing the system. The team hope to lay the ground work to keep this project continuous in the coming years.

Project Icarus will make its first attempt at the von Karmen line – the edge of space – 63 miles – this summer from White Sands Missile Range, NM. Above the first Icarus rocket takes flight from NASA's Wallops Flight Facility, March 2007. Project Icarus focuses on the technology challenges of interstellar travel.

Updates

PhD Program

In 2018 six students completed their PhD degree: Michael Borghi (Dec. 18, advisor Engblom), Marco Coderoni (Aug. 18, advisor Lyrintzis), Petr Kazarin (Dec. 18, advisor Golubev), Kaveh Gharibi (Dec. 18, advisor Tamijani), Vasileios Papapetrou (Dec. 18, advisor Tamijani), Nirmit Prabhakar (Dec. 18, advisors, Prazenica/Balas)

Florida Space Grant Consortium Masters Fellowship Recipient

David Zuehlke was awarded the Florida Space Grant Consortium Masters Fellowship, a one-year, prestigious award supporting outstanding students completing their thesis in areas relevant to NASA's needs.

Alumna Receives Technology Rising Star Award

At the 2018 Women of Colour conference, Hemali Virani (Bachelor of Science Aerospace Engineering '12 and Masters of Human Factors '14) was awarded the "Technology Rising Star" award by her senior leadership and technical lead. There were a total of 61 women from Lockheed Martin (only 3 from the F-35 Sustainment Line of Business) that received an award at the conference.

During the conference she had an opportunity to not only share her story but to also hear from many other women in the professional field. As she thought about how thankful she is to be working at Lockheed Martin and more importantly the team that she is a part of. It is no surprise to her that she is one of two women reporting to her manager, and honored to be working with such a supportive and motivating group of people.

Hemali further regressed on how she got to where she is today and decided to write Dr. Maj Mirmirani, College of Engineering Dean. She wanted to take the opportunity to say Thank You! For she did not know if she would have had the drive and the all-in attitude if it weren't for her education at ERAU.

Attending the conference was even more empowering because she got an opportunity to talk to the next generation of young ladies from high school and universities who plan to/are pursuing their education in the STEM field. It is her ultimate goal in life to be able to encourage the next generation of men and women to pursue their career in STEM fields. She left the conference with a few important thoughts:

1) It's not an easy task to find a job with such a supportive team, a team which not only encourages her but also motivates her to keep learning and growing.

2) Key to success lies in the ability to be comfortable with being uncomfortable. She always told herself to never stop pushing herself to get outside her comfort zone and to never stop learning. In a way, she got the much needed reassurance by attending the conference.

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Alumni Update

Where Are They Now?

Mike Warzinski ('11, BSAE, DB) and Zack Laser ('11, BSAE, DB) met up on a recent flight. "Got to drag my good buddy and fellow alumnus Zack Laser a couple weeks ago from his Marine F-35C training to Japan with my AF KC-10," said Warzinski.

Nathan Von Minden ('05, BSAE, DB) is working on a film about the Space Shuttle Challenger explosion. Learn more about the project at its Facebook page.

Brian Gamage ('95, BSAE, DB) and Fathi Hakam ('95, BSAE; '97, MSAE, DB), who are friends from their time as students at Embry-Riddle, recently met up in California. Hakum is a senior vice president of engineering at AirMap in California and Gamage is director of emerging solutions for Global Strategic Partnerships at IBM in Atlanta, Georgia.

Axel A. Garcia Burgos ('15, BSAE, DB), the founder and CEO of Pratian, won first place at the EO Global Student Entrepreneur Awards (GSEA) on April 16, 2018, in Toronto, based on his research and development of Agrobeads, a cost-effective, self-contained, hydration and nutrient bead capable of supporting the growth of an individual plant for up to a year. EO GSEA is an international competition open to students who own and operate a business while attending college or university. Garcia-Burgos is presently a Ph.D. researcher at MIT. He founded Pratian to create and commercialize space technologies to solve global issues and benefit society.

Ravi Gondaliya ('13, BSAE; '16, MSAE, DB) recently gave a TEDx talk that explores companies that are changing the world by disrupting established conventions, and shares the process he's developed for himself to help him think like a disruptor. Gondaliya is a materials and processes engineer at Gulfstream Aerospace Corporation in Savannah. His previous work experiences include engineering at Spirit Airlines and Southwest Airlines.

Col. Jim Ryan ('88, BSAE, DB), former commander of the New Hampshire Air National Guard's 157th Refueling Wing, recently retired. Earning his U.S. Air Force pilot wings in 1989, he was assigned to Royal Air Force Lakenheath in England. During the 1990s, he flew missions in support operations during the first Gulf War and the Balkan conflicts. In 1996, Ryan was assigned to Pease Air National Guard Base as a mission pilot with the 133rd Air Refueling Squadron and became commander of the 133rd in 2011. He was promoted to commander of the 157th Operations Group in 2014. Ryan became director of operation for the New Hampshire Air National Guard, then became wing commander of the 157th Air Refueling Wing in 2016.

Vivek Lall ('91, MSAE, DB), who currently serves as vice president of strategy and business development at Lockheed Martin, will join the Department of Transportation's NextGen Advisory Committee. An aerospace scientist, Lall has been appointed for a two-year term on the committee. The committee advises the government on topics of NextGen investment priorities, capability deployment timing, equipage incentives, specific technologies and deployments such as DataComm, National Airspace System performance metrics and airspace design initiatives.

David Bhola, DO. ('04 BSAE, DB), who is a primary care and sleep specialist, joined Rockledge Regional Medical Center and Steward Medical Group in Brevard County, Florida. A Daytona Beach Campus graduate, Bhola pursued a career in aerospace engineering and worked an internship in the space program, but he'd also been interested in medicine since childhood and saw a pressing need for healthcare providers. Bhola has worked as a nocturnist at Wellmont Medical Associates in Bristol, Tennessee, and has treated sleep disorders at Larkin Community Hospital in Hialeah, Florida. During his medical career, he also spent about a year and a half practicing rural medicine in the Appalachian regions of Tennessee.

Anthony Vareha ('06) is the SpaceX-15 lead flight director and one of the flight directors at NASA in charge of International Space Station (ISS) operations at the Johnson Space Center's Mission Control. A Daytona Beach Campus graduate, he recently led the team conducting the SpaceX-15 cargo resupply mission to the ISS. Several lead officers for the mission were also fellow Eagles. They included: SpaceX-15 Lead Robotics Officer Billy Jones ('06, BSAE, DB); SpaceX-15 Robotics Analyst Brian Costello ('04, BSAE, DB); and SpaceX-15 Ground Segment Lead Casey Johnson, ('11), who are all Daytona Beach graduates. Also on the team are SpaceX-15 Lead Trajectory Officer Victor Rice ('14), who is a Prescott Campus graduate, and SpaceX-15 Lead Ground Controller Ronald Moseley ('06), a Worldwide Campus graduate. SpaceX-15 Robotics Crew Instructor Mike Ferullo, ('07, BSAE '18, MSAE, DB) is also on the team and is a Daytona Beach and Worldwide campus graduate.

Faculty Roster

Marwan Al-Haik
Professor & PhD 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 (Ph.D., Texas A&M University)

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

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)

Claudia Moreno
Assistant Professor (Ph.D., University of Minnesota)

Sirish Namilae
Assistant 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
Assistant Professor (Ph.D., University of Central Florida)

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

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

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

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

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

Bogdan Udrea
Associate Professor (Ph.D., University of Washington)

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

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