AEROCONTACT

AEROSPACE ENGINEERING AT MARYLAND

To the Stars!

Clark School Alumna Makes History

Chairman's Corner

The Value of Partnerships

The Department of Aerospace Engineering is proud of the partnerships we have forged with the local community, federal agencies, and related organizations. This issue of *AeroContact* celebrates many of those partnerships. From faculty who are testing the marketplace with breakthrough products to students who are gaining invaluable work experience through internships at NASA and other organizations, we are constantly exploring ways to move the field and our students ahead.

In this issue, we honor one of our outstanding graduates, who is propelling her career and the department forward. Next year, Jeannette Epps (Ph.D. '00, M.S. '94) will become the first African American on the International Space Station. (See related story on the next page.) Epps regularly visits UMD to share her experiences as an astronaut and serve as a role model for our students.

Like Epps, the department recognizes the importance of giving back. Read more about our partnership with one of College Park's hidden gems, the College Park Aviation Museum. Our continued support expands the museum's ability to reach aerospace engineering students as well as students and residents throughout the area.

Partnerships are important on other fronts as well. The stellar accomplishments of our faculty and students have attracted the attention of numerous national research agencies, and our students are recognized with awards and scholarships from the public and private sector alike. Professor Derek Paley's $2 million SEA-STAR grant brings together investigators from Carnegie Mellon University and Harvard University to create soft underwater robot appendages. Student teams have garnered top spots in national competitions sponsored by NASA, the Department of Energy, and Deloitte Consulting, to name a few.

Good partners make for a much stronger department. They provide funding for our research and offer extraordinary opportunities to students that extend far beyond the classroom. We are constantly searching for ways to enhance the learning experience for our students. If you would like to work in partnership with our students and faculty, feel free to contact me directly.

Norman M. Wereley
MINTA MARTIN PROFESSOR AND CHAIR
DEPARTMENT OF AEROSPACE ENGINEERING

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COVER IMAGE: UMD will be well represented when alumna Jeanette Epps, far right, joins the International Space Station in 2018.

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AEROSPACE ENGINEERING AT MARYLAND

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Please send letters to the editor and alumni notes to anhentz@umd.edu

PHOTO: TROY FIELDS

To the Stars!

Clark School Alumna Makes History

For the first time ever, an African American will call the International Space Station (ISS) home.

Jeanette Epps (Ph.D. '00, M.S. '94) will join Expedition 56 to the ISS in 2018 and will remain aboard as part of Expedition 57. This milestone posting will make her the first African American, the 13th woman, and the first University of Maryland graduate to live and work as a long-duration crew member on the station.

NASA selected Epps in 2009 as one of 14 members of the 20th NASA astronaut class. As a flight engineer aboard the ISS, which circles the earth every 90 minutes at an altitude of about 250 miles, Epps will be responsible for supporting both research activities during the mission and onboard maintenance for the nearly 20-year-old station. In addition, crew members serve as experiments themselves, with data regularly collected on them to provide insights into the effects of space on the human body.

The New York native has regularly returned to visit the UMD campus, speaking at undergraduate aerospace engineering classes about her experiences as an astronaut and discussing what it takes to succeed as an engineer.

One of the most unexpected side effects of her position as an astronaut has been the level of responsibility she feels to the public. According to Epps, astronauts are role models who have an obligation to give back. As one of only two black female astronauts, Epps told UMD's *Terp* magazine she wants to expand the universe of possibilities for African-American girls interested in science and technology.

"I was raised in a way that there was really nothing I thought I couldn't do. The fact that I never saw anyone who looked like me doing this didn't really matter to me, but I think it does matter to a lot of young girls," she said. "So, I do want to send them the message that if I'm doing this, there's no reason you can't do this too."

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NASA Internships Can Launch Student Careers

NASA rendering of the Orion Space Capsule.

Summers can be a bit quiet for Assistant Professor Christine Hartzell. That's when almost all her graduate students head for internships at NASA locations around the country. "It takes a village to get a Ph.D.," said Hartzell. "Students need to talk to subject matter experts other than their advisors to gain the knowledge and expertise required to complete their degrees," she added.

FROM THE MOON TO MARTIAN DUST

For the last two summers, Dylan Carter, a third-year Ph.D. student, has interned at the Electrostatics and Surface Physics Lab (ESPL) in the SwampWorks facility at Kennedy Space Center in Florida. "The lab conducts research into the electrostatic environment of the moon and Mars, especially with regards to developing methods for handling regolith or removing dust from atmosphere or sensitive surfaces," Carter explained.

"During my internship, I completed the design of an experiment I am conducting to measure the distribution of electric charge in a typical sample of lunar regolith," said Carter. "I also assisted with the operation and troubleshooting of an experiment related to electrostatic precipitation of atmospheric Martian dust."

The internship is part of the NASA Space Technology Research Fellowship (NSTRF). Each summer, NSTRF fellows conduct research at NASA centers, drawing upon the expertise and resources of professionals in the same field.

KEEPING ASTEROIDS UNDER CONTROL

Anthony DeCicco, a third-year Ph.D. student, spent the last two summers working at NASA Marshall Space Flight Center in Alabama after winning an NSTRF in 2015. His research focuses on asteroid deflection, particularly on a device called a Neutral Beam for Asteroid Control (NBAC), which is used to reduce the rotational speed and deflect asteroids. He recently presented his NBAC design and his asteroid deflection analysis at the International Academy of Astronautics Planetary Defense Conference held in Tokyo.

This summer DeCicco tested his technology at NASA Marshall. He successfully achieved thrust with NBAC and measured it with a finer resolution (micro-newtons) than had previously been achieved at NASA Marshall. He conducted his thrust tests at both low- and high-electrical power modes and achieved steady flows in both cases. He has submitted his work for presentation at the Institute of Electrical and Electronics Engineers Aerospace Conference in Montana in March 2018. Additionally, DeCicco has continued work on the Charger-1 facility, testing the initial electrical discharge stages that will be used to fire a high-energy (one terawatt), pulsed power experiment for compression of nuclear fuels. Charger-1 seeks to validate the use of a hybrid fission-fusion reaction for propulsion to Mars and outer planets.

SUPPORTING HUMAN SPACEFLIGHT

Thomas Leps, a third-year Ph.D. student, set his sights on the Johnson Space Center in Texas because of his long-time interest in human spaceflight. At the center, he worked on the testing and implementation of the optical navigation camera for the Orion Space Capsule.

"Working on the Orion Capsule, which will someday take astronauts to the moon, asteroids, and Mars, is a fulfillment of my career goals and makes me feel like I'm making a contribution to our human nature of exploration," explained Leps. The optical navigation system for Orion is designed to guide the capsule to a safe re-entry if ground telemetry is lost, determining trajectory by identifying the size of imaged planets to find range and the location of the centroid to plot direction.

During his first summer internship, Leps primarily worked on characterizing the performance of the flight cameras for edge detection and testing algorithms designed to accurately find edges in images at sub-pixel precision. In his second year, he discovered a glitch in the navigation camera and saved considerable resources for NASA. He also built a test stand that simulates the field of view of the camera in the EM-1 test flight using artificially rendered images of the moon.

"WORKING WITH A RELATIVELY SMALL GROUP HAS GIVEN ME THE OPPORTUNITY TO BE INVOLVED WITH MANY ASPECTS OF THE PROJECT."

SAM PAWLYK

"THIS FELLOWSHIP SEAMLESSLY CLOSES THE GAP BETWEEN RESEARCH IN ACADEMIA AND IN A PROFESSIONAL ENVIRONMENT LIKE NASA."

DYLAN CARTER

"MY EXPERIENCE AT NASA WAS EXCELLENT. I WAS QUICKLY ASSIMILATED AS PART OF THE TEAM AND WAS WORKING ON MEANINGFUL PROJECTS."

THOMAS LEPS

"CONDUCTING EXPERIMENTS AT NASA MAXIMIZES YOUR ABILITY TO RECORD HIGH-QUALITY DATA IN A SHORT PERIOD."

ANTHONY DECICCO

"I HAD GREAT OPPORTUNITIES, SUCH AS WEEKLY MEETINGS WITH THE PRINCIPAL INVESTIGATOR, TO REPORT ON PROGRESS AND OFFER SUGGESTIONS."

ALEX WALTS

TRACKING COSMIC MICROWAVES

At Goddard Space Flight Center in Maryland, Sam Pawlyk, a second-year M.S. student, worked on several software and control pieces of the Primordial Inflation Polarization ExploreR (PIPER), a suborbital scientific balloon that will fly a telescope to 120,000 feet and observe cosmic remnants of the Big Bang. PIPER's findings could hold clues about the distribution of matter in the universe by providing insight on the phenomenon known as cosmic inflation.

Pawlyk developed the altitude determination and control system and worked on a control algorithm for maintaining transition edge sensors (TES) at 100 mK as well as a detector readout chain for the TES. He also worked on the development of a variable-delay polarization modulator (VPM) to allow for the mapping of polarization. Pawlyk travelled to New Mexico and Texas to support launch campaigns.

An undergraduate intern at Goddard, Pawlyk was offered a position as a graduate research assistant upon graduation. "I find the science of cosmic microwave background (CMB) and inflation to be very interesting," he said. "I also find the engineering challenges associated with looking for the tiny signals associated with CMB polarization fascinating."

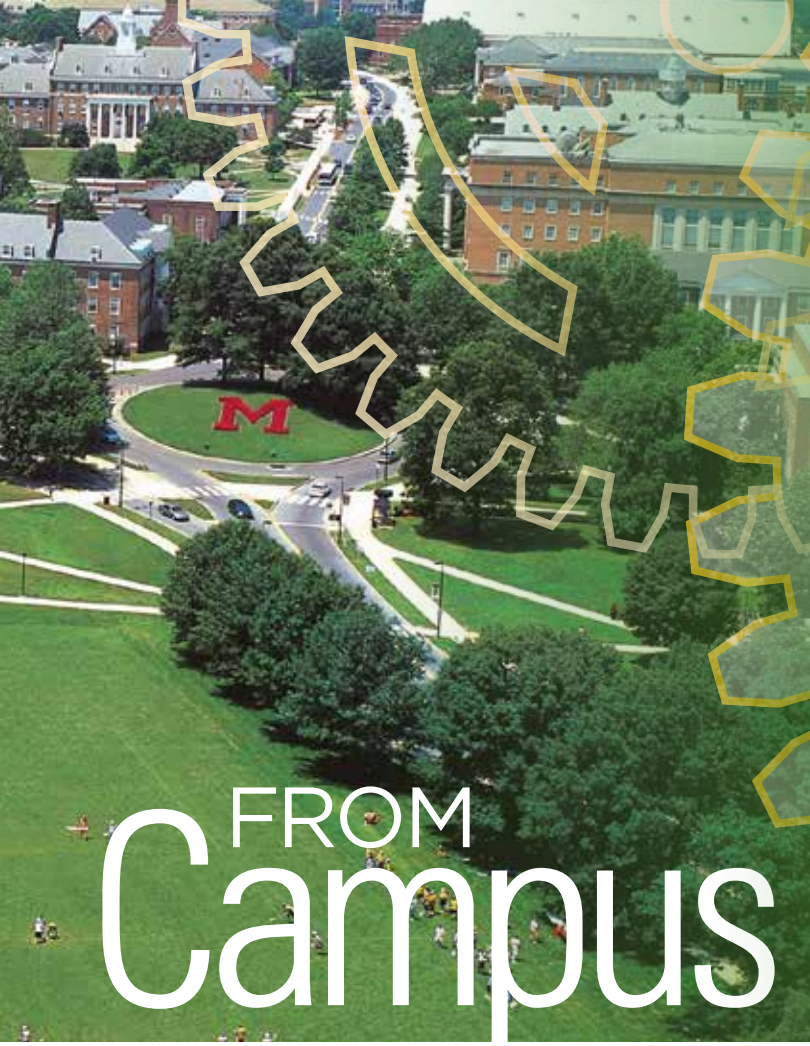
TO MARS AND BEYOND

Alex Walts, a second-year M.S. student, is no stranger to Goddard Space Flight Center. He completed internships there in 2013 and 2014, which led to his current position working with the same team.

He also gained valuable experience working on the PIPER project as a graduate research assistant. He has been designing passive thermal control systems to ensure the telescope's electronics stay within their operable temperature ranges. As an advisee of both Hartzell and Alan Kogut, an astronomy and space scientist at Goddard, Walts is looking forward to the launch of PIPER.

Last summer, Walts completed an internship at Kennedy Space Center, where he supported an upcoming Mars Pathfinder Lander mission. The mission will convert Martian atmosphere into liquid water and methane. Walts organized and ran tests on the prototype equipment that completes this chemical process while also modeling the prototype.

"Anything that's going to Mars is high on my list, especially since the success of this project has the potential to really impact the feasibility of supporting human life on Mars," said Walts.



FROM Campus TO Commercialization

FACULTY RESEARCH TRANSLATES TO PROMISING INNOVATIONS

The entrepreneurial bug is alive and well in the Department of Aerospace Engineering. Faculty members are increasingly transitioning success in the research lab to the marketplace, forming their own companies or aligning with outside entrepreneurs to make the move from campus to commercialization. Along the way, the University's Maryland Technology Enterprise Institute (MTECH) and Office of Technology Commercialization, and the state of Maryland's Technology Development Corporation (TEDCO) are helping faculty entrepreneurs navigate the complexities of business, patents, and regulation.

"Scientific papers are good because we're scholars, but if you can translate some of that into societal use, there could be huge benefits," said Department Chair Norman Wereley. "I hope College Park becomes a magnet, and people will say 'I think working with University of Maryland faculty and students would be a great way to develop a new technology.'"

UAS LIKE NO OTHER

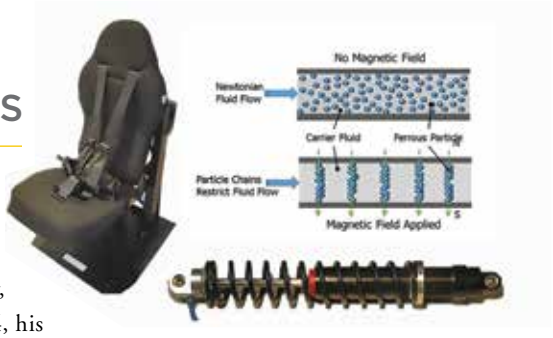
Instructor Evandro Valente (B.S '03, M.S. '06) kept his research innovation to himself for the better part of a decade. "What really bugged me was the thought of someone else coming along with the same idea and doing something about it," admitted Valente.

Three years ago, he took the entrepreneurship plunge and recently partnered with Pramod Raheja (B.S. '91) to co-found Airgility, Inc. to commercialize a patent-pending unmanned aerial system (UAS) called the HorseSHU (Specialized Hybrid Unit).

The UAS is rooted in the NASA Langley Vought V-173 "Flying Pancake," a disc-shaped, short take-off and landing aircraft once envisioned to operate aboard aircraft carriers in World War II. By adding vertical flight capability to the craft's forward flight efficiency, Airgility's multimission HorseSHU will blend unmatched range, speed, and payload volume with the operational freedom of vertical take-off and landing. The HorseSHU was bio-inspired by, and named for, the Chesapeake Bay horseshoe crab.

Airgility's near future includes flight testing and seeking investors. "If you want to know what you're made of, become an entrepreneur," advised Valente. "Your personal drive and grit are, bar none, the most important products you have to offer." He has found the ideal partner in Raheja, who handles the business side of the project. "You've got to have technical expertise back in the lab and someone out there hustling," said Raheja.

SAVING PILOTS' BACKS



Department Chair Norman Wereley has researched rotorcraft for most of his career, but he was surprised to learn that 75 to 90 percent of helicopter pilots develop back problems from vibration in the cockpit.

Seats in aircraft like the Blackhawk, a utility helicopter used by the military, are designed to be crashworthy. "They are like a rock," said Wereley. In 2004, his team started looking at how magnetorheological suspension systems, based on a type of smart fluid that reacts to a magnetic field, could be used in helicopter seating to reduce the impact of vibration, yet remain crashworthy. They came up with a new approach to the suspension system: an adaptive damper that adjusts to velocity and a spring that holds the pilot in place. Early tests show a 90 percent reduction in seat vibration under normal flight conditions.

One Ph.D. candidate on Wereley's research team was Greg Hiemenz (M.S. '00, Ph.D. '07), who was working for an aerospace company at the time. He and Wereley began looking for opportunities to transition the seat technology, leading them to the creation of InnoVital Systems, Inc. where Hiemenz is now CEO. "My role is putting a practical focus on the research, keeping government sponsors happy, and making sure the products stay on schedule," said Hiemenz.

"I'm pretty convinced these technologies make a lot of sense," Wereley said. Hiemenz noted that pilots who have stopped by InnoVital demonstrations at trade expos agree. "They ask, 'How do I get that?' then they show me the scars from their back surgeries. That's how I know we are barking up the right tree."

CHEAPER POWER FOR SMALL AIRCRAFT

When Associate Professor Christopher Cadou and Daanish Maqbool (M.S '11, Ph.D. '15) started their research on the pulse jet engine, their intent was strictly academic. But as they came to understand the theory, they saw potential for practical application.

The pulse jet engine, a hollow tube with no moving parts, was used by the Germans in World War II, but its intermittent combustion was so noisy and had so much vibration that it fell out of favor. "Understanding the theory of the engine helped us develop a strategy for how to massively cut down on the vibration," explained Maqbool. Their solution: Get two engines to work in antiphase.

"There's a lot of push for small aircraft these days," Maqbool said, "If you have an engine with no moving parts, it would be lighter and cheaper to make."

Cadou and Maqbool co-founded North American Wave Engine Corporation, (NAWEC) and, with the help of TEDCO, are hoping to test their engine on an experimental platform by next year. "Running a business is a juggling act, constantly trying to satisfy customers, investors, your own partners, and employees," Maqbool said. "There's never a dull day."

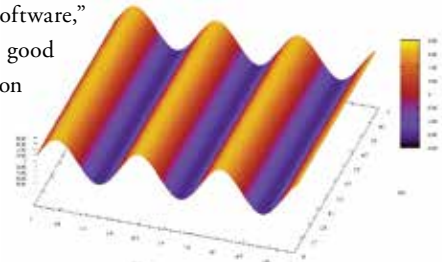
OPEN SOURCING TO INDUSTRY

Professor Olivier Bauchau took a different route to transitioning his research to the marketplace. Given that only three companies in the U.S. make helicopters, Bauchau did not see commercial viability for the software he developed and chose to provide free access. Dymore Solutions is a free open-source software for the simulation of rotorcraft and wind turbines.

"I want to make sure that our research is going to help someone," noted Bauchau. A simulation code that helps predict how proposed rotor designs will perform, Dymore is currently used by Sikorsky Aircraft, Bell Helicopter, Vestas, Siemens, and U.S. government laboratories.

"These companies developed similar pieces of software in house, but they are nowhere as capable as what we provide," said Bauchau, whose graduate students keep the software updated. "I've had engineers come back and say, 'We improved our designs because we had good predictions from your software.'"

The company has another bonus for manufacturers and for the Clark School. "Many of our students eventually get hired by these companies and use the software," added Bauchau. "It's a good example of collaboration between academia and industry."



GROUNDBREAKING APPROACH DEMONSTRATED IN THE GLENN L. MARTIN WIND TUNNEL

ASSOCIATE PROFESSOR ANYA JONES AND ANDREW LIND (PH.D. '15) HAVE COMPLETED THE FIRST SUCCESSFUL DEMONSTRATION of time-resolved flow field measurements of reverse flow using particle image velocimetry (PIV) in the Glenn L. Martin Wind Tunnel (GLMWT).

The researchers teamed up with graduate student Lauren Trollinger (B.S. '15, M.S. '17), who was preparing to test custom-built and carefully balanced rotor blades as part of her research in trimming and tracking rotors at high advance ratios. Using Trollinger's model rotor as a pilot test bed for PIV in the GLMWT, the team acquired the first quantitative, high-speed flow field measurements of reverse flow, or flow that travels backwards over the rotor blades.

The results provide new insight into the unsteady flow structures that limit high-speed helicopter flight. The team presented its findings at the 43rd Annual European Rotorcraft Forum in September in Milan, Italy.

PIV involves using a pulsing laser and high-speed camera to obtain snapshots of the flow as it develops or interacts with an object. The team set up its laser to illuminate the side of the rotor blade over which vortex structures develop, and they studied their development at different test points.

While Lind had studied the reverse flow phenomena using two-dimensional models as part of his doctoral research at UMD, this was the first opportunity to investigate reverse flow on a three-dimensional model using time-resolved PIV.

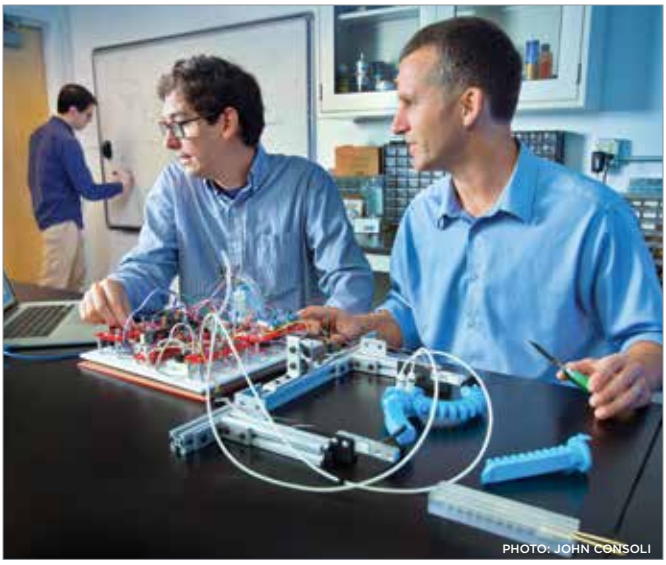
Above, Lind and Trollinger adjust the rotor model in the Glenn L. Martin Wind Tunnel.

According to Jones, saving time is one of the biggest benefits of using time-resolved PIV in the GLMWT. Rather than measuring flow at just one or a few points on a model or test section, the time-resolved PIV technique could save engineers and developers a great deal of time because they can collect more data across more points in a given aerodynamics test. In addition, researchers could make adjustments on the fly since they will see the data in real time across multiple points, rather than a single plane.

PIV instrumentation is common in smaller wind tunnels, but the application of PIV in larger wind tunnels like the GLMWT continues to be challenging, especially for time-resolved measurements. If the team continues successfully demonstrating real-time PIV data collection in the GLMWT, the technique could offer researchers a more robust measurement technique for quickly quantifying unsteady features in a flow field.

GLMWT Director Jewel Barlow said this test was the first flow-field measurement using PIV in the university's largest wind tunnel. While there have been many tests that acquired quantitative flow field data using multihole probes and provided maps of velocity vectors, vorticity, etc., this was the first example of time-resolved data.

Paley Leads $2 Million SEA-STAR Project



Professor Paley (right) and postdoctoral research associate Will Scott examine the fluidic control board used to test the dynamic properties of pneumatic actuators that may be used for a novel starfish-inspired underwater robot.

Professor Derek Paley, with a joint appointment in the Institute for Systems Research, is the principal investigator for a new $2 million grant from the Office of Naval Research's (ONR) Basic Research Challenge Program. Co-principal investigators on the "SEA-STAR: Soft Echinoderm-Inspired Appendages for Strong Tactile Amphibious Robots" grant are Aerospace Engineering Chair Norman Wereley, Associate Professor Carmel Majidi (Carnegie Mellon University), Senior Research Scientist James Weaver (Harvard University), and Professor Robert Wood (Harvard University).

The researchers will create soft underwater robot appendages that mimic functionality found in sea stars, brittle stars, and basket stars. These animals are known as "radially symmetrical echinoderms."

The long-term goal of the SEA-STAR project is to develop a functionally hierarchical architecture and distributed control scheme for the robot appendages that will give them dexterity and allow them to operate with a high force-to-compliance ratio. The design will be inspired by the complex organization seen in the echinoderms—endoskeletal elements, water vascular systems, and tube-feet arrays.

The project aims to yield a robot like this brittle star, which is an echinoderm that crawls using flexible arms for locomotion.

The SEA-STAR robotic appendages will be controlled by a network of embedded sensors and hydraulic actuators, which provide shape proprioception (grasping) and local closed-loop control. The researchers have combined expertise in echinoderm anatomy, soft and bio-inspired robotics, the mechanics of materials and tribology, multimaterial three-dimensional printing, and distributed sensing and control of underwater robotic systems.

The ONR Basic Research Challenge Program was established to competitively select and fund promising research programs in new areas. The program stimulates new, high-risk basic research projects that have naval relevance with the hope of attracting new investigators to the ONR.

From left: Matt Scassero, director, UAS Test Site; Don Woodbury, UMD director of innovation partnerships; Robert Briber, Clark School associate dean for research; Clark School Dean Darryll Pines; and AE Chair Norman Wereley.

NEW OUTDOOR FLIGHT LABORATORY ADVANCES AUTONOMY, ROBOTICS

In September, the Clark School opened the only university outdoor flight laboratory for testing unmanned aircraft systems (UAS) in the D.C.-Maryland-Virginia region. Located in the University of Maryland Discovery District just minutes from campus, the netted Fearless Flight Facility will serve as a catalyst for innovation in the areas of flight control, sensing, autonomy, collaboration, and counter-UAS.

Student and faculty researchers, who were confined to testing vehicles in a lab or to forego testing according to federal outdoor flight restrictions, now have room to iterate on the fly. The 100-foot wide, 300-foot long, and 50-foot high facility also serves as a critical nexus between the Clark School's College Park labs and the UAS Test Site in southern Maryland.

Wereley Receives UMD Making a Difference Award

PHOTO: AL SANTOS

The UMD Office of Community Engagement (OCE) has recognized Aerospace Engineering Department Chair and Minta Martin Professor of Engineering Norman Wereley with its 2016 Making a Difference Award for building local outreach activities in the College Park community. This award recognizes those who have helped the OCE achieve its goals to connect the university with the wider and diverse surrounding community.

OCE specifically acknowledged Wereley for his commitment to connect and collaborate with the College Park Aviation Museum and for giving aerospace engineering students the opportunity to learn from the community and to share their knowledge.

Wereley has forged connections in the College Park community, particularly between the department and the museum. Recently, he helped coordinate the donation of both a helicopter and an operational 15-foot-per-second open circuit wind tunnel to the museum from the department. The wind tunnel will serve as a learning tool for both museum visitors and UMD students. In addition, Wereley has supported student involvement in community events such as College Park Day and Discover Engineering Family Day at the National Building Museum.

"I want to make sure that all those individuals, and the many students that supported these initiatives, know that I very much appreciate the great support I received from all of them in realizing these initiatives," said Wereley.

UMD DONATES HELICOPTER, LOANS WIND TUNNEL TO COLLEGE PARK AVIATION MUSEUM

Last fall, the department donated an American Sportcopter Ultrasport 496 helicopter to the College Park Aviation Museum. According to the museum's press release, the Ultrasport, a kit helicopter, first flew in 1995, required 60 to 100 hours to assemble, and was used at UMD to conduct fuel studies.

In addition, the department loaned the museum a wind tunnel for use by both UMD students and the museum as part of its educational programming.

This donation and loan are win-wins, according to Museum Director Andrea Cochrane Tracey, who commented, "This type of community-minded approach from the Department of Aerospace Engineering is vital for a museum like ours." She added, "Thanks to the department's support, we are now in a position to dramatically enhance the learning activities for the public and, in turn, we provide the department with a local resource for students to learn about the history of early aviation as well as demonstrate their latest experiments for the public."

The Ultrasport helicopter is installed at the College Park Aviation Museum.

CAMERON BUTLER

HYPERSONIC JACK OF ALL TRADES

As a new Ph.D. student in spring 2015, Cameron Butler knew he wanted to work in hypersonics. Little did he know that his adviser, Assistant Professor Stuart Laurence, would make him an essential member of the team that is building a new High-Speed Aerodynamics and Propulsion Laboratory (HAPL). Butler has spent the last two years in the design and manufacturing process for two hypersonic wind tunnels that are planned to be fully operational by the end of 2017.

The Hypersonic Tunnel for Educational and Research Purposes (HyperTERP), a reflected shock tunnel equipped with a Mach 6 free-jet nozzle, will be capable of temperatures and pressures up to approximately 1500K and 25 atmospheres. Butler contends that the tunnel can achieve higher enthalpy than other university tunnels and, while not as powerful as tunnels at government facilities, has "impressive capabilities."

The second tunnel, Pre-Heated Ludwieg tube with Isentropic Compression (PHLIC), has targeted reservoir conditions of 1850K and 60 atmospheres, which will be sufficient to accurately simulate Mach 6.5 flight at 27 km altitude. The facility also will be equipped with a Mach-8 nozzle, which will allow larger test articles. Unlike HyperTERP, PHLIC's ability to perform tests at higher velocities and temperatures (900 kelvin) will more closely simulate hypersonic flight.

Laurence attests to Butler's contributions to the lab. "Cam is the go-to person in our research group if a computational simulation is required, but he has distinguished himself equally well when it comes to experiments."

While HyperTERP will also be used as a teaching tool, with Butler supervising aerospace honors program undergrads and graduate students, both tunnels allow the lab to do more internal initial testing. The long road to completion of the tunnels has required Butler to learn about the logistics of establishing a university lab. "It was really interesting to learn how some undergrad coursework I had forgotten about applies to designing a hypersonic wind tunnel," said Butler. Funded by a National Defense Science and Engineering Graduate fellowship he won in May 2017, Butler now has more time to establish the lab and settle on a topic for his dissertation.

ROSEMARY DAVIDSON

A STUDENT LEADER IN ENGINEERING AND BEYOND

When Rosemary Davidson joined the department in 2014, she hit the ground running. She performed well in her classes and jumped right into research. "I've been at Goddard Space Center since my freshman year," she said. "During my freshmen and sophomore years, I worked with two heliophysicists studying the aurora and with data from the Rosetta mission." She is currently working with those same heliophysicists on her honors project involving altitude control systems for a CubeSat. Her research experience combined with strong academic performance led to her selection as an AEROS scholar and recipient of the John Anderson Scholarship.

Davidson didn't always know she wanted to be an engineer, and she credits her pursuit of aerospace engineering to shadowing experiences in high school. "I definitely had role models," she said. "I think that helped because my parents weren't engineers." In the spirit of paying it forward, Davidson served as the vice president of outreach for the department's chapter of Women in Aeronautics and Astronautics (WIAA) and coordinated a mentoring program as well as a community event that brought 75 girls to campus to learn more about aerospace engineering. With those successes under her belt, Davidson is taking on an even bigger leadership role in WIAA. "This year I'll be president and try to live up to what WIAA's past presidents have done."

As if her research and WIAA leadership are not enough to keep her busy, Davidson has several other roles on campus as a resident assistant for Flexus and Virtus (the engineering living-learning communities) and as vice president of Sigma Gamma Tau. She is also a member of the Club Running Team as well as a parishioner at the Catholic Student Center.

While Davidson is excited to work in the aerospace industry one day, she is hardly done pushing herself academically. "Eventually I'd like to work in attitude controls, but right now I'm focused on applying to graduate school," she explained. Davidson acknowledges that the field comes with challenges and advises others not to get discouraged along the way. "There are so many people who want to help you achieve your goals, so don't let setbacks stop you from working toward them."

Aerospace Engineering Teams Dominate Student Competitions

UMD TEAM IN TOP SIX AT SECOND HYPERLOOP COMPETITION

TEAM TOOK TOP SPOT IN PERFORMANCE AND OPERATIONS AT FIRST COMPETITION

In the second SpaceX Hyperloop Pod Competition, held in late August in Hawthorne, Calif., a team of UMD undergraduate students was one of only six teams selected to complete an open-air run (riding down an unsealed track) in the Hyperloop tube.

The team, UMD Loop, competed against 24 international teams in this round of competition, which aims to advance the hyperloop concept for a long-distance, high-speed transportation system that would send pods full of people or cargo through a near-vacuum tube at high speeds. In the preliminary rounds, teams first ran their pods on a test track. UMD completed two of these runs before being selected to complete an open air run in the tube.

UMD Loop and its second-generation pod Nemesis completed a successful open-air run in the tube on the first day of competition, but were ultimately not one of the three teams selected to attempt a vacuum-pressure run on the final day of competition. WARR, a team from the Technical University of Munich in Germany, won the competition by reaching a top speed of 201 miles per hour during its vacuum run.

"It was incredibly exciting to see Nemesis achieve levitation," says UMD Loop team captain Kyle Kaplan (B.S. '18).

The UMD Loop Team participated in the second SpaceX Hyperloop Pod Competition in August and was one of only six teams to complete an open air run in the Hyperloop tube.

"Our team was complimented by many of the SpaceX judges about our design choices and craftmanship, and we are very excited for the next competition." By achieving levitation, Kaplan means the pod reached a sufficient speed for it to lift off its wheels, per the principles of passive magnetic levitation. When the pod reaches that speed, it lifts off the track by up to half an inch.

The team's top-six finish follows its successful run in the first Hyperloop competition in January 2017. UMD students previously won the Performance and Operations Award and placed in the top five for overall pod design at the 2017 SpaceX Hyperloop Pod Competition in January. As part of that competition, teams underwent rigorous safety inspections and testing that evaluated all aspects of the pod's design from structural and functional to mechanical and navigation. In addition, each team participated in an open-air run to operate their pod on the test track without vacuum pressure. UMD's pod Prometheus featured a passive magnetic levitation control and breaking using neodymium magnets—the strongest type of commercially available permanent magnet—a unique chainmail breaking system, and a multilink suspension system for smoothing the ride.

"This has been a remarkable experience for our students, staff, and advisors," said Darryll Pines, Clark School dean and the Nariman Farvardin Professor of Aerospace Engineering. "UMD Loop competed well, and we strongly represented the University of Maryland."

From left, faculty mentor Professor James Baeder with team captain Andrew Dallas and team members Andrew Jones, Jason Cho, and MIchael Queen at the Wind Competition in Colorado.

UMD WINS IN TECHNICAL DESIGN CATEGORY AT DEPARTMENT OF ENERGY COMPETITION

A team of UMD students took first place in technical design at the U.S. Department of Energy's Collegiate Wind Competition 2017 Technical Challenge. Wind TERPines was one of 10 teams nationwide selected to take part in this year's competition in April at the National Wind Technology Center in Boulder, Colo.

Wind TERPines, including students from the Clark School, the College of Computer, Mathematical and Natural Sciences, and the Smith Business School, spent two years developing and refining their concept. "The team's projects are highly interdisciplinary, and a diversity of majors and backgrounds is important to the success of the team," explained Andrew Dallas, team captain and senior in aerospace engineering and computer science.

This year's Collegiate Wind Competition required students to design and build a small-scale wind turbine able to address changing wind directions, and be safe, reliable, and effective while using sound engineering practices. The UMD team's 2016 design aimed at developing a wind turbine suitable for agricultural areas with little or no access to grid power.

>> LEARN MORE, VISIT go.umd.edu/windTERPines

From left, faculty advisor David Akin and team members Shaheer Khan, Hermann Kaptui Sipowa, Rounak Mukhopadyay, Leandre Jones, Ryan Ernandis, and Mary Beth Wusk (NASA LaRC).

TEAM CAPTURES SECOND AT NASA BIG IDEAS DESIGN COMPETITION

A UMD team placed second at the NASA BIG Ideas Competition that was held at NASA Langley in February. The engineering design competition engages the university community in driving innovation and developing unique solutions to NASA technology focus areas.

University teams were asked to come up with concepts for constructing a solar electric propulsion (SEP)-powered space tug using autonomous robotic assembly. The tug would need to transfer payloads from low-earth orbit to a lunar orbit.

Of 29 original submissions for the competition, two UMD teams were selected to compete. During the event, teams presented their final concepts to a panel of NASA experts.

The winning UMD team, SMo-FLaKE (Solar-Electric Modular Flexible Escort), was advised by Professor David Akin and Lecturer Andrew Becnel.

From left, Conor Casey, Joshua Cocker, Brooke Nesselt, and Alexander Tran.

AERO STUDENT PART OF TOP TEAM IN NATIONAL DELOITTE CASE COMPETITION

A UMD team that included three engineering students won first place and a $4,000 prize in the national Deloitte Consulting Undergraduate Case Study Competition in Westlake, Texas in March.

Among 17 universities represented in the competition, the UMD team was challenged to develop a practical solution for an online clothing retailer to establish brick-and-mortar operations. Team solutions had to adhere to Deloitte's three-segment consulting method, which includes human capital, technology, and strategy and operations. The event culminated with four finalist teams presenting to an audience of more than 100 Deloitte employees and participating universities.

The UMD team included sophomores Conor Casey (aerospace engineering), Joshua Cocker (mechanical engineering), Brooke Nesselt (mechanical engineering), and Alexander Tran (finance and information systems). Kimberly Berlic (B.S. '14, mechanical engineering), now a consultant with Deloitte, mentored the UMD team at the national competition.

Penton Aviation Week Network's 20 Twenties Includes AE Students

Brian Free, Rubbel Kumar, Wanyi Ng, and Rosie Weinstein have been named "Tomorrow's Engineering Leaders: The 20 Twenties" by Penton's Aviation Week Network. The award, granted in partnership with the American Institute of Aeronautics and Astronautics (AIAA),

Brian Free

Rubbel Kumar

Wanyi Ng

Rosie Weinstein

recognizes top students in engineering, math, science, and technology worldwide and connects the next generation of aerospace and defense talent with established leaders in the fields.

Since Penton's Aviation Week Network first launched the program in 2013, the organization has recognized 10 UMD students and alumni as 20 Twenties, including: Sylvie DeLaHunt, Elaine Petro, and Lauren Trollinger (2016); Nelson Yanes and Elena Shrestha (2014); and Kenneth 'Kip' Hart (2013).

Evan Peaco Named 2017 NSCF Keynote Scholar

PHOTO: LARRY CANNER

The National Space Club and Foundation (NSCF) selected aerospace engineering junior Evan Peaco for its 2017 NSCF Keynote Scholarship. The $10,000 scholarship supports a student, from high school to graduate level, who intends to pursue a career in the science, technology, engineering, or mathematics (STEM) fields, is academically strong, and excels in public speaking.

More than 7,000 students applied for this year's award, and a final round of six students were chosen for Skype interviews. According to NSCF, "Peaco rose to the top of the competition with his strong academic record and experience in aerospace" as well as "his impressive list of honors and accomplishments, including being named a National Merit Scholar and receiving the school's prestigious Banneker/Key Scholarship."

THREE STUDENTS AWARDED NDSEG FELLOWSHIPS

Students **CAMERON BUTLER**, **LUCAS PRATT**, and **PATRICK WASHINGTON**, were selected for 2017 National Defense Science and Engineering Graduate (NDSEG) Fellowships. The NDSEG Fellowship is part of the Department of Defense's (DoD) commitment to increasing the number and quality of the nation's scientists and engineers. The department awarded only 150 fellowships nationwide for 2017.

Cameron Butler

Lucas Pratt

Patrick Washington

NDSEG fellowships are highly competitive, portable awards granted to U.S. citizens and nationals who intend to pursue doctoral degrees in one of 15 supported disciplines, including aerospace and aeronautical engineering. The three-year fellowship allows recipients to attend the U.S. institution of their choice, covering full tuition and all mandatory fees along with a monthly stipend and medical insurance support. The Department of Defense (DoD) has awarded nearly 3,400 NDSEG fellowships since the program began in 1989.

PETRO ADDS TO LIST OF HONORS

Department of Aerospace Engineering Ph.D. student **ELAINE PETRO** continues to add to her list of honors. Petro was named the 2017-2018 Lockheed Martin Scholar of the Metropolitan Washington Chapter of Achievement Rewards for College Scientists (MWC/ARCS) Foundation.

Petro previously was recognized for her outstanding engineering work with a 2014 National Science Foundation Research Fellowship and a 2015 Zonta International Amelia Earhart Fellowship. In 2016, she was named one of Penton Aviation's 20 Twenties, representing tomorrow's engineering leaders.

She is a student in Associate Professor Raymond Sedwick's Space and Propulsion Laboratory working on the development of a water-propelled helicon thruster with specific impulse control. She is focusing on operating the helicon thruster—a type of ion propulsion system—with water vapor as a propellant to achieve performance suitable for deep space exploration missions. Through her research, the lab team has developed a water vapor ionization model that predicts plasma characteristics such as the molecular composition and energies of ions created as a function of the electron energy. The plasma characteristics determine the achievable thrust and specific impulse. These and additional loss mechanisms in the helicon source have been incorporated into a power balance analysis to predict and optimize thruster efficiency.

Beyond the Space and Propulsion Lab, Petro is actively involved in the department's Women in Aeronautics and Astronautics (WIAA) student group. She serves as WIAA's vice president of community development and helps the group facilitate and organize activities to engage the community and enhance industry networking.

SSPI SCHOLARSHIPS AWARDED TO FOUR STUDENTS

Aerospace engineering students **ERIC FRIZZELL**, **HERMANN KAPTUI SIPOWA**, **JACOB MCCULLUM** and **JACKSON SHANNON** received Society of Satellite Professionals International (SSPI) Scholarships, which provide funding to students pursuing research in relevant fields, for the spring 2017 semester. The SSPI Mid-Atlantic chapter has a partnership with the university and regularly supports UMD students through chapter scholarships.

SSPI scholarship recipients participated in the 2017 SSPI Mid-Atlantic and Iridium Student Competition in Leesburg, Va., where they showcased research in new technologies and approaches that can greatly enhance the space and satellite industries in the not-too-distant future.

ERIC FRIZELL: Senior

MENTOR: Associate Professor Raymond Sedwick
RESEARCH: Speeding construction assessment of orbital debris using parallel processing and graphical processing units at CODER

HERMANN KAPTUI SIPOWA: Senior

MENTOR: Assistant Professor Christine Hartzell
RESEARCH: Quantifying the deformation of a silicone bag of magnetorheological fluid

JACOB MCCULLUM: Junior

MENTORS: Minta Martin Professor of Aerospace Engineering Norman Wereley and Research Associate Byungseok Yoo
RESEARCH: Conducting structural health monitoring research

JACKSON SHANNON: Senior

MENTOR: Assistant Professor Christine Hartzell
RESEARCH: Designing a theoretical CubeSat constellation for orbital debris mapping

TWO STUDENTS RECEIVE 2017 VERTICAL FLIGHT FOUNDATION SCHOLARSHIPS

Thomas Herrmann

Tyler Sinotte

Two graduate students have received American Helicopter Society International (AHS) Vertical Flight Foundation Scholarships for 2017. **THOMAS A. HERRMANN** received the Marat N. Tishchenko Scholarship and **TYLER SINOTTE** received the Alfred Gessow Scholarship.

Herrmann is a graduate assistant working toward his Ph.D. and is a simulation and modeling engineer with the Sikorsky Aircraft Corporation. He is currently working with Professor Roberto Celli on optimum control allocation for noise, performance, and fatigue life for advanced rotorcraft configurations. Sinotte is a master's student working with Igor Sikorsky Distinguished Professor in Rotorcraft Olivier Bauchau on research related to the structural dynamics of highly curved rotor blades.

The Vertical Flight Foundation (VFF) is the philanthropic arm of AHS, and VFF scholarships recognize some of the world's most talented engineering students interested in vertical flight. Many recipients have gone on to become leaders in the vertical flight technical community. Only 24 awards are given internationally each year. This year's recipients were recognized during the AHS Grand Awards Banquet in May during the AHS International 73rd Annual Forum in Fort Worth, Texas.

STUDENTS PLACE AT AIAA STUDENT CONFERENCE

Eric Wallace, left

Eric Frizzell, left

Undergraduate team, from left: Ehiremen Ebewele, David Hairumian, Nick Rehm, and Andres Christenson

UMD students took top spots at the American Institute of Aeronautics and Astronautics (AIAA) Student Papers Conference held at the University of Virginia. The AIAA Student Paper Conference is an annual research competition to give students a chance to have their work reviewed and critiqued by practicing professionals. Department winners included:

- **ERIC WALLACE**
  First Place Undergraduate Individual
- **ERIC FRIZZELL**
  Third Place Undergraduate Individual
- **DAVID HAIRUMIAN**, **NICK REHM**, **EHIREMEN EBEWELE**, and **ANDRES CHRISTENSON**
  Second Place Undergraduate Team
  "Development of a Package Delivery and Acquisition MAV"

In addition to the competition, the Student Papers Conference gives students the opportunity to interact with industry and AIAA professionals and their fellow student members. Social events allow participants to discuss presentations or current events and topics in aerospace engineering. Winners in each category are invited to attend and compete at the AIAA International Student Conference.

PHOTO: JHU APL

Van Wie Elected to the National Academy of Engineering

Alumnus David M. Van Wie (B.S. ’80; M.S. ’82; Ph.D. ’86) has been elected as a member of the National Academy of Engineering (NAE). The NAE recognized Van Wie for his contributions to hypersonic technology enabling new classes of flight vehicles.

Election to the NAE is among the highest professional distinction for engineers. Membership honors those who have made outstanding contributions to “engineering research, practice or education, including, where appropriate, significant contributions to the engineering literature” and to “the pioneering of new and developing fields of technology, making major advancements in traditional fields of engineering or developing/implementing innovative approaches to engineering education.”

Van Wie is the mission area executive for Johns Hopkins University Applied Physics Laboratory’s (APL) precision strike mission area. He is responsible for strategic planning, execution, and performance of approximately $100 million in annual funding in programs addressing integrated strike, air dominance, and electronic attack. As the nation’s largest University Affiliated Research Center, APL performs research and development on behalf of the Department of Defense, the intelligence community, NASA, and other federal agencies. The laboratory has more than 5,000 staff members who are making critical contributions to a wide variety of nationally and globally significant technical and scientific challenges.

Prior to his current appointment, Van Wie served as the chief technology officer for the mission area, focusing on technology development supporting asymmetric multidomain system concepts for use in anti-access/area-denial (A2/AD) environments. He also served on the U. S. Air Force Scientific Advisory Board, where he led a science and technology quality review of the Air Force Research Laboratory and conducted studies on advanced weapons, virtual training, and space launch vehicles. Van Wie has served on National Academies of Science, Engineering, and Medicine studies addressing a wide range of complex topics such as conventional prompt global strike; civil aeronautics; future Air Force needs for survivability; boost-phase missile defense; reusable booster systems; and Air Force development planning.

An active member of the U.S. science and technology community, Van Wie has published more than 140 papers in the fields of high-temperature fluid dynamics, plasma aerodynamics, and hypersonic airbreathing propulsion systems.

Van Wie has lectured extensively in the department on hypersonics, fluid dynamics, and space propulsion. He holds a research faculty position in the Department of Mechanical Engineering at Johns Hopkins University. In addition, he currently serves on the Aeronautics and Space Engineering Board of the National Academies National Research Council.

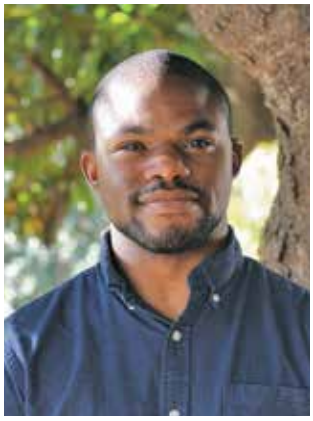
A fellow of the American Institute of Aeronautics and Astronautics, he has been recognized for his sustained contributions by the Joint Army, Navy, NASA and Air Force Airbreathing Propulsion Subcommittee as a recipient of the Air Force Award for Meritorious Civilian Service.

In 2016, the Department of Aerospace Engineering inducted Van Wie into its Academy of Distinguished Alumni, which recognizes alumni who have made notable contributions to the field of aerospace engineering and/or achieved other significant accomplishments. This spring, Van Wie was the Clark School’s commencement address speaker for the graduating class.

Frontin and Stebbins Awarded NASA Fellowships

Cory Frontin (B.S. '14) received a 2017 NASA Space Technology Research Fellowship (NSTRF), which provides training grants for students to conduct research at NASA centers. He currently studies at Massachusetts Institute of Technology, where he hopes to attain an S.M. and a Ph.D. in aeronautics and astronautics. At UMD, he was a member of the aerospace engineering department honors program and conducted research with Professor Derek Paley with the support of a NASA Aeronautics Scholarship. As an intern at NASA Ames Research Center, he worked on experimental boundary layer experiments.

Spencer Stebbins (B.S. '14) received the NASA Aeronautics Scholarship & Advanced STEM Training and Research (AS&ASTAR) Fellowship. Stebbins is currently pursuing a Ph.D. at the University of Virginia. As an undergraduate in the department, he worked with Professor Alison Flatau on the development of bio-inspired magnetostrictive flow sensors. AS&ASTAR fellowships sponsor U.S. citizen and permanent resident graduate students who show significant potential to contribute to NASA's goal of developing skills and competencies for the future workforce in the science, technology, engineering, and mathematics fields.



>> LEARN MORE, VISIT go.umd.edu/frontin-stebbins

Alumni Networking Event at AHS Forum in Texas

The department welcomed more than 65 alumni to their first Alumni Networking Event during the American Helicopter Society Forum 73 in Fort Worth, Texas, in May.

ALUMNI APPOINTMENTS

KARTHIK DURAISAMY (PH.D. '05)
FACULTY MENTOR: JAMES BAEDER
ASSOCIATE PROFESSOR, UNIVERSITY OF MICHIGAN

IMRAAN FARUQUE (PH.D. '11)
FACULTY MENTOR: SEAN HUMBERT
MECHANICAL AND AEROSPACE ENGINEERING
OKLAHOMA STATE UNIVERSITY

ATUL JAYASIMHA (PH.D. '06)
FACULTY MENTOR: ALISON FLATAU
PROFESSOR
VIRGINIA COMMONWEALTH UNIVERSITY

FRANK LAGOR (PH.D. '17)
FACULTY MENTOR: DEREK PALEY
ASSISTANT PROFESSOR (SPRING 2018)
MECHANICAL AND AEROSPACE ENGINEERING
STATE UNIVERSITY OF NEW YORK-BUFFALO

POSTDOC APPOINTMENTS

RYAN HOUIM
FACULTY MENTOR: ELAINE ORAN
ASSISTANT PROFESSOR, MECHANICAL AND AEROSPACE ENGINEERING
UNIVERSITY OF FLORIDA

FEITIAN ZHANG
FACULTY MENTOR: DEREK PALEY
ASSISTANT PROFESSOR, ELECTRICAL AND COMPUTER ENGINEERING
GEORGE MASON UNIVERSITY

Paley Promoted to Professor

Associate Professor Derek Paley has been promoted to the rank of professor, effective July 1, 2017. Paley joined UMD faculty in 2007 and currently directs the Collective Dynamics and Control Laboratory where his research focuses on the areas of nonlinear dynamics and control, cooperative control of autonomous vehicles, adaptive sampling with mobile sensor networks, autonomous underwater vehicles, and spatial models of biological collectives.

PALEY PRESENTS AT NAE 2016 FRONTIERS OF ENGINEERING SYMPOSIUM

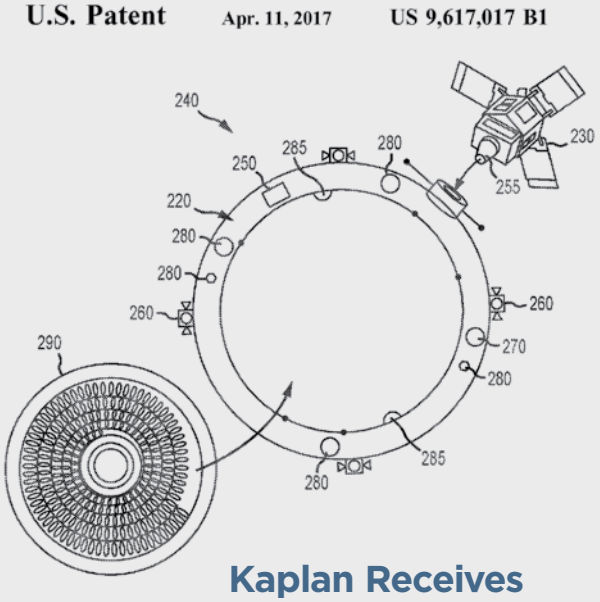
Paley presented at the National Academy of Engineering's (NAE) 2016 Frontiers of Engineering Symposium serving on an engineering autonomy panel titled "Extreme Engineering: Extreme Autonomy in Space, Air, Land and Under Water." The session highlighted breakthroughs in advanced decision-making and bio-inspired mechanical design that enable new applications for autonomous robotics in space, air, land, and water.

He discussed how the development of autonomous underwater robots via the Naval Research Laboratory in the late 1990s helped open the field to more work and research, with developments in remotely operated vehicles (ROVs)—controlled by tethers on the surface—giving way to unmanned vehicles and the need for greater autonomy and sensing capability for underwater vehicles.

"Demand for autonomy is greater with the underwater environment," said Paley. "Communication methods available to land and air vehicles, such as global positioning systems and radio communication, are simply not possible underwater. Just from a physics standpoint, it's more challenging."

Jones Promoted to Associate Professor

Faculty member Anya Jones was promoted to the rank of associate professor with tenure, effective July 1, 2017. Jones has been a faculty member at UMD since 2010, and she is director of the Separated and Transient Aerodynamics Laboratory, an experimental aerodynamics laboratory that focuses on unsteady, separated, and three-dimensional flows on flapping wings, rotorcraft, and wind/water turbines.



Kaplan Receives Patent for Orbital Debris Removal System

Professor of Practice Marshall Kaplan was awarded a U.S. patent for "Apparatus and Methods for Orbital Debris Removal." With the ever-increasing concern over the volume of debris in orbit around earth, a growing number of approaches have been taken to tackle the orbital debris problem.

Kaplan, associate director of UMD's Center for Orbital Debris Education and Research, recently proposed a new type of deployable interception vehicle capable of intercepting debris. The vehicle is maneuverable to avoid active satellites and can be deployed in numbers.

According to the patent, Kaplan's orbital debris interception vehicle includes a satellite bus coupled with a debris interception module capable of a separate deployment from the main vehicle. The module includes a debris impact pad, such as a pancake-shaped Whipple shield, which is a type of hypervelocity impact shield used to protect spacecraft from collisions with micrometeoroids and orbital debris. Kaplan's proposed vehicles could be deployed in numbers into an equatorial orbit and could release the debris interception module before an intercept and then reconnect after interception.

In addition, Kaplan estimates that the costs for the apparatus and methods described in his patent will not exceed one percent more than the costs of other possible options for the clean-up and maintenance of the near-earth, high-density debris field.

Elaine Petro

Madeline Caracappa

Haley Patel

ARCS Scholarships Support Aerospace Students

Three aerospace engineering students have been honored with scholarships from the Metropolitan Washington Chapter of Achievement Rewards for College Scientists (MWC/ARCS) Foundation.

Ph.D. student Elaine Petro was named the 2017-2018 Lockheed Martin Scholar of the Metropolitan Washington Chapter of Achievement Rewards for College Scientists (MWC/ARCS) Foundation.

Sophomores Madeline Caracappa and Haley Patel were named 2017-2018 Lockheed Martin Undergraduate Scholars of the Metropolitan Washington Chapter of Achievement Rewards for College Scientists (MWC/ARCS) Foundation.

Petro is a student in Associate Professor Raymond Sedwick's Space and Propulsion Laboratory, where she works on the development of a water-propelled helicon thruster with specific impulse control. (See related story, p. 13.)

Caracappa is actively engaged in research at UMD and is an active member of the Near Space High Altitude Balloon Payload Program. She has participated in a number of high-altitude payloads and most recently was the lead engineer on the group's April 1 payload launch.

Patel has been involved with research at UMD since her freshman year through her participation in the First Year Innovation and Research Experience (FIRE) program.

The ARCS Foundation advances science and technology in the United States by providing financial awards to academically outstanding students who are completing graduate degrees in science, engineering, and medical research. Since its founding in 1958 in Los Angeles, Calif., ARCS has grown to a national organization of 17 chapters that have provided more than 14,000 scholar awards totaling nearly $83 million at 54 leading universities. Since the Metropolitan Washington Chapter of ARCS' inception in 1968, it has raised approximately $7 million in scholar awards.

> "The department is grateful for our wonderful partnership with the Washington Chapter of the ARCS Foundation and its continued support of the next generation of America's technology leaders."
>
> **NORMAN M. WERELEY**
> MINTA MARTIN PROFESSOR AND CHAIR, DEPARTMENT OF AEROSPACE ENGINEERING

DEPARTMENT OF AEROSPACE ENGINEERING VISITING COMMITTEE

DR. SUPRIYA BANERJEE
FOUNDER AND CEO
THE FINEHAS GROUP

DR. PETER CHEN
(B.S. '90, M.S. '92, Ph.D. '96)
SENIOR DIRECTOR, ADVANCED TECHNOLOGY
INTELLIGENT AUTOMATION, INC.

DR. RAVINDER CHONA
(B.S. '84, M.S. '85, Ph.D. '87)
SENIOR SCIENTIST, STRUCTURAL INTEGRITY AEROSPACE SYSTEMS DIRECTORATE
AIR FORCE RESEARCH LABORATORY, WRIGHT-PATTERSON AIR FORCE BASE

STEVEN DONALDSON (B.S. '87)
HEAD, AEROMECHANICS ENGINEERING DIVISION
NAVAL AIR SYSTEMS COMMAND DEPARTMENT OF THE NAVY

PETER HOWORTH
DIRECTOR, AEROSPACE AND DEFENSE MECHANICAL TECHNOLOGY
LORD CORPORATION

MATTHEW HUTCHISON
VICE PRESIDENT, ENGINEERING
AURORA FLIGHT SCIENCES CORPORATION

DAN NEWMAN (M.S. '89)
SENIOR TECHNICAL FELLOW/CHIEF ENGINEER ADVANCED VTOL
BOEING

THOMAS NG (B.S. '84)
DIRECTOR, COMMERCIAL ENGINE PRODUCT INTEGRATION
GE AVIATION

MICHAEL RYSCHKEWITSCH
SPACE SYSTEMS
JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY

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AEROSPACE ENGINEERING CONSULTANT
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FEARLESS FLIGHT

PHOTO: ANJANETTE RILEY

WHAT'S IN THIS PHOTO? Faculty, staff, students, and partner organizations now have access to the full spectrum of unmanned aircraft systems (UAS) research at the new Fearless Flight Facility. From concept through development and evaluation and life-cycle testing, researchers can advance the latest UAS technology at the outdoor flight space located just minutes from campus.

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