



Winter 2013

AEROCONTACT

AEROSPACE ENGINEERING
A. JAMES CLARK SCHOOL of ENGINEERING
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A NEWSLETTER FOR ALUMNI AND FRIENDS OF THE DEPARTMENT OF AEROSPACE ENGINEERING AT THE A. JAMES CLARK SCHOOL OF ENGINEERING, UNIVERSITY OF MARYLAND, COLLEGE PARK.

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Gamera Rises! Clark School Team Celebrates Record-Breaking Flights



Colin Gore, a Ph.D. candidate in the Clark School's materials science and engineering department, pilots the Gamera II.

What a year it has been for Team Gamera! Just last summer the team was celebrating its certified, world-record flight durations of 4.2 seconds and 11.4 seconds at altitudes of one to two feet with the *Gamera I* human-powered helicopter. By August 2012, the team had increased flight duration to 65 seconds and set an unofficial altitude record of 9.4 feet—tantalizingly close to meeting the requirements of the prestigious American Helicopter Society's (AHS) Igor I. Sikorsky Human Powered Helicopter Competition. The \$250,000 AHS Sikorsky Prize, sponsored by Sikorsky Aircraft, stipulates a 60-second hover while momentarily exceeding an altitude of 3 meters (9.8 feet) all within a 10-meter-by-10-meter square. Team Gamera has "checked the box" on almost all of these requirements (within 5 inches of the 9.8 feet altitude requirement) during separate

flights and is now working to achieve the requirements simultaneously.

What happened in the last 12 months that is responsible for such a quantum leap in performance? Enter *Gamera II*.

After the *Gamera I* flights, the team returned to the drawing board, realizing they had to make significant modifications to come close to the AHS requirements. The experience gained during the 30 months of work on *Gamera I* shifted to the design of *Gamera II*. Team members spent three months building and testing prototype components, conducting scaled rotor tests in ground effect, refining modeling and optimization programs and gaining a better understanding of the human power available from the pilots. The end result: a vehicle that was the same overall size as *Gamera I*, but a full 30 pounds lighter, down to 75 pounds. Structural design

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CHAIRMAN'S CORNER

A Culture of Excellence



NORMAN WERELEY

Last spring, Professor Mark Lewis left the University of Maryland to assume the role of Director of the Science and Technology Policy Institute at the Institute for Defense Analyses in Washington, D.C. I thank Professor Lewis for his decades of outstanding service to the department and the university as professor, department chair and director of the Center for Hypersonic Education and Research. Faculty and staff members of the department are proud that one of our most accomplished faculty members, who recently served as chief scientist of the U.S. Air Force and as president of the American Institute of Aeronautics and Astronautics (AIAA), will continue contributing to national service and leadership in his new position. We wish him the best of luck.

In my new role as department chair, I will continue to emphasize our strong traditions of teamwork and excellence in education, research, innovation and service. Students, staff and faculty in the department are all working toward this goal with great enthusiasm.

What do I mean by this culture of excellence?

Aerospace engineering students have achieved great success in many competitive arenas. The *Gamera II* human-powered helicopter team recently received a certified endurance flight record of 65 seconds from the Fédération Aéronautique Internationale for its August 2012 flight. The *Gamera II* team continues to work towards the AHS Sikorsky Prize. At the AIAA Region 1-MA Student Conference last spring, the Undergraduate and Graduate Presentation Awards went to Elena Shrestha, B.S. '12, and Erica Hocking, M.S. '12. Both students attended the AIAA International Student Conference last year, concurrent with the Aerospace Sciences Meeting, where Hocking was the overall Graduate Paper Award winner!

Our faculty continue to shine in their respective fields. Professor Mark Lewis is the 2013 recipient of the AIAA Dryden Lectureship, a premier research award. Professor Alison Flatau received the 2013 ASME Adaptive Structures Prize. Professor Emeritus John Anderson was awarded the inaugural AIAA Hypersonic Systems and Technologies Award for his lifetime contributions to hypersonic research. Our faculty, students and alumni have won best paper awards, been awarded patents, published numerous articles in influential journals, and continue to work to emphasize a culture of excellence in research, education, innovation, and service on a daily basis.

There are also the extraordinary achievements of our alumni, who continue to do us proud! Ashish Bagai, B.S. '90, M.S. '92 and Ph.D. '95, who is a key architect behind the rotor technology driving the Collier Trophy award-winning Sikorsky X2 helicopter, was recently inducted into the Clark School Innovation Hall of Fame. Shane Jacobs, Ph.D. '09, was a key designer behind the spacesuit used by Felix Baumgartner in his recent sound barrier-breaking jump from an altitude of 24 miles to a safe landing via parachute.

As chair, I celebrate the exploits, accomplishments, and derring-do of our alumni, undergraduate and graduate students, staff and faculty on many occasions. Keep up the great work! As you read this newsletter, take a few moments to enjoy that same sense of pride in being a Terp Aerospace Engineer! Best wishes for a productive and successful 2013!

Go Terps!

Norman M. Wereley
Minta Martin Professor and Chair
Department of Aerospace Engineering

Gamera Rises!

Continued from page 1

innovations, such as the filament-wound carbon fiber truss, as well as the application of multidisciplinary optimization routines enabled the dramatic weight reduction and improved aerodynamic efficiency. The power required to hover *Gamera II* was some 40 percent less than *Gamera I* required. (See the full design report for *Gamera II* on the team website at www.agrc.umd.edu/gamera/publications.html.)

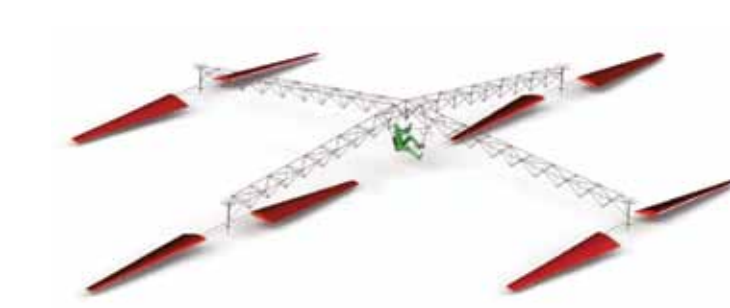
Enter Gamera II

From November 2011 through May 2012, *Gamera II* was constructed, and the first test flights were completed in June 2012 in the Reckord Armory on campus. It was immediately clear that *Gamera II* was superior to *Gamera I* in almost all respects, unless you prefer the aesthetic of the pink rotors of *Gamera I*. In one of the first public test flights, Colin Gore achieved a flight of almost 40 seconds, smashing the 11.4 second team record set in 2011. The next day test pilot Kyle Gluesenkamp did even better, powering to an officially certified time of 49.9 seconds. In altitude attempts, both pilots were able to reach around 3.5 feet, an unofficial record at the time but still far from the 9.8 feet or 3 meters required of the AHS prize. On their heels were two other competitors for the AHS Sikorsky Prize: the Atlas (AeroVelo, Toronto, Canada), and the Upturn (NTS Works, California) —neither of which have achieved the needed requirements.

During July, the team made further improvements to an already well-optimized vehicle. The rotor radius was increased from 6.5 to 7.2 meters (23.6 feet), which reduced power requirements by 12 percent. The transmission also was dramatically improved, with a stiffer drive-chain and improved pilot ergonomics. Vehicle empty weight increased to 82 pounds with the changes, but the increase was well worth it. During an early August flight testing on the main floor of the Comcast Center, a tethered hover flight of 70 seconds was achieved by Gluesenkamp, unofficially shattering the 60-second mark.

A Ground-breaking Flight

The team, now confident that the 60-second barrier would fall during their next observed free-flight attempts, booked a larger indoor space to flight test in late August. The Prince George's Sports and Learning Complex in Landover, Md., provided more room for the vehicle to drift without crashing into a wall, as was the case in the Reckord Armory. An observer from the National Aeronautic Association (NAA) attended to certify any



Left: *Gamera* team members conduct a check during a flight test. Top: A computer model of the *Gamera II*. Middle: The *Gamera II* Team, flanked by mentors V.T. Nagarag (left) and Inderjit Chopra (right). Bottom right: Judy Wexler, the *Gamera I* pilot celebrates with team members.

record attempts. During the first day of attempts, Colin Gore managed a 65-second flight within a 10-meter box, although at an altitude of only about two feet. The team was ecstatic, and with their main goal accomplished, they moved on to maximum altitude testing. New pilot Henry Enerson, an incoming freshman, was eager to climb as high and as fast as he could. The team was expecting about 5 to 6 feet of altitude based on the most recent *Gamera II* altitude attempts and the subsequent improvements. Enerson astonished everyone in the indoor track building when he climbed smoothly up to 8 feet (2.5 meters) and safely landed during a 25-second flight. After decades of doubt, the AHS Sikorsky Prize was suddenly looking within the realm of possibility! Flights continued for the next 4 days, with all 3 pilots reaching altitudes over 8 feet. The final flight reached around 9.4 feet, a mere 5 inches short of the 9.8 feet goal before significant

structural failures in flight ended that round of testing.

Team *Gamera* is currently repairing and rebuilding and will be back soon to take a real shot at making aviation history and bringing the AHS Sikorsky Prize home to the Alfred Gessow Rotorcraft Center, the Aerospace Department, the Clark School of Engineering and the University of Maryland. "For more than 30 years, the AHS Sikorsky Prize has been thought by many to be unachievable," says Mike Hirschberg, the AHS executive director. "The *Gamera* team has now clearly demonstrated that it has the ability to achieve the impossible." Go Terps! ■

Follow Team *Gamera's* progress on their website at www.agrc.umd.edu/gamera/; on YouTube at www.youtube.com/user/TeamGameraHPH/videos; or on Twitter at @UMD_Gamera. To learn more about the AHS Sikorsky Prize, go to www.vtol.org/hph.



GAMERA I vs. GAMERA II		
	Gamera I	Gamera II
Configuration	Quad-Rotor	
Maximum dimension (ft)	105	
Rotor diameter (ft)	42.6 (x4)	
Disk area (ft ²)	5700	
Rotor RPM	18	20
Vehicle weight (lb)	106	71
Pilot weight (lb)	107-110	135-145
Power required to hover (2 ft altitude, 135 lb pilot)	770 W (1.03 hp)	460 W (0.62 hp)

Gamera Wins Industry Achievement Award

The Clark School's *Gamera* human-powered helicopter team was recognized with the annual American Helicopter Museum and Education Center (AHMEC) Achievement Award for 2011. This award is presented to a person or organization that has made a significant contribution to furthering rotary-wing aviation during the previous year. "This is a testament to everyone who has worked on this project from day one," says Clark School Dean Darryll Pines. "This project has brought worldwide attention to the Gessow Rotorcraft Center, the Department of Aerospace Engineering and the Clark School. I could not be prouder of the

extraordinary accomplishments of the *Gamera* Team."

AHMEC chose the *Gamera* team for its record-breaking flights of a human-powered rotary wing aircraft. "The team's innovation, teamwork and ambition towards overcoming extreme engineering challenges represents a significant accomplishment and is an inspiration to all," noted AHMEC. In 2010, Sikorsky Aircraft received the award for the X2 Demonstrator record-breaking flight program, in which Ashish Bagai, B.S. '90, M.S. '92 and Ph.D. '95, played a key role. The award is presented annually at the AHMEC Fall Gala. ■

Research Team Makes Cyclocopter History

Innovative Design Brings Concept Full Circle

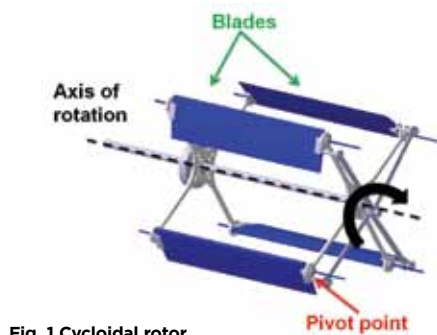


Fig. 1 Cycloidal rotor.

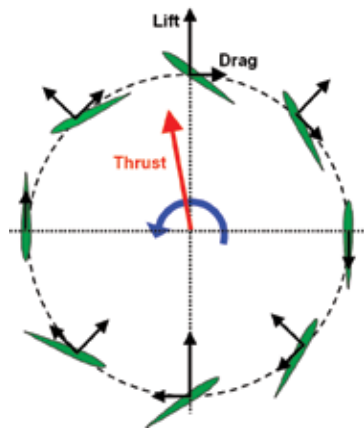


Fig. 2 Blade pitching kinematics.

A full century after the inception of the cyclorotor concept, a University of Maryland team has made history with the first cyclocopter ever reported in the literature to perform both a piloted and autonomous stable flight in hover. In addition, the 110-gram cyclocopter is, to date, the smallest cyclocopter to have ever flown.

The University of Maryland Cyclocopter team, which includes Moble Benedict, Elena Shrestha, Vikram Hrishikeshavan, and Inderjit Chopra, has successfully developed an innovative micro air vehicle (MAV) concept based on a cycloidal rotor system. Cycloidal rotor is a revolutionary VTOL (vertical take-off and landing) concept that was popular during the early 20th century, and many researchers claim is more efficient than conventional helicopter rotors. A cycloidal rotor (or cyclorotor) is different from a conventional helicopter rotor because it has a horizontal axis of rotation with the blades aligned parallel to the rotational axis (see Figure 1). The development of such an unconventional MAV concept is the result of the growing need for efficient VTOL MAVs capable of rapid deployment, real-time data

acquisition, low radar cross section and low production costs for both civilian and military applications.

Current research at the University of Maryland on micro-scale (about 6 inches) cyclorotors has shown that, if properly optimized, a cyclorotor can achieve higher aerodynamic efficiency than a conventional helicopter rotor. The operating principle of a cyclorotor is shown in Figure 2. The unique capability of the cyclorotor to instantaneously change the direction of the thrust vector to any direction perpendicular to the rotational axis can dramatically improve the maneuverability and gust tolerance of a cyclocopter.

Ever since the inception of this concept in the early 20th century, numerous attempts have been made to build a flying cyclocopter. However, all these attempts remained unsuccessful primarily due to the lack of fundamental understanding of this concept and the inability to build light-weight, flight-worthy cyclorotors. The main focus of current research was to perform detailed experimental studies to understand the aerodynamics/aeroelasticity of cyclorotors and utilize this understanding along with innovative design and fabrication techniques to build light-weight cyclorotors with high thrust-to-weight ratios.

With the development of each cyclocopter, both the blade and rotor design have been systematically improved to reduce weight and increase performance. The most recently developed cyclocopter uses an innovative composite blade design with a foam core wrapped in carbon fiber skin along with a carbon spar to provide the required bending and torsional stiffness. Currently, each blade weighs only 15 grams (70 percent lighter than the initial blade design) and has a very high stiffness-to-weight ratio.

The current vehicle design has evolved to a hybrid twin cyclorotor and horizontal tail rotor configuration (Figure 3). The tail rotor counteracts the large pitch-up reaction

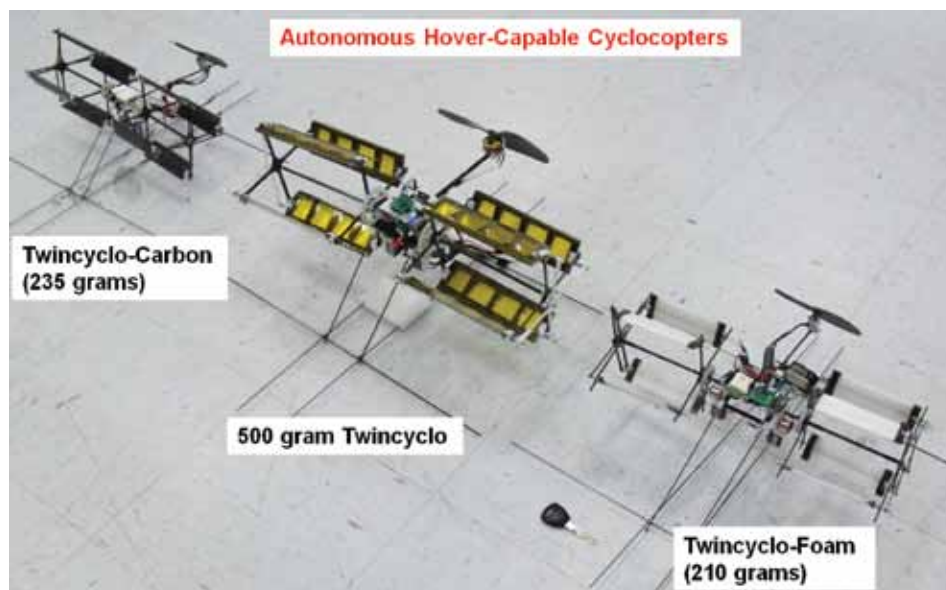


Fig. 3 Flight-capable cyclocopters.



Fig. 4 Autonomous hover of 235 gram twin-cyclocopter.



Fig. 5 Autonomous hover of 500 gram twin-cyclocopter.

moment produced by the cyclorotors since they rotate in the same direction. The present vehicle configuration is capable of both hover and forward flight. Attitude control is achieved through a combination of independent speed control of all the three rotors and thrust vectoring of the two cyclorotors. In this configuration, the tail rotor is used to control the pitch by varying its rotational speed. Roll is directly controlled by differential rotational speed variation of the cyclorotors, and yaw is controlled by differentially tilting the two thrust vectors of the cyclorotors. With the present control strategy, pitch, roll and yaw moments are completely decou-

pled other than through gyroscopic effects.

Because of the fast vehicle dynamics, due largely to its small scale, the cyclocopter could not be stabilized without implementing an onboard closed-loop feedback control system. The avionics system on the vehicle includes a 15-gram processor-sensor board called GINA MOTE, which is integrated with both gyros and accelerometers. The gyros measure the pitch, roll and yaw attitude rates while the accelerometers record the tilt of the gravity vector. The GINA MOTE effectively stabilized the cyclocopter for stable flight and also enabled autonomous hover capability (Figures 4 and 5). ■

Cyclocopter Researchers Gain Recognition

MOBLE BENEDICT was awarded the 2012 Hal Andrews Young Engineer/Scientist of the Year Award. A premier award of the national Capital Section of the AIAA, the Hal Andrews Award is presented annually to a local AIAA member under 35 years old in recognition of a single significant professional accomplishment. Inderjit Chopra submitted a winning nomination on behalf of Benedict. Both were recognized at the AIAA-NCS Honors and Awards Banquet in June. Benedict was recognized for his leading-edge pioneering research in the analysis-based design, fabrication and first successful flight of a direct lift aircraft employing a cycloidal rotor: *the Cyclocopter Micro-Air Vehicle*.



Moble Benedict

ELENA SHRESTHA captured first place in the undergraduate category at the AIAA Region I Mid-Atlantic Student Conference in April for her presentation: "Autonomous Hover Capability of a Cycloidal Rotor Micro Air Vehicle." Her advisors were Moble Benedict and Inderjit Chopra. She used her cyclocopter research when she competed at the Region I Aerospace Sciences meeting in January. ■



Elena Shrestha

For more information on Dr. Benedict's research and cyclocopter flight videos, visit www.terpconnect.umd.edu/~moble/, www.youtube.com/watch?v=mwgcG9suTl, and www.youtube.com/watch?v=sF8TV2PVWII.



Anderson Scholarship Encourages Undergraduate Aerospace Research



JOHN D. ANDERSON

Aerospace Engineering Professor Emeritus John D. Anderson, a former chair of the department, is recognized worldwide for his contributions to the field and to the university. Although Anderson retired from the university in 1999, his ties remain strong through the John Anderson Research Scholarship in Aerospace Engineering, which he established to assist and encourage aerospace undergraduate students to discuss research, exchange knowledge and generate interest in the field.

Anderson graduated from the University of Florida with High Honors and a Bachelor of Aeronautical Engineering Degree in 1959 and from The Ohio State University with a Ph.D. in aeronautical and astronautical engineering in 1966. He served as a lieutenant and task scientist at Wright Field in Dayton from 1959 to 1962, as chief of the Hypersonics Group at the Naval Ordnance Laboratory in White Oak, Md., from 1966 to 1973 and became chairman of the Department of Aerospace Engineering in 1973.

He subsequently served as professor of aerospace engineering and was designated a Distinguished Scholar/Teacher in 1982. In addition, in 1993 he was made a full faculty member of the Committee for the History and Philosophy of Science, and in 1996 an affiliate member of the History Department at the University of Maryland. In 1996 he became the Glenn L. Martin Distinguished Professor in Aerospace Engineering. He retired from the university in 1999 and was appointed professor emeritus. Anderson currently serves as the curator for aerodynamics at the National Air and Space Museum, Smithsonian Institution. He continues to teach undergraduate and graduate level courses, and give lectures, seminars and short courses at institutions worldwide.

Anderson has published 10 books, some in multiple editions in the areas of aerodynamics, computational fluid dynamics, airplane performance, hypersonics, high-temperature gas dynamics, the history of aerodynamics and the history of aeronautical engineering. He is the author of more than 120 papers in radiative gas dynamics, re-entry aerothermodynamics, gas dynamic and chemical lasers, computational fluid dynamics, applied aerodynamics, hypersonic flow and the history of aeronautics. An honorary fellow of the American Institute of Aeronautics and Astronautics (AIAA) and a fellow of the Royal Aeronautical Society, he was selected to receive the 2012 AIAA Hypersonic Systems and Technologies Award. The award recognizes sustained, outstanding contributions and achievements in the

advancement of atmospheric, hypersonic flight and related technologies. Anderson was recognized for his lifelong achievement in the advancement of scientific knowledge in hypersonic gas dynamics and its application to hypersonic flight through seminal research, teaching and publication.

Leah Krombach Wins 2012 Award



LEAH KROMBACH

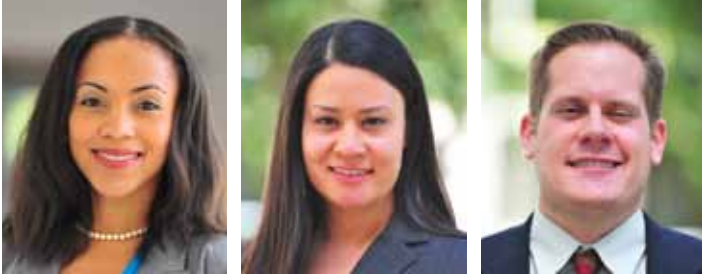
Aerospace senior Leah Krombach was awarded the John Anderson Research Scholarship for 2012. Her scholarly paper highlighted the importance of her research project on the "Design of 3D Helmet-mounted Heads-up Display for Space Exploration." Krombach cited the need to better equip astronauts with improved technologies to enhance responsiveness and efficiency during extravehicular activities. By creating an integrative 3D visual interface projected onto an astronaut's visor,

Krombach hopes to spur innovation in integrative visor display technology. Impressed by her scholarly paper and research, the Anderson Scholarship Committee awarded her the \$3,000 prize and plaque.

To apply for the scholarship, the Anderson Scholarship Committee requires students to submit a scholarly paper and give a poster presentation on research performed at the university. The committee then awards the scholarship, based on the caliber of research and its impact on the profession, to help students continue their research during the summer after their junior year.

Support the Anderson Research Scholarship

The Anderson Research Scholarship encourages motivated, innovative and bright students to pursue research, and it helps fund their efforts. To continue promoting student success and on-campus research opportunities, the department seeks to expand its support of the best and brightest students through opportunities such as the Anderson Research Scholarship. If you are interested in making a contribution to the Anderson Research Scholarship fund and/or the Department of Aerospace Engineering, contact the department directly at www.aero.umd.edu or visit <http://advancement.umd.edu/giving>. With your support, the department can continue to provide education, research and public service at the standard of excellence that helps define the Department of Aerospace Engineering as one of the top programs in the world. ■



From left, Erika Aparakakankanange, Aileen Hentz, Tom Hurst

Department Realigns to Better Serve Students

The Department of Aerospace Engineering has separated student services into two distinct areas to more effectively serve undergraduate and graduate students. **ERIKA APARAKAKANKANANGE**, the former assistant director of student services, has transitioned into the role of assistant director of graduate studies, working closely with Professor Sung Lee, the director of graduate studies. In her new role, Aparakakankanange continues to be an essential point of contact for current and prospective graduate students. In addition to providing more extracurricular activities for graduate students, she has been working on improving the department's public relations, outreach and recruitment.

AILEEN HENTZ is the new assistant director of undergraduate studies, working closely with Professor Robert Sanner, the director of undergraduate studies. Hentz assists with recruitment, orientation, advising, academic support and curriculum management for undergraduate students.

Program Management Specialist **TOM HURST** provides support for both the undergraduate and graduate programs. In his new role, Hurst continues to provide administrative support to graduate and undergraduate students while assisting with travel reservations and reimbursements and updating the department website and Facebook page. ■

Clark School Honors Debora Chandler

At the 2012 A. James Clark School of Engineering Annual Staff Appreciation Reception and Service Award presentation, **DEBORA CHANDLER** was recognized for 35 years of service to the state. As the coordinator of payroll and business services for the Department of Aerospace Engineering, Chandler is one of the first department staff members any new faculty or staff member meets. A member of the university community since 1991, she joined the Glenn L. Martin Wind Tunnel in 1998 and transferred to the Department of Aerospace Engineering in 1999. In her current position, she processes payroll for faculty, staff, graduate assistants and student workers. In addition, Chandler oversees and approves the processing and receipt of goods and services, credit card logs and reconciliations.



Debora Chandler

The proud mother of three: Danielle, Rashard, and Gregory; and the proud grandmother of three: Rakira, Antonio, and Gabrielle, Chandler is a true family person and loves family gatherings. Her youngest child, Gregory, began his second year at Norfolk State University, and Chandler and her family enjoy watching him perform in the Spartan Legion Marching Band.

The Department of Aerospace Engineering team congratulates Debora Chandler on 35 years of service and outstanding contributions to the department. She is a valued member of the team. ■

Rotorcraft Center Designated Center of Excellence



PHOTO BY ADRIAN HOOD.

The Alfred Gessow Rotorcraft Center (AGRC) was officially designated as a Vertical Lift Rotorcraft Center of Excellence (VLRCOE) by the Vertical Flight Foundation in 2012. Several aerospace faculty members contributed to the winning proposal. The AGRC was awarded funding for approximately half of the proposed program (12 out of 23), while Penn State and Georgia Tech also received similar funding for their proposed

tasks. Aerospace faculty members Anya Jones, Sean Humbert and Derek Paley received approval from their rotorcraft peers to fund a task through the AGRC, which is now embarking on a partnership with the U.S. Naval Academy, Wyoming University, Texas-Austin and North Carolina A&T through its VLRCOE designation. ■

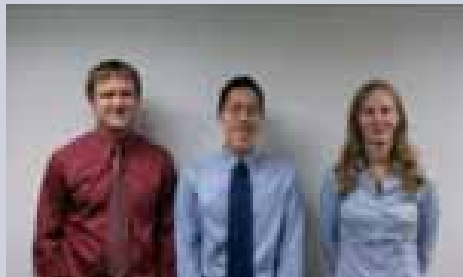
Department Named Affiliate Member of National Aeronautic Association

The Department of Aerospace Engineering has become the first university academic department certified as an affiliate member of the National Aeronautic Association (NAA). Affiliate members represent a special collection of aviation businesses and organizations that have an interest in many critical aviation issues, including aircraft manufacturers' liability, airline operations and aviation historical preservation. NAA's members help support the association in its role as a leader in the aerospace community, and affiliate members broaden participation in the shared forum. ■



A Banner Year for Aerospace Students

Students Receive NSF Graduate Research Fellowships



From left: Sean Symon, Harrison Chau and Robin Klomporens

HARRISON CHAU, B.S. '12, **ROBIN KLOMPARENS**, B.S. '12, and **SEAN SYMON**, B.S. '12 have been awarded NSF Graduate Research Fellowships, which recognize and support outstanding graduate students in NSF-supported science, technology, engineering and mathematics disciplines who are pursuing research-based master's and doctoral degrees at accredited U.S. institutions. As the oldest graduate fellowship of its kind, the program has a long history of selecting recipients who achieve high levels of success in their future academic and professional careers. Fellows benefit from a three-year annual stipend of \$30,000 along with a cost-of-education allowance for tuition and fees of \$10,500, opportunities for international research and professional development, and the freedom to conduct their own research at the accredited U.S. institution of graduate education of their choice.

Dean's Research Award Winners

Aerospace graduate students **ERICA HOCKING**, M.S. '12, and **MONICA SYAL**, Ph.D. '12,



Monica Syal

placed second and third in the 2012 Dean's Research Award Competition. Dean Darryll Pines created both the Dean's Doctoral and Master's Student Research Award Competitions to give

top Clark School graduate student researchers special recognition to help launch their careers

and to demonstrate the importance of high-quality engineering research.

Syal received \$500 for her research on the computational modeling of the dual-phase rotorcraft brownout problem, and Hocking received \$1,000 for her research to develop and characterize small-scale actuators based on pneumatic artificial muscle technology.



Erica Hocking

Aero Students Awarded NASA Aeronautics Scholarships



Cory Frontin

Three Clark School Department of Aerospace Engineering undergraduate students received NASA Aeronautics Scholarships for the 2012-2013 academic year—the highest

number of scholarships granted to any school in the nation. The three rising juniors,

CORY FRONTIN (DeMatha Catholic High School, Md.), **CODY KARCHER** (Grove City Area High School, Penn.) and **NELSON YANES** (Northwestern High School, Md.), each

received a two-year, \$15,000 per year scholarship and a \$10,000 stipend for a summer internship with NASA.



Nelson Yanes



Cody Karcher

Scholarship recipients intern with NASA researchers and work on developing technologies for managing air traffic more efficiently; reducing aircraft noise, fuel

consumption and emissions; and improving safety. The program attracts hundreds of applicants each year, and only 20 undergraduate awards were granted nationwide.

L-3 Scholarship/Fellowship Winners Announced

Clark School Corporate Partner L-3 Communications has selected a number of graduate fellowship and undergraduate scholarship recipients for the last two academic years. The awards are part of a \$1 million gift to the Clark School by L-3 Communications.



L-3 Graduate Research Fellowships annually support five Ph.D. candidates in their last three years of a doctoral program who conduct research at either the Institute for Systems Research, the Maryland Robotics Center, the UM Energy Research Center, the Unmanned Autonomous Vehicles Laboratory, the UM Rotorcraft Center, the Center for Advanced Life Cycle Engineering or research in cybersecurity.

The L-3 Graduate Fellows from aerospace are:

- **RYAN ROBINSON**
- **GREGORY GREMILLION**
- **DAVID MAYO**

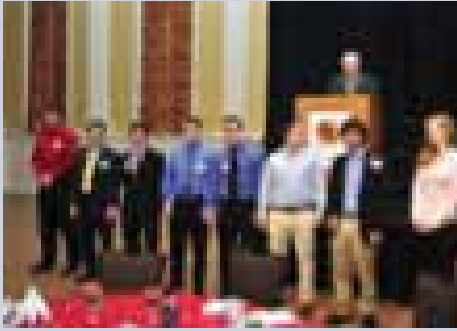
The company seeks to increase awareness among Clark School students and encourage future recruitment. The 2011-2012 L-3 Undergraduate Scholars were:

- **ELENA SHRESTHA**
- **LAURA MILES**
- **MATTHEW RICH**

The L-3 Corporate Partner Scholars are:

- **HARRISON CHAU**
- **LI PENG LIANG**

2012 Honors and Awards Ceremony



Honors and Awards Ceremony honorees.

The 2012 A. James Clark School of Engineering Honors and Awards Ceremony recognized students from all majors for their academic and service accomplishments. The Department of Aerospace Engineering Gessow Academic Achievement Awards were presented to graduating seniors in the department who attained the highest overall academic average.

- **ROBIN KLOMPARENS**
(Elaine Gessow Award)
- **MATTHEW STOECKLE**
(Alfred Gessow Award)

The Robert M. Rivello Scholarship Award and the Joseph Guthrie Memorial Scholarships were presented to those juniors in the department who attained the highest overall academic average.

- **JOHNATHAN PINO** (Rivello)
- **JASON BURR** (Guthrie)
- **MICHAEL HAMILTON** (Guthrie)
- **MATTHEW RICH** (Guthrie)
- **JOSHUA SLOANE** (Guthrie)

The American Institute of Aeronautics and Astronautics (AIAA) Outstanding Achievement Award was presented to the student who made the most outstanding contribution through scholarship and service to the student branch and the department.

- **MICHAEL WILLIAMS**

Vitucci and Knittel Receive NASA Honors



John Vitucci

the nation with a pipeline of highly skilled engineers and technologists to improve U.S. competitiveness. Fellows benefit from a \$36,000 stipend for doctoral students and \$30,000 for master's students in addition to \$30,000 to offset the costs of tuition and other fees.

Fellows also gain on-site NASA center/research and development lab experience.

Vitucci is advised by Raymond Sedwick in the Space Power and Propulsion Lab. His

research project is titled "Development of a Superconducting Helicon Thruster." In the upcoming academic year, he will continue his position as graduate student liaison for the University of Maryland Chapter of AIAA. Knittel is advised by Mark Lewis in the Hypersonics Lab. His research project is titled "Optimal Aerodynamic Forms for High-Lift, Low-Drag Planetary Entry." He is also the department's Graduate Student Government representative.

JOHN VITUCCI and **JEREMY KNITTEL** were among the seven Clark School inductees in NASA's inaugural class of Space Technology Research Fellowships. The program's

goal is to provide



Jeremy Knittel

Rich Named 2012 Philip Merrill Presidential Scholar



MATTHEW RICH was named a 2012 Philip Merrill Presidential Scholar, a program that honors the university's most successful seniors and their faculty advisors and K-12 teachers for their mentorship. Rich is an aerospace engineering honors and university honors student in the astronautics track. He works for Inderjit Chopra in the Alfred Gessow Rotorcraft Center on flapping wing research and has completed internships at the Johns Hopkins University Applied Physics Laboratory. He also has volunteered as a mentor for America Counts.

Marcus Recognized for Achievements as ETE Scholar



Matthew Marcus

Aerospace engineering major **MATTHEW MARCUS**, B.S. '13, was the 2011 recipient of the Shirley C. Sorensen Academic Excellence Award from the University of Maryland Phi

Kappa Phi Foundation. An alumnus of the Environment, Technology and Economy (ETE) program, Marcus received the annual \$1,000 scholarship that honors the long-time executive secretary of Phi Kappa Phi Chapter 22 and mathematics department faculty member Shirley C. Sorensen. Marcus, who earned his College Park Scholars citation last spring, was selected for the award based on his exemplary service record and academic achievements

Waters and Vocke Win SMART Scholarships



Dan Waters

Aerospace doctoral students **DAN WATERS**, M.S. '11, and **ROBERT VOCKE III**, B.S. '08, M.S. '12, recently received the Science, Mathematics And Research for Transformation (SMART) Scholarship.

Originally from Massachusetts, Waters received his B.S. in aerospace engineering from Boston University. He has been a graduate research assistant in the department under the guidance of Christopher Cadou since 2008. Waters' research is focused on modeling fuel-cell hybrid systems for aircraft applications, which involve integrating fuel-cell systems into gas turbine and internal combustion engine cycles to produce electrical power at much higher efficiencies than conventional generators.

Vocke is a fourth-year graduate student in the aerospace department's Smart Structures and Composite Research Laboratories and is working toward a Ph.D. with a concentration in structural mechanics and composites and rotorcraft. His research is focused on the application of smart materials and actuators to morphing aircraft. Following graduation, he will work with the Army Aeroflight Dynamics Directorate's (AFDD) Aviation Advance Design Office located at NASA Ames in Mountain View, Calif.



Robert Vocke III

A New Look at Sigma Gamma Tau



The university's chapter of **SIGMA GAMMA TAU** (SGT) was re-introduced to the community during the 2011-2012 academic year thanks, in large part, to the efforts of current aerospace engineering students **KIP HART**,

B.S. '13 and **MATTHEW MARCUS**, B.S. '13, and SGT faculty adviser **CHRISTOPHER CADOU**.

Through their efforts and the dedication of the entire SGT executive board, the organization expanded its membership and organized service-related events to benefit the aerospace engineering community. The 2012-2013 executive board includes: President **KENNETH 'KIP' HART**; Vice President **LEAH KROMBACH**; Secretary **REBECCA FOUST**; Treasurer **JASON BURR**; Initiation Officer **JEREMY GARBER**; Public Affairs Officer **SCOTT WINGATE**; and Service Officer **MICHAEL CUNNINGHAM**.

Founded in 1953, SGT is the national aerospace engineering honor society that seeks to identify and recognize individual achievement through scholarship, service and integrity in the field of aeronautics and astronautics. Each semester, the top third of the senior class, top quarter of the junior class, and top fifth of the sophomore class in aerospace engineering are invited to join the chapter. The organization's primary focus is on community service, particularly service that fosters excellence in aerospace engineering.

University Hosts AIAA Student Conference



The University of Maryland chapter of the **AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS** (AIAA) hosted the Region 1 Mid-Atlantic Student Conference in spring 2012. Dozens of top students from

the region visited and presented research. In addition to hosting the 2012 student conference, the AIAA student chapter continues to operate as one of the most active branches on the east coast. Students can get involved by visiting www.eng.umd.edu/AIAA or attending one of the upcoming events listed on the home page.

Aerospace Engineering Wins Alumni Cup



Members of the aerospace engineering team with their device.

The Department of Aerospace Engineering won the first-ever **CLARK SCHOOL ALUMNI CUP** that pitted departmental teams of Clark School graduates against each other to create a Rube Goldberg-inspired device that inflated and popped a balloon. The competition, held as part of National Engineers Week 2012, required each team to incorporate some aspect of its discipline in its device. Aerospace engineering's contraption included a flying space monkey, a make-shift wind tunnel, and textbooks by Professor Emeritus John Anderson. The aerospace engineering team, led by **MATTHEW WESTERFIELD** included **GRANT BARRETT**, **KENNETH HART**, **ANDREW KEHLENBECK**, **PATRICK NOLAN**, **THOMAS NOYES**, **SIDDARTH KOLLURU VENKATA**, and **SAMANTHA WALTERS**. ■



Design team members (left to right): Nitin Sydney, Anish Sydney, Will Staruk, Mathieu Amiraux, Joseph Schmaus, Jonathan Elliott. Not pictured: Conor Stahlhut. The students were advised by faculty members Inderjit Chopra, V. T. Nagaraj and J. Gordon Leishman.

Clark School Team Captures Top Honors in AHS/Industry Student Design Competition

Clark School aerospace engineering graduate students have won the American Helicopter Society (AHS) Student Design Competition for the 11th time in 14 competitions with Dart T690/E550, a lift and thrust compounded vertical take-off and landing aircraft.

The AHS Student Design Competition challenges students to design a vertical lift aircraft that meets specified requirements, provides a practical exercise for engineering students at accredited colleges and universities worldwide and promotes student interest in vertical flight technology. Each of the first- and second-place winning teams receives a cash stipend and two members of the first-place team are invited to present proposal details at the AHS Annual Forum and Technology Display. This year, the AHS and sponsor Sikorsky Aircraft challenged students to design a purpose built rotorcraft to complete a prescribed pylon race course (similar to the Red Bull and Reno Air Races). Located on the Hudson River between New York City and New Jersey, the race course required the rotorcraft to perform complex maneuvers such as “hammer-head”

turns and slaloms as well as high-speed straightaways, sideward flight and hover. Each competing team was required to submit a thorough design report describing their aircraft as well as an X-Plane simulation showing the aircraft completing the course.

The Dart T690

To meet these requirements, the Clark School team designed the Dart T690 and Dart E550, turbine and electric versions of a dual-propeller compound rotorcraft. This configuration provided a good balance between the competing design requirements of high-speed forward flight, extreme load-bearing capability, agility and maneuverability. Each feature of the rotorcraft, from the landing gear to the rotor, was optimized to complete the course and exceed all prescribed requirements. The Dart also incorporates cutting-edge technologies, such as a hybrid fuel-cell/battery-powered engine, fly-by-wire control, and a hingeless rotor system to achieve a truly innovative design. The Dart T690 completed the course in 183 seconds, demonstrating superior maneuverability, agility, dash capability and speed. The Clark School entry truly hit the bull's eye in rotorcraft pylon air racing.

Bell Helicopter Textron Inc. sponsored the 28th annual competition, which rotates among Augusta Westland, Bell Helicopter Textron, The Boeing Company, Sikorsky Aircraft Corp. and Eurocopter. ■



Morphing Technology Takes Off

The September-October 2011 issue of *Composites Manufacturing* magazine featured the Clark School Composites Research Laboratory and its work on morphing aircraft skin technology currently under development. Robert Vocke III, a graduate student in Department Chair Norman Wereley's research group, is developing elastomeric matrix composites (EMCs) that are capable of large-area changes, even doubling their skin area during aircraft wing morphing. For more information, see the September-October 2011 issue, page 21, at www.cmmagazineonline.org. ■

Bernard Promoted to Sikorsky's Director of Analytics and Technology



ANDREAS BERNHARD

Andreas Bernhard, M.S. '95, Ph.D. '00, has been named director of analytics and technology for Sikorsky Aerospace Services. Bernhard will continue to serve as chief engineer for Sikorsky Aerospace Services in addition to his new role. As chief engineer, he is the technical lead for Sikorsky's aftermarket and out-of-production aircraft, including strategic engineering leadership of aftermarket activities for U.S. military, international military and commercial customers. In his expanded role, Bernhard will

oversee the analytics and technology business unit, which includes training, maintenance planning, technical publications, fleet support technologies, fleet management and analytics. ■

Aerospace Students Shine at YPSE Conference

More than 15 undergraduate and graduate aerospace engineering students were among the 65 students presenting their research at the 11th Young Professional, Student and Education Conference at the Johns Hopkins University Applied Physics Laboratory. Participating universities, in addition to the University of Maryland, included: Old Dominion University, The Pennsylvania State University, University of Virginia, New Jersey Institute of Technology, Johns Hopkins University, New Mexico State University and George Washington University. ■

GRADUATE FIRST PLACE - BYUNGSEOK YOO

- Guided Lamb Wave Based Spiral Phased Array for Damage Detection of Thin Composite Panels
(Advisor: Clark School Dean Darryll Pines)

HONORABLE MENTION - PAULINE PARENT

- TWSM Training of NiTiNOL Via Thermo-Mechanical Cyclic Loading of a Plate Subject to a Constant Bending Moment
(Advisor: Allison Flatau)

UNDERGRADUATE THIRD PLACE - SEAN SYMON

- Percolation Transition of Fe Spherical Microparticle Magneto-rheological Elastomers
(Advisor: Norman Wereley)

HONORABLE MENTION - ELENA SHRESTHA

- Development of a Hover Capable MAV Scale Cyclocopter
(Advisor: Inderjit Chopra)

Kip Hart Brings Heart to Academics and Community Service

Student-created Nonprofit Helps South African Youth

Kip Hart, B.S. '13, aerospace engineering, puts his whole heart into just about everything he does. From academics to founding a highly successful nonprofit organization, Hart aggressively pursues his passion. "I've learned that however out-of-the-box a passion might be, you should pursue it and be fearless in sharing that passion with other people," attests Hart.

His boundless passion for learning and helping others speaks for itself. An alumnus of the College Park Scholars Program, Hart is also a member of the engineering honor society Tau Beta Pi, a member of the Department of Aerospace Engineering Honors program, and the incoming president of the university's chapter of the national aerospace honor society Sigma Gamma Tau. He has completed internships at the Space Telescope Science Institute, where he modeled two variable shadows inside the Hubble Space Telescope to mitigate their effects on data quality for both of the spectrographs on board the telescope. He currently works with Department Chair Norman Wereley in the university's Composites Research Laboratory, exploring methods of applying pneumatic artificial muscles to airfoils.

Throughout his Clark School career, Hart has balanced multiple leadership roles with his coursework. In addition to building an impressive academic resume, Hart is passionate about his community service activities. In 2007, he and his younger brother founded a nonprofit called the South African Lacrosse Project (SALP). The initial mission of this organization was to help children in Waterberg, a region of South Africa with one of the highest rates of HIV transmission, develop life skills by learning and playing lacrosse. The Hart brothers worked hard to gain sponsorship and volunteer support and have organized an annual lacrosse camp in Waterberg that roughly doubles in size each year.

Hart is most proud of SALP's growing literacy program, which he added to the

project's mission once he discovered that most area children could not afford public school, and those who could were entering high school at a third-grade reading level. The SALP has supported scores of children through high school, sponsored three students through college including a tourism degree recipient who will work at a nearby game lodge, and arranged for an after-school tutor to teach English and math to 150 students each week. With support for SALP spanning the entire United States, the organization can now provide more lacrosse equipment, scholarships and volunteers to support the children both educationally and athletically.

The SALP has taught Hart valuable leadership and communication skills that often are lost in a highly technical education. As part of SALP, he values the opportunity to work as part of an interdisciplinary team, to engage volunteers in meaningful projects, and to initiate and delegate responsibilities. "I've learned some powerful life lessons working on the lacrosse project," he admits. "My brother and I did not initially set out to create a nationwide, registered non-profit organization. We just wanted to share the joy of lacrosse with children affected everyday by poverty and HIV."

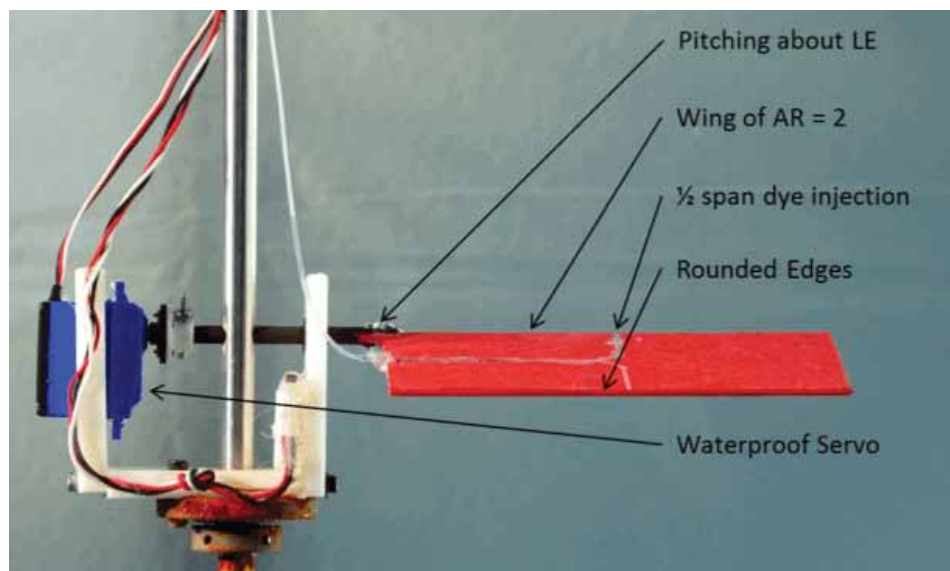
He notes that through a series of monetary and in-kind donations, "we were able to continue our lacrosse camps annually and, by sharing our passion and our story with others, this grassroots basement operation has become the success it is today."

Through his involvement in SALP as well as his dedication to academic studies and co-curricular activities, Hart has clearly been pursuing and sharing his passions with others. He acknowledges, "I do not expect to get it all right in college, but someday I would like to become a leader in the aerospace research and development industry." Undoubtedly, he is well on his way. ■



Kip Hart's efforts are supporting the education of young students in Waterberg, South Africa.

Faculty Win DURIP Instrumentation Awards



Models used in Jones's (left) and Sedwick's research (below).

member of a NATO Research Technology Organization task group on unsteady aerodynamics and a member of the AIAA Low Reynolds Number Discussion Group, the Maryland Robotics Center, and the board of the Washington, D.C. branch of the Royal Aeronautical Society.

Jones received the 2011 NATO Research and Technology Organization's (RTO) Scientific Achievement Award for her revolutionary work in unsteady flows of micro air vehicles, including significant contributions to the mission of the RTO task group, whose members represent nine nations. Jones also has received an Air Force Office of Scientific Research (AFOSR) Young Investigator Award for her proposal "Lift Production on Flapping and Rotary Wings at Low Reynolds Numbers." The objective of the AFOSR Young Investigator Program is to foster creative basic research in science and engineering, enhance early career development of outstanding young investigators and increase opportunities for the young investigators to recognize the Air Force mission and related challenges in science and engineering.

To learn more about her innovative research, visit the Jones Aerodynamics Laboratory at <http://joneslab.umd.edu/index.html>.

Continued on next page

Two Aerospace Engineering faculty members have received Defense University Research Instrumentation Program (DURIP) funding to support the purchase of research instrumentation: Assistant Professor Anya Jones for "Equipment for the Study of Micro Air Vehicle Gust Response" and Associate Professor Raymond Sedwick for "Development of a Dusty Plasma Bombardment Source using Laser Ablation." DURIP, administered through the U.S. Air Force Office of Scientific Research, the Army Research Office and the Office of Naval Research, funds the procurement of major equipment to enhance research capabilities in technical areas of interest to the U.S. Department of Defense.

and unsteady flight environments affect the aerodynamics of small-scale vehicles. This equipment also will be used for experiments to characterize control response and vehicle handling in unsteady flight environments.

Jones joined the aerospace engineering faculty in 2010. She earned her Ph.D. in experimental aerodynamics from the University of Cambridge, her S.M. in aeronautics and astronautics from the Massachusetts Institute of Technology and a dual B.S. in aeronautical and mechanical engineering from Rensselaer Polytechnic Institute. Jones also has worked with Lockheed-Martin, Boeing, NASA, the U.S. Army and the U.S. Navy. In addition to running her lab, she is a technical team

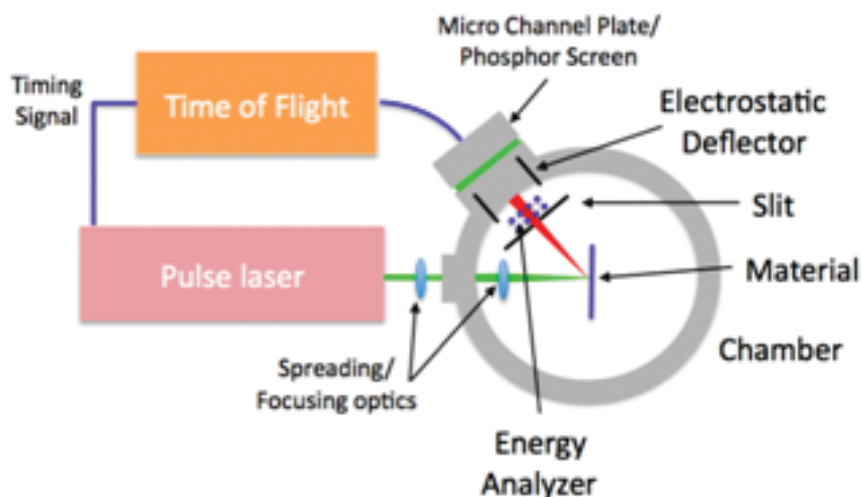
Improving Flight in Unsteady Environments



Anya Jones

Jones's DURIP award will help fund a gust-enabled towing tank, instrumentation and control system that will allow a low-Reynolds number model, such as a bird, insect or micro air vehicle,

to "fly" through a field of well-characterized gusts underwater. The goal of the research is to understand how atmospheric wind gusts



Studying the Impact of Space Debris



Raymond Sedwick

Sedwick recently won a DURIP award to help fund the procurement of a high-power pulsed laser system for the generation and study of dusty plasmas and their impact on material surfaces. The goal

of the research is to characterize the impact of small space debris on spacecraft in earth orbit. A secondary use of the hardware will be to test the effectiveness of laser ablation as propulsion for the removal of large space debris from orbit. ■

Wereley and Hubbard Promoted to AIAA Fellow

Professors James E. Hubbard Jr. and Norman M. Wereley have been promoted to the rank of fellow of the American Institute of Aeronautics and Astronautics (AIAA). Fellows have made notable and valuable contributions to the arts, sciences or technology of aeronautics or astronautics. Hubbard and Wereley were honored at a May 2012 AIAA Fellows Dinner and black-tie Aerospace Spotlight Awards Gala in Washington D.C. ■



James E. Hubbard Jr.



Norman M. Wereley

alumniNEWS



From left: Mr. Sean M. Bond, BS '89, Mr. Charles F. Brink, BS '84, Dr. Jeanette J. Epps, MS '94, Ph.D. '00 and Mr. John Miller, BS '69

New Members Join Academy of Distinguished Alumni

The Academy of Distinguished Alumni was established in 1999 to honor University of Maryland alumni who have made significant contributions to the field of aerospace engineering. The 2012 honorees include **SEAN BOND**, chief executive officer of ISS Facility Services, Inc.; **CHARLES BRINK**, Air Force Research Laboratory's X-51A Scramjet Engine Demonstrator program manager; **JEANETTE EPPS**, NASA astronaut and former technical intelligence officer for the Central Intelligence Agency; and **JOHN MILLER**, director of the U.S. Army Research Laboratory. At its induction ceremony, the Department of Aerospace Engineering inducted four graduates, as well as aviation pioneer Glenn L. Martin. This year's inductees join fellow Academy members:

WILLIAM BISSELL, B.S. '52
KEVIN BOWCUTT, B.S. '82, M.S. '84, PH.D. '86
GARY CURTIN, MAJOR GENERAL
 U.S. AIR FORCE (RETIRED), B.S. '65
MICHAEL DEITCHMAN, B.S. '73
MICHAEL GRIFFIN, PH.D. '77
BASTION "BUZ" HELLO, B.S. '48

NORRIS KRONE, JR., B.S. '55, PH.D. '74
BERNARD LOEB, B.S. '60
DAVID MATUSKA, B.S. '81, M.S. '83
MARK NIXON, B.S. '83, PH.D. '93
GEORGE ORTON, B.S. '64
MARK TISCHLER, B.S. '78, M.S. '79
MICHAEL TOROK, M.S. '86, PH.D. '89



CONGRATULATIONS TO THE GRADUATING CLASS OF 2012!

The department recognizes recent aerospace honors graduates:

ANDREI AREVALO
JUSTIN BRANNAN
HARRISON CHAU
MARISSA GOLFOND
MATTHEW GROSS
ANDREW KEHLENBECK
ROBIN KLOMPARENS
ELIZABETH LATO
LI PENG LIANG
JASON LU
AHMED ABDEL-SALAM MAHMOUD AHMED
ANGELA MAKI
ALEXANDER NELSON
GINO PERROTTA
THOMAS PILLSBURY
DANIEL SKEBERDIS
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Gifts may be made by check to "University of Maryland College Park Foundation (UMCPF)." Please designate "The Department of Aerospace Engineering" in the memo line, and mail to:

Dr. Norman M. Wereley, Chair
Department of Aerospace Engineering
3181 Martin Hall
University of Maryland
College Park, MD 20742

You can help make a difference with a gift of any amount!

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Your alumni news and comments are welcome. Please send them to:

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