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WILLIAM E. BOEING
DEPARTMENT OF AERONAUTICS & ASTRONAUTICS
UNIVERSITY *of* WASHINGTON

HIGH *f*LIGHT

FEATURED STORY:

PROFESSIONAL PURSUITS :: THE MAE

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AUTUMN 2014

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W

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NEW FACULTY 2013 - 2014:



MICHAEL B. BRAGG
Frank & Julie Jungers
Dean of Engineering

PhD, Aeronautical & Astronautical Engineering, The Ohio State University
M.S., Aeronautical and Astronautical Engineering, University of Illinois at Urbana-Champaign

B.S., Aeronautical and Astronautical Engineering, University of Illinois at Urbana-Champaign



ANSHU NARANG-SIDDARTH
Assistant Professor

PhD, Aerospace Engineering, Texas A&M University
MS, Aerospace Engineering, Indian Institute of Technology Madras
BS, Electrical & Electronics Engineering, Jawaharlal Nehru Technological University



JINKYU "JK" YANG
Assistant Professor

PhD, Aeronautics and Astronautics, Stanford University
MS, Aeronautics and Astronautics, Stanford University
BS, Aerospace Engineering, Korea Advanced Institute of Science and Technology

As you will see in the following pages in this issue of Highflight, this has again been an excellent year in A&A with many outstanding activities and accomplishments by our students, faculty and staff. Beyond this, as our department transitions to a new Department Chair I look back with pride on all of our accomplishments in A&A over the past four years. These include the naming of the department as the William E. Boeing Department of Aeronautics & Astronautics, significant growth in our academic programs, the hiring of outstanding new faculty members and staff in A&A, substantial new gift funding, and significant overall budget growth in our department. Key to all of these accomplishments has been the dedicated efforts of many individuals in A&A and in the College of Engineering.

PROF. HERMANSON



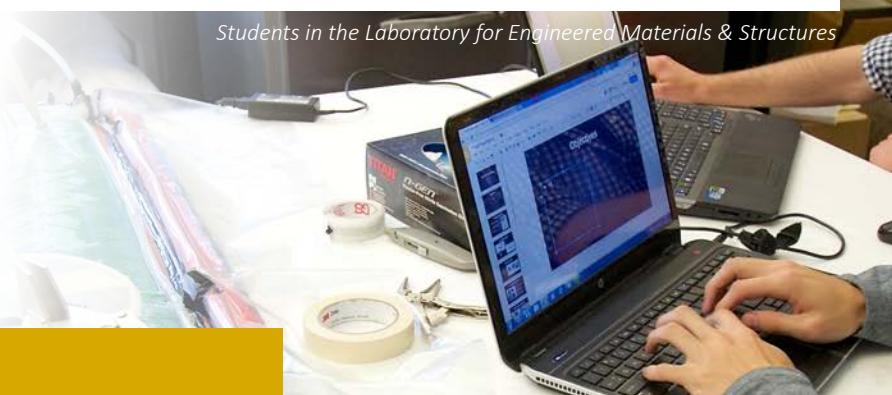
Transitions are both exciting and challenging times. I am pleased that we will have such strong continuity of leadership from two outstanding academicians, researchers and colleagues, first Professor Uri Shumlak as Interim Department Chair, then Professor Tony Waas as permanent Department Chair in January, 2015. The ongoing challenge will be to continue to build on our many strengths and accomplishments as we move our department forward to even greater heights of research excellence, impact in the aerospace engineering community, and outstanding academic experiences for our diverse student population. In addition, we continue to be committed to being an accessible and responsive partner with government, industry, and other academic institutions in the areas of commercial aviation, unmanned systems, space propulsion and beyond.

I have been honored to have served the department and university as the Chair of the William E. Boeing Department of Aeronautics & Astronautics. I thank all of you for your support of A&A and trust you will join me in looking forward to the challenges and achievements of our outstanding department in the years ahead.

September 15th, 2014

JAMES C. HERMANSON

*2010 - 2014 Chair, William E. Boeing
Dept. of Aeronautics & Astronautics*



Students in the Laboratory for Engineered Materials & Structures



WILLIAM E. BOEING
DEPARTMENT OF AERONAUTICS & ASTRONAUTICS
UNIVERSITY of WASHINGTON

Highflight 2014

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Address corrections, questions, and comments may also be sent to the editor:

highflight@aa.washington.edu



YOU + W

Introducing the UW Aeronautics & Astronautics
INDUSTRY AFFILIATES PROGRAM ::

**SAVE THE DATE:
FRIDAY NOVEMBER 21, 2014**

ATTN: Gaia Borgias Brown
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A&A INCOMING CHAIR IS NAMED

Anthony M. Waas, University of Michigan's Felix Pawlowski Collegiate Professor of Aerospace Engineering and of Mechanical Engineering, has been named the new chair of the University of Washington's William E. Boeing Department of Aeronautics & Astronautics. His term will begin in early 2015. He will also hold the Boeing-Egtvedt Chair.

Waas brings research expertise in composite structures and lightweight materials as well as a long history of working with The Boeing Co., General Electric Co. and the automotive industry. He has had research programs with Boeing since 2004 and served as a consultant on a team that studied issues related to the 787 Dreamliner aircraft. Entire announcement at www.engr.washington.edu/news/aachair2015.html

ANTHONY WAAS**SHUMLAK APPOINTED TO SERVE AS INTERIM CHAIR**

Prof. Uri Shumlak has agreed to serve as interim chair of A&A through the end of 2014. Professor Shumlak's research areas are plasma physics, innovative magnetic plasma confinement for fusion energy, electric propulsion, and theoretical and computational plasma modeling. His work includes theoretical and experimental investigation of the stabilizing effect of sheared flows in magnetically confined plasmas. Professor Shumlak's leadership, scholarship, and impact are widely recognized on this campus and across the country and we are grateful that he has been willing to assume this role in service to the department and college.

URI SHUMLAK**PROF. LIN, DISTINGUISHED CONTRIBUTIONS TO LIFELONG LEARNING**

Professor Kuen-Yuan Lin received the Distinguished Contributions to Lifelong Learning Award during the 2014 Awards of Excellence ceremony at the University of Washington.

His current research topics include development of reliability-based damage tolerant structural design methodology, time-dependent fracture, as well as aging degradation of

polymeric composites at elevated temperatures. Most of his current research efforts have direct applications to the critical technologies needed in developing the next generation of aerospace vehicles.

Prof. Lin developed the "UWAA- Boeing Aircraft Composite Structural Analysis and Design (ACSAD)" Certificate Program in 2014 to support Boeing's 787 program. Since 2005, 331 Boeing engineers have completed the certificate program. The ACSAD certificate program has received two prestigious national awards, including 2007 CUX Excellence Award and 2011 ASEE Top Excellence Award. He has taught over 1,200 Boeing engineers about composite materials since 2004 and developed the A&A department's MAE-Composite Materials and Structures degree program with a grant from Boeing LTD. Prof. Lin also developed a UW MOOC course on Composites. As of today, over 3,500 students have enrolled for the AQ 2014 course.

Research **HIGHLIGHTS ::**

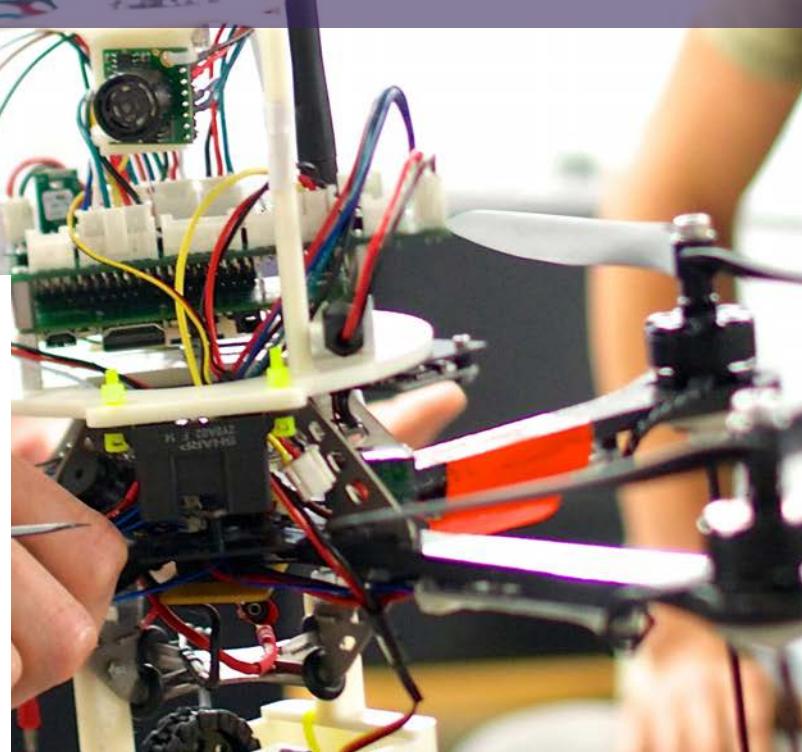
PROFESSOR URI SHUMLAK BBC World News-Horizons is featuring research being performed by Professor Shumlak and his research group. The show can be seen online and discusses his work with plasma fusion (the ZaP experiment) as well as the development by Zplasma of a stable discharge produced plasma (Stable DPP), the first and only technology that stabilizes the plasma used to generate EUV light. This will have a major impact on the semiconductor industry and beyond. Shumlak was named VP and president elect of the University Fusion Association and most recently, his Multidisciplinary University Research Initiative (MURI) proposal was selected for funding. The MURI project is being led by Prof. Mark Cappelli at Stanford University.

PROFESSOR TOM JARBOE has announced that a cost effective controlled fusion configuration called the spheromak has been efficiently sustained while stably confining high pressure fuel. The new sustainment method may lead to fusion power that is cost competitive with coal. Jarboe's work was recently featured in the journal *Nature*:

"Academic projects worthy of consideration include a radically simplified design for a fusion power reactor developed by Thomas Jarboe and his group at the University of Washington in Seattle: they believe that it could be built for about one-tenth the cost of a tokamak."

PROFESSOR JOHN SLOUGH Fusion Rocket Technology success: University of Washington researchers and scientists at a Redmond-based space-propulsion company (Helion Energy) are building components of a fusion-powered rocket aimed to clear many of the hurdles that block deep space travel, including long times in transit, exorbitant costs and health risks. The project is funded through NASA's Innovative Advanced Concepts Program. Sough was quoted in *Nature*:

"The big experiments have been funded for decades, so there's little chance they won't meet their milestones," says John Slough, a plasma physicist at the University of Washington. "If they start funding these alternatives, all the uncertainties come back... People are starting to think, 'Hey, maybe there are other ways of doing this!'"



PROFESSOR KRISTI MORGANSEN The Nonlinear Dynamics and Controls Lab is a member of the recently awarded AFOSR Center of Excellence on Nature Inspired Flight Technologies and Ideas led by Prof. Tom Daniel in the Department of Biology. This center is in partnership with Case Western Reserve University, the University of Maryland and Johns Hopkins University. The center brings together expertise in engineering, neuroscience, animal behavior and computational approaches to reveal principles of design and architecture in natural systems that will inspire the next generation of autonomous systems. These systems will be capable of flight in complex environments, carrying out a range of missions autonomously and safely. The center is partnered with a parallel effort in the UK.

The Nonlinear Dynamics and Control Lab is a member of the UW Institute for Neuroengineering (UWIN) recently funded by the Washington Research Foundation. The focus of UWIN is to develop the next generation of devices and algorithms that assist individuals with neural and mobility disorders. Inspired by neural systems, the intent is to develop interactive and autonomous devices that can be used for assistance within the home and for exploration in the remote regions of the planet and in space.

PROFESSOR BOB BREIDENTHAL Recent projects include a new method for magnetic-confinement fusion using a super-exponential magnetic field; the aerodynamic performance of an airfoil with stationary, streamwise vortices; a new theory for orographic rain and thunderstorms; a new model for the entrainment rate and growth law of the transverse plume (relevant to wildfires); and a model for the radiative flux of the honeycomb in the world's cleanest combustor (consulting work at ClearSign Combustion).

Research **HIGHLIGHTS ::**

PROFESSOR ANSHU NARANG-SIDDARTH has published a book on fundamental principles for flight control. The book, *Non-linear Time Scale Systems in Standard and Nonstandard Forms: Analysis and Control*, is published by the Society of Industrial and Applied Mathematicians (SIAM) and appears in the Advances in Design and Control Series. It features a foreword written by Professor M. Vidyasagar, a Fellow of The Royal Society and the Cecil & Ida Green Chair in Systems Biology Science at The University of Texas at Dallas.

PROFESSOR SETTYOU received a Department of Energy Early Career Research Program Award. The five year project is called "A Laboratory Astrophysical Jet to Study Canonical Flux Tubes" for a total of \$961k.

PROFESSOR JIM HERMANSON NASA has selected 10 university-led proposals for study of innovative, early stage space technologies that address high priority technical needs America's space program must master to enable future missions. Hermanson won a proposal from NASA to look at stability and heat transfer issues associated with cryogenic propellants. The work is being led by Michigan Tech (Jeff Allen is his collaborator there), with UW A&A (Hermanson's group), NIST, and NASA Glenn collaborators. The intended "mix" of study will be a cryogenic mixture of hydrogen and methane, with the experiments to be done at NIST.

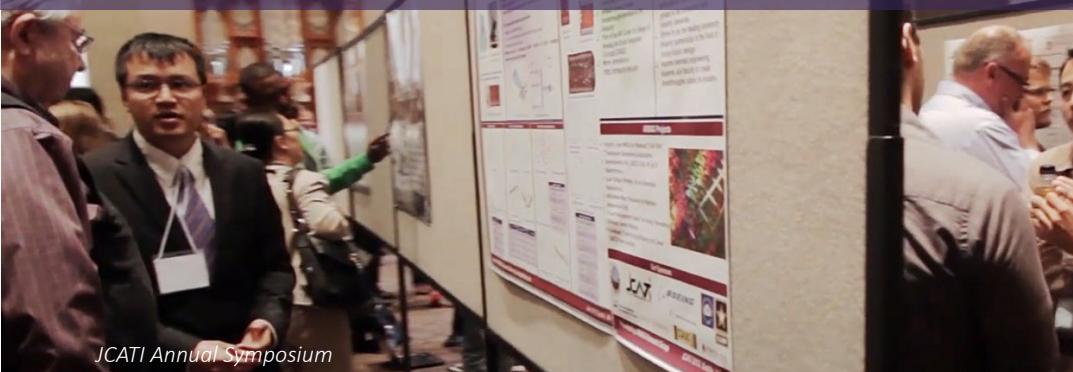
A&A (Prof. Hermanson) and Mechanical Engineering (Profs. Kramlich, Malte, and Mescher) are collaborating on research exploring the combustion characteristics of bio-derived "alternative" jet fuels. The experiments are examining flame blow-out tendency and NOx and soot emissions of the various biofuels as compared to conventional jet fuel. The effort is supported by several Washington-State companies, including Boeing, Imperium Renewables, E3 Energy Partners, and Mercurius Biofuels, in addition to Pacific Northwest National Lab (PNNL) and the US Air Force.

DR. CHRISTOPHER LUM The UW is competing to become an FAA Center of Excellence for Unmanned Aerial Systems (UAS). As part of a nine-school consortium, the UW hopes to win this Center of Excellence designation and perform research related to safe integration of Unmanned Aerial Systems into the National Airspace. The UW Autonomous Flight Systems Laboratory is in the process of creating a UAS research platform for use in civil applications such as biological/ecological monitoring, precision agriculture, etc.

THE A&A DEPARTMENT is involved in the new FAA Center of Excellence in Alternative Jet Fuels & Environment, led by Washington State University and MIT. The first funded research project in A&A as part of this new Center involves noise level reduction and is being conducted by Prof. Kuroseka and Dr. Bob Dougherty, who is an Affiliate faculty member in A&A. We expect to launch other projects in A&A under this center in the coming year. The department is also participating in a new AFOSR Center of Excellence on Nature Inspired Flight Technologies and Ideas led by the UW Department of Biology.

A&A continues to be involved in the Washington State "JCATI", the Joint Center for Aerospace Technology Innovation program. This program supports aerospace industry in our state by funding joint university-industry research collaborations amounting so far to more than \$3.92 million, including several current programs in A&A and more on the way.





Collaboration through JCATI ::

The Joint Center for Aerospace Technology Innovation (JCATI) was established in 2012 by the Governor and Legislature to support the aerospace industry in Washington State by:

Pursuing joint industry-university research in new technologies that are relevant to aerospace firms

Providing aerospace industry-focused research opportunities for engineering and computer science students by assisting the development of undergraduate and graduate student research opportunities that give students hands-on experience with aerospace firms

In concert with aerospace firms and aerospace industry associations, identifying research needs and opportunities for technology transfer that benefit the State's aerospace industry.

By law, JCATI is operated and administered out of the UW but functions as a multi-institutional education and research center for all of Washington State. In Fiscal Year 2014-2015, JCATI awarded over \$1.2 million to 16 research projects at the UW, Washington State University and Western Washington University. Faculty and students directly work with industry partners, who provide in-kind support such as materials, testing facilities and fabrication. "The participation of industry in these research projects is key not only to solving problems but it also gives students valuable hands on experience working with aerospace companies", says Beth Hacker, JCATI Program Manager.

JCATI has driven innovation by funding cutting-edge aerospace research proposals.

BETH HACKER



JCATI PROGRAM MANAGER
bhacker@aa.washington.edu
PHONE: (206) 685-8063
WEB: www.jcati.org

The next JCATI Research Funding Proposal will be announced in December, with a Letter of Intent due in January 2015 and full applications due in March. After completing a review process, awardees' funding begin on July 1.

The 2015 JCATI Annual Symposium, which will be held on April 20, 2015 at the UW HUB, will highlight the research progress of the 2014 awardees with speakers and panel discussions featuring both industry and academia. A poster session will allow students to present their work and answer questions.

Information regarding funding announcements and the Symposium will be posted on the JCATI website (www.jcati.org). If you have any questions regarding JCATI, please contact Beth Hacker.



"Collaboration and Control of Multiple Unmanned Aerial Systems"

*PI: Lum, Christopher (UW)
Co-PI(s): Vagners, Juris (UW)
Industry Partner(s): Insitu*

"Advanced Altitude Control for Solar Electric Propulsion Spacecraft: Analysis, Modeling, and Simulations"

*PI: Morgansen, Kristi (UW)
Industry Partner(s): Aerojet Rocketdyne*

"Test Facility for Insulator Materials Employed in Space Propulsion, Power and Communication"

*PI: Slough, John (UW)
Industry Partner(s): MSNW LLC, Sienna Technologies*

"Development of High Resolution Wall Pressure and Wall Shear Stress Measurement System"

*PI: Dabiri, Dana (UW)
Industry Partner(s): Pacific Northwest National Laboratory, Boeing*

"The Continuous Rotating Detonation Engine for Propulsion"

*PI: Kurosaka, Mitsuru (UW)
Industry Partner(s): Aerojet-Rocketdyne, OptiNav, Inc.*

"Baffled-Tube Ram Accelerator Technology Development"

*PI: Knowlen, Carl (UW)
Co-PI(s): Bruckner, Adam (UW)
Industry Partner(s): EnergeticX LLC*

"Guidance, Navigation and Control Autonomy for Asteroid Sample Return Missions for Solar Electric Propulsion Spacecraft"

*PI: Morgansen, Kristi (UW)
Industry Partner(s): Aerojet-Rocketdyne*

"Emissions and Combustion Stability of Advanced Bio-Derived Aviation Fuels"

*PI: Kramlich, John (UW)
Co-PI(s): Hermanson, Jim, Mescher, Ann
Industry Partner(s): The Boeing Company, Pacific Northwest National Laboratory, Imperium Renewables, E3 Energy Partners Consulting Engineers*

**SERVING BOTH THE PROFESSION
AND THE INDUSTRY THROUGH
GRADUATE EDUCATION**

As a department that began more than eighty years ago with a wind tunnel gifted by industrialist William Boeing and a building funded by mining magnate Daniel Guggenheim, we are well aware and proud of our ties to industry. Moreover, we are dedicated to advancing the technology, knowledge, and training that takes American industry into the future.

It was this dedication that lead to the creation of a professional "Master of Aerospace Engineering" (MAE) in 1998, with a track in "Composite Materials & Structures" added in 2009. This degree augmented the cutting-edge research curriculum in our Master of Science and Doctor of Philosophy by offering a program of study that met the needs of today's application-oriented professional engineers.

After fifteen successful years, we had learned a lot. We found that MAE students were not the traditional, full-time, on-campus crowd. A large and growing majority of MAE students were working in industry and pursuing a graduate degree part time. With this in mind, we concluded it was time revisit and revitalize our professional curriculum in order to better meet the students' needs. The result was an entirely restructured, part-time Master of Aerospace Engineering offering official concentrations in Controls, Fluids, Propulsion/Plasma/Power, Structures, and Composites.

This updated MAE would focus on the needs of today's working engineer in multiple ways. MAE-specific courses would emphasize advanced material relevant to today's (and tomorrow's!) industry demands. Evening classes that meet once per week would make it possible for professional students to come to campus for



instruction and collaboration – the number one desire of previous MAE students who could not attend traditional daytime classes. High-quality distance learning technology, however, would remain a major resource for professional students who need schedule flexibility or who live and work outside of the Seattle area – including active-duty military personnel. Lastly, the new curriculum would offer an efficient, focused course of study that trimmed time-to-degree to a reliable three years. So, after more than a year of planning, the newly renamed William E. Boeing Department of Aeronautics & Astronautics implemented a redesigned MAE and admitted the first class in Autumn 2013. The results have been outstanding.

The admission process alone confirmed an unmet need among working engineers. One hundred and seventy-five prospective students applied to the new MAE program – up from a historical applicant pool of less than fifty. Plus, thanks to

the new course structure, we were able to triple the number of new MAE admits in 2013-2014, effectively doubling our total professional graduate student population. By 2015-2016, the total MAE population should reach a steady-state target of 120 students. This, of course, is in addition to our similarly robust, growing, and successful MS and PhD graduate student enrollments.

While we are pleased with the early success of this degree program, far more important is the success of the students. After only one year, students in the new MAE program showed a ninety percent persistence rate (i.e., almost everyone is continuing to their second year) and the average first-year GPA was above a 3.4.

It has been an impressive few years of change in our department – a new name, two new assistant professors, a soon-to-arrive new Department Chair, and a new Industry Affiliates Program. But our attention is not focused entirely inward. Through energetic efforts such as the modernized Master of Aerospace Engineering, we continue to focus our attention outward and forward with emphasis on service to the engineering profession and the aerospace industry through dynamic and innovative education.

INTRODUCING THE MAE FOR PROFESSIONALS:

For more information about the current Master of Aerospace Engineering program - and all our graduate degree options - visit us online:

www.aa.washington.edu/admissions/grad.html

Undergraduate Seminar ::

ALUMNI SPEAKERS

We have been fortunate to have many of our alumni return to the A&A Department to make presentations at our Undergraduate Seminar. Special thanks to:

DANA ANDREWS (BS 86)
Andrews Space, Inc. (ret.)
A&A Affiliate Professor

ERIK CHRISTOFFERSON
(BS 88, MS 89)
Raisbeck Engineering

BOBAK FERDOWSI (BS 01)
NASA Jet Propulsion Laboratory

SEAN FINDLAY (MS 02)
Blue Origin

MYRON ROB GROVER (MS 98)
NASA Jet Propulsion Laboratory

KOUSHROSH HADI
(BS 82, MS 87)
Boeing Commercial Product Development

ROB HOYT (MS 92, PhD 94)
Tethers Unlimited, Inc.

HOWARD HU (BS 91, MS 94)
NASA Johnson Space Center

ROBERT LIND (BS 90, MS 92)
TLG Aerospace

STANLEY LOVE (PhD 93)
NASA Astronaut

CHRISTOPHER MCLAIN (BS 95)
Panasonic Avionics Corp.

NUJOUD MERANCY (BS 01)
NASA Johnson Space Center

HEATHER ROSS (BS 85)
The Boeing Company

BILL ROYCE (BS 68)
Boeing Flight Test (ret.)

TOM ZIERTEN (BS 62)
The Boeing Company (ret.)

BEHCET ACIKMESE The main GN&C challenge for many autonomous systems is to achieve the performance goals safely with minimal resource use in the presence of mission constraints and uncertainties. A key difficulty in meeting this challenge is developing the ability to solve these complex GN&C decision making problems autonomously, onboard, and in the context of constrained optimization problems.

REINER DECHER "History of the Jet Engine: Aviation Reinvented." In this seminar decher reviewed aircraft propulsion from its earliest days, focusing on the development of the jet engine from its origins in England and Germany in the 1930s, and emphasizing its revolutionary impact on the advancement of aviation. Today's turbofan engines, which propel the great majority of commercial and military aircraft, are marvels of efficiency, power, and reliability.

PERETZ FRIEDMANN Presented a review of the evolution of active control approaches for vibration reduction in rotorcraft that have resulted in Higher Harmonic Control (HHC) and Individual Blade Control (IBC). A more recent alternative, On Blade Control (OBC), is defined.

SCOTT EBERHARDT "Newton Reigns in Aerodynamics." Explaining the critical importance of Newton's three laws of motion, particularly the 2nd Law, to how airplanes fly, and how some of the basic relationships governing airplane performance can be derived simply and intuitively from these laws.

CHRIS LEWICKI Planetary Resources and Asteroid Mining. "Establishing a new paradigm for resource discovery and utilization that will bring the solar system into humanity's sphere of influence."

SUSAN MURPHY The Boeing Company, "787: Globally Designed and Built." At the heart of the 787 design is a modern systems architecture that is simpler, more functional and more efficient than that of other airplanes. - boeing.com

PROF. ADAM BRUCKNER Presenting "Alternative Space Launch Technologies".

PROF. STEPHEN E. WOOD "Life and Living on other Planets: The Science and Engineering of Dirt, Ice and Heat."

INTERESTED IN SPEAKING AT ONE OF OUR UNDERGRADUATE SEMINARS? LET US KNOW:

EMAIL: highflight@aa.washington.edu

Visionary GUESTS ::

JAIWON CHIN

A STRATEGIC VISION FOR NASA AERONAUTICS

Jaiwon Shin, associate administrator for aeronautics at NASA, addressed a room full of students, faculty, staff, and industry on campus April 23, 2014 to share the agency's new strategic vision for its aeronautics research programs geared toward strengthening and growing the U.S. aviation industry.



S. RAO VARANASI

GENESIS OF THE AGING AIRPLANE

Rao Varanasi gave a brief chronological review of the evolution of aircraft structural safety since the advent of the large jet transport category airplanes in the 1950s, including the contributions and limitations of the aircraft structural design standards that contributed to safety efforts over time.





HARRISON STANKEY is currently an undergraduate in William E. Boeing Department of Aeronautics & Astronautics at the University of Washington. Alongside his role of Director of Operations at Space Angels Network, he is a Systems Engineer for Planetary Power, a company that is transforming global energy generation through innovative solar and natural gas technologies that efficiently and affordably deliver power to the point of need. Previously, he performed undergraduate research at the University of Washington on a plasma science research experiment with applications in both propulsion and nuclear fusion.

JAIME KATZER is a 2014 UW Alum. She credits her passion for airplanes to attending Aviation High School, where she served as school ambassador, interned at the Museum of Flight and was named valedictorian of her class. She spends time in the pilot's seat with her student license, and takes flight whenever possible. Her background in aviation, combined with her love of mathematics and problem solving, inspired her to pursue a degree in aeronautical engineering. At the University of Washington, Jaime worked in the Kirsten Wind Tunnel as Crew Chief, and has interned with The Boeing Company in the Flight Sciences division. Jaime spent a summer in France, studying aerospace engineering and exploring French culture. She graduated with her Bachelors in Spring of 2014.

LILLIAN PRYOR is a second-year graduate student researching fast-responding pressure-sensitive microbeads in the fluids laboratory for Dr. Dana Dabiri. These aerosolized microbeads are loaded with dyes, and the intensity of their luminescence can be measured to back-calculate pressure. Her research focuses on optimizing a dual-dye microsphere that responds on the order of microseconds. She has worked in the lab for one year and will be presenting her research at the 67th annual meeting of the American Physical Society Division of fluid dynamics.

JOSUE CALDERON is a graduate student at the University of Washington pursuing a degree in Aeronautics, specializing in control systems. He conducted his undergraduate studies at Whitworth University, graduating with a B.S. in Engineering Physics and a B.A. in Mathematics; these studies were completed in a period of two years. His research has included creating computational fluid dynamics (CFD) models of various fluid flows and he is currently focused on predictive stabilization of flight vehicles using control theory as well as the autonomous identification and rejection of nonlinear disturbances. Josue was awarded a 2013 National Science Foundation Graduate Research Fellowship along with fellow doctoral student, Natalie Brace.



A&A Students working at SpaceX in Los Angeles, CA

UW SPACEX INVADERS (PICTURED ABOVE):

Back row (left to right):

Tyler Pierce (UWAA undergrad '14, Propulsion Intern),
Ryan Westerdahl (UWAA undergrad '13, Propulsion Intern),
Erich Carson (UWAA undergrad '14, Propulsion Development Engineer)

Front row (left to right):

Kelly Cheung (UWAA undergrad '14, Propulsion Intern),
Nathaniel Guy (current UWAA masters student, Avionics Intern) Brian Chang
(current UWAA masters student, Production Intern)





*A&A Student Rocket Launch.
Thank you to our funding sponsor: Gencorp*

STUDENT ROCKET BLASTS OFF TO WIN TECHNICAL EXCELLENCE AWARD!

A team of University of Washington students from the A&A, EE, and ME Engineering Departments launched a 15-ft-tall rocket to 1100 feet-per-sec at the 9th Intercollegiate Rocket Engineering Competition (IREC) in Green River, Utah during the last week of June this year (<http://www.soundingrocket.org/>). This is one of the world's most challenging high-power rocket competitions for college students. Twenty-eight university teams from the US, Canada, Brazil, Turkey, and Puerto Rico participated in the competition this year. The UW team, a registered student organization known as the Society for Advanced Rocket Propulsion (SARP), won the prestigious Furfaro Technical Excellence Award in which their engineering expertise was recognized from among all of the other rocket designs that were launched.

The team of undergraduate students, led by A&A Dept. seniors Ellen Moyer, Chas Manfredi, and Jacob Brown, with Dr. Carl Knowlen as their faculty advisor, refined the design of a high-performance nitrous oxide-paraffin hybrid rocket motor that was first flight-tested in 2012 and integrated it into a 15-foot-long

rocket christened STEVe. Two full-scale static tests were carried out in central Washington as part of the program and one shake-down flight was launched at Mansfield, Washington, during Memorial Day weekend. On board the rocket was a sophisticated data acquisition payload designed and fabricated by EE Department students, along with an innovative dual-deployment recovery system developed for high-altitude trajectories by AA Dept. juniors. This rocket was designed to deliver a payload of 10 pounds to 25,000 ft in the IREC advanced category.

Upon ignition at the IREC launch, the UW rocket ascended beautifully, then about 10 seconds into the flight the custom-built hybrid motor chamber burned through, causing the fin-can to separate and the rocket to go cart-wheeling across the sky. Just before breaking up, the rocket had attained exactly the predicted velocity (1100 fps) and altitude (7000 ft) that would have put it on a trajectory to meet its 25,000-foot goal. Even though the target altitude was not reached, the SARP team was given the Technical Excellence Award out of recognition of their professionalism and ability to design, build, and launch a sophisticated rocket using a high-powered hybrid rocket motor (1200-pound-thrust). Many kudos to the SARP team for a job well done!

STUDENT AWARD AT AIAA REGION VI CONFERENCE:

Two UW A&A students won awards at the AIAA Region VI Student Conference that was held in 2014. In the graduate category, Jasmin Bumanowski won 2nd place for her paper on portfolio project management. In the undergraduate category, junior Bonghan Kim won 3rd place for his paper on plasma diagnostics in the ZaP machine. Three other students - Eleanor Forbes, Sydney Swofford, and David Goldstone - also attended the conference and presented papers on various aspects of ZaP plasma diagnostics. As a whole the UW A&A student group made a great impression at the conference.



A&A Students participating in the AIAA Region VI Student Conference

DESIGN-BUILD-FLY

Our Design-Build-Fly (DBF) team (led by Dr. Chris Lum) had a great season and successfully competed against 80 other international schools in Wichita, KS. The DBF team designed, built, and successfully flew an aircraft designed for backcountry rescue and evacuation operations. Despite competing against schools that focus on DBF projects full-time, the UW A&A team placed within the top 1/3 of all competitors.

SENIOR AIRCRAFT DESIGN:

Our senior aircraft design class, under the guidance of Prof. Eli Livne, Chet Nelson from Boeing, and Chuck Bower, our pilot and Remote Control model expert, has been working on the development of a tailless supersonic long-range configuration. Chet Nelson is a Boeing Technical Fellow and an Affiliate Professor in A&A. We gratefully acknowledge AeroTec for its CFD and CAD support and for wind tunnel model design and construction.

SENIOR SPACE DESIGN:

The senior space design team, under the supervision of Prof. Dana Andrews, has been working on concepts for the systematic expansion of human outposts and colonies to the moon. This involves inserting a human-tended outpost at the Earth-Moon Lagrange point (L2) behind the moon, using the outpost to capture samples returning from Mars, and then developing a first outpost at the lunar north pole. The Space Design team competed in this year's NASA RASC-AL competition.

Another one of Prof. Andrews student teams designed an asteroid mining architecture that provided a discounted return on investment of 42%. The results were presented at the International Astronautics Federation meeting in Beijing in September, and the paper was accepted for publication in *Astronautica Acta*, the peer-reviewed Journal of the IAF.

NEW STAFF

**KATIE FRISBIE-BUNTEN***Associate Director, Advancement*

Katie works closely with faculty, administration and alumni volunteers to provide strategic leadership in the design and implementation of programs to engage our alumni, and to grow philanthropic investment in A&A.

**GAIA BORGIAS BROWN***External Relations Officer*

Gaia helps companies access student talent and identify potential UW research partners in plasma, fluids, structures & controls. She is responsible for developing and growing the A&A Industry Affiliates Program.

**PATRICK J. GIBBS***Department Administrator*

Patrick provides primary oversight of departmental budgets, cost centers, self-sustaining accounts, and human resources and payroll matters.

**NANCY-LOU POLK***Fiscal Specialist*

Nancy-Lou is on the financial services team, contributing to the development and implementation of processes that are easy to use.

**FIONA SPENCER***Research Scientist, Engineer*

Fiona is a Test Engineer supporting experimental research programs, educational laboratory courses, and UWAL. Her experience includes working with Newport Corporation, helping set up research labs around the world.

**KRIS VENDEN***Senior Computer Specialist*

Kris focuses on the Windows support needs for the department and maintains the computer lab images. He also works with all network accounts, department checkout needs, and hardware upgrades.

**ALUM PLAYS KEY ROLE IN BOEING PARTNERSHIP**

This past spring, the University of Washington and the Boeing Company signed a "Master Research Agreement" making the long-standing partnership between the two organizations a more seamless one. The agreement worked out all details of collaborations between UW and Boeing in advance (IP, legal, funding mechanisms, etc.), creating a more streamlined system for starting new projects. The master research agreement applies to the entire university, and enhances the ongoing partnership between A&A and Boeing.

The UW is one of a select number of universities to have such an arrangement with the company. A number of key people made the agreement possible, including A&A alumnus, Kourosh Hadi (BS 82, MS 87). Hadi is the director of Airplane Product Development for Boeing Commercial Airplanes and has served as the Boeing Executive focal to the department since 2007. He considers the master agreement a significant step.

WITH NEARLY 30 YEARS at the Boeing Company, Kourosh Hadi has held a range of key leadership positions. He first joined the Company as an engineer in Noise Research, working in Aerodynamics supporting 737/757, then worked in Product Development early in his career. In his current role, Hadi is responsible for the

**KOUSHRO HADI**

"Boeing is a business, and this agreement made business sense," Hadi says. "[Boeing and the UW] are in each other's back yards and this was an opportunity to grow both of our businesses."

Several projects in the department have been sitting on the sidelines waiting for the master research agreement to come together. Hadi is excited to see these launch, including one focused on flight controls. He says the agreement allows for the UW and Boeing to explore more significant projects, which are overall more strategic.

Hadi looks forward to future collaborations between Boeing and A&A, and wants to get more alumni involved.

"The opportunities are huge."

THE JOSEPH F. SUTTER ENDOWED EDUCATION FUND IN AERONAUTICS & ASTRONAUTICS The Joseph F. Sutter Endowed Education Fund In Aeronautics & Astronautics, which supports undergraduate scholarships, undergraduate senior capstone design projects, and departmental K-12 outreach, has grown in size to nearly \$590,000 with the generous support of the Boeing Company as well as many other companies and individuals. Contributions to the Fund are continuing to come in, with all contributions matched by the department. If you would like to make a gift to the Sutter Fund, please contact Katie Bunten at frisb@uw.edu or 206.616.8310.



Engineering Discovery Days tour group learns about flow visualization with grad student Wei-Hsin Tien

Inspiring future GENERATIONS ::

ENGINEERING DISCOVERY DAYS

At Engineering Discovery Days, students and faculty from all UW engineering departments share their work with students, teachers, families and the community. Engineering Discovery Days 2014 brought over 9,000 guests to campus to participate in engineering innovation through 115-plus exhibits and information sessions.

BRYANT ELEMENTARY SCIENCE FAIR

Three of our A&A Grad students mentored local science fair teams at Bryant Elementary School. Together, students and their mentors designed and carried out their scientific investigations mimicking the group dynamics present in adult research or work teams. Thank you to Eder Sousa, Kevin Ueunten, and Nick Dona. We are extremely proud of you and your 4th/5th grade researchers.

A&A DISCOVERY EXHIBITS INCLUDED:

Demonstration of autonomous operation of underwater vehicles that move using fins rather than propellers.

Use of tools to figure out how mechanical waves form.

Demonstration of the RC plane that the UW Design Build Fly (DBF) team built.

Discussion about alternative concepts for magnetic field confinement of plasma.

Demonstration of DUBotics Teams mars rover that was entered into the 2014 University Rover Challenge.

Ramjet/Ram accelerator laboratory tour.

Reduced Flight Water Rockets.

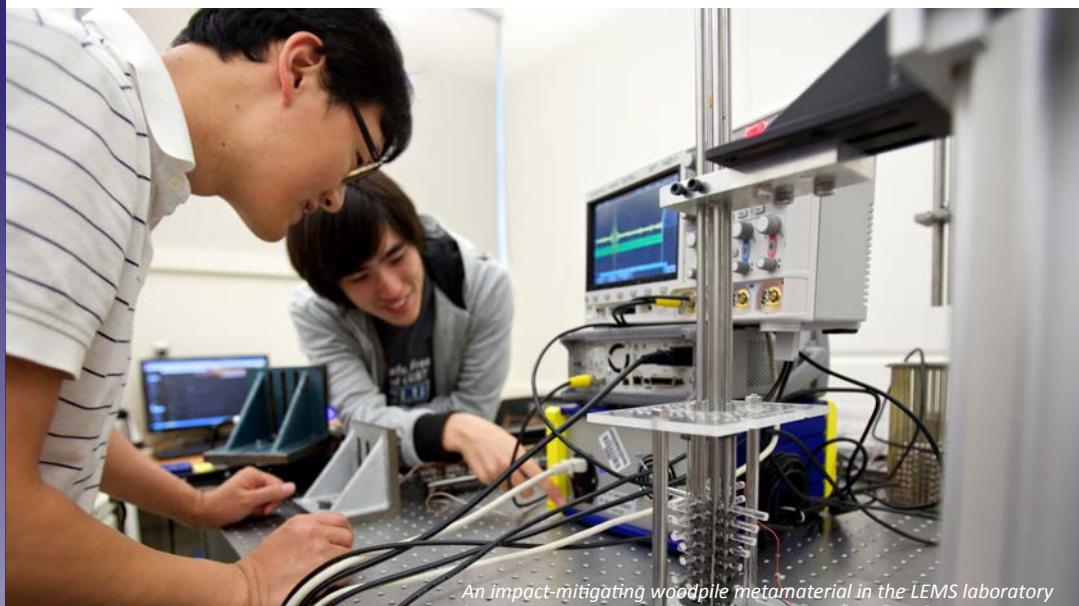
Wing-Tip Vortices.

ZaP HD Experiment.

RAISBECK AVIATION HIGH SCHOOL DEPARTMENT TOUR

100 high school students from Raisbeck Aviation High School came to UW Campus to learn about their college options. Over 50 of the students joined A&A Lab tours and visited the Kirsten Wind Tunnel. Raisbeck Alum Jaime Katzer led a Q&A session after the tour. Thank you to our student volunteers:

*Jamie Katzer
Stanton Wisner
Frederico Alvarez
Zachary Perry
Kelsey Gabel
Tyler Pierce*



An impact-mitigating woodpile metamaterial in the LEMS laboratory

DANA ANDREWS 2014

DISTINGUISHED ALUMNUS 2014



After a long career at Boeing and Andrews Space, Dana was asked to teach the AA420/421 classes in 2012. Under Dana's guidance, the 2012 Senior Space Design Class received first place in the NASA space design competition, the first time the UW has taken first place in this competition. To the department's dismay, Dana retired in June 2014.

KEVIN FOWLER 2013

DISTINGUISHED ALUMNUS 2013



KEVIN FOWLER is the Chief Architect of Processes and Tools for Boeing Commercial Airplanes (BCA). He has always been passionate about the need for continued career education, demonstrated by his Boeing Executive sponsorship for development of the Aircraft Composite Certificate curriculum at the University of Washington.

Alumni UPDATES ::

GERRIT VAN DER WEES (MS 76) came by to say hello last month. Gerrit fondly remembers working with Professors Ganzer and Joppa as a research assistant in the department.

WILLIAM (TOBY) DITTRICH (MS 81) paid us a visit recently. Toby taught physics at Portland Community College for 27 years. He also became a multi-engine instrument flight instructor. Toby has received five patents, and has 30 patents pending!

LINDA HEDGES (PHD 91) attended last year's UW AIAA Evening With Industry as a representative of Stark Aerospace, Inc., Analytical Methods Division, where she is vice president of engineering. Linda stopped by again this year with her son to talk about admission to the UW. No doubt he will be inspired by his mother's accomplishments and want to follow in her footsteps.

STEVE FRIMER (BS 88) is a field service manager for Boeing Commercial Airplanes. Steve is managing a team of customer support field service representatives, providing technical support to the commercial airplane customers in the Central Asian region.

DISTINGUISHED ALUMNUS DENNIS MUILENBURG (MS 90) has been appointed to the Board of Directors of FIRST(R) (For Inspiration and Recognition of Science and Technology). Dennis is president and chief executive officer for Boeing Defense, Space & Security.

CHRISTOPHER BECK (BS 92, MS 93) is a senior lead engineer at The Boeing Company.

DAYTON GRIFFIN (MS 92) stopped by for a visit earlier this year after presenting a seminar in Civil & Environmental Engineering. Dayton is the senior principal engineer, Renewables Advisory Energy at DNV.GL.

BILL FISHBURN (BS 93) paid us a visit last year. After leaving the UW, Bill received his MS in ME from UC Berkeley, after which he accepted a position at Intel, where he has been for nearly 20 years. Bill took a sabbatical from Intel to tour Europe with his wife, Beth. In addition to being a world traveler, Bill is an avid home brewer and is a certified (BJCP) beer judge!

A&A Graduating Class, 2014



CHRIS MCLAIN (BS 95) is a principal engineer at Panasonic Avionics Corporation in Portland, OR. After leaving the UW, Chris received an MS in Aeronautics & Astronautics at MIT. In the ensuing years, Chris has been an inventor on more than 10 patents!

RALPH EWIG (BS 95, MS 97, PHD 06) has published a book titled, *Empowering Excellence - An Executive Guide to Continuous Improvement*. Ralph has also published several science fiction novels. After a career as a VP at Aerojet in Sacramento, Ralph is now pursuing an MBA at the Stanford University Business School. Check out his blog at: <http://ralphewig.tumblr.com>

CHRIS CHUHRAN, PE (BS 97) is VP at Guido Perla and Associates, Inc. a Naval architecture firm in Seattle. Chris led the design of the Navy's newest oceanographic research vessel which is to be named after Neil Armstrong. The ship, under construction in Anacortes, WA, will be over 230 ft. long and equipped with many advanced systems. Chris will be delivering a speech at the vessel's christening ceremony.

WALTER URBANCHOCK (BS 97) stopped by the department to say hello to faculty and staff. Walter is a "rocket scientist" working on monopropellant thrusters at Aerojet.

CHRIS ABERLE (BS 98, MS 04) came to visit this summer while here for a high school reunion. Chris is a software engineer for the U.S. Navy (NAVAIR), working on training software. In his spare time, Chris enjoys high power rocketry (including launching a Christmas tree!).

KEQIN GU (MS 98) happily surprised us with a visit along with his 8 year old son, Alton (a future aeronautical engineer?). Keqin is a software engineer at Oplink Communications, Inc. in California.

SARAH MUSI (BS 04) is working in product development at Boeing Commercial Airplanes. Sarah's projects have included the BDS P-8 Poseidon - aerodynamics, static loads, wind tunnel testing, BCA Flight Operations Engineering, and 777X Wing - advanced composite manufacturing.



ADI SALEHUDDIN (BS 04; MS 06) received his MBA from Washington University in St. Louis and is now a project manager in the Strategic Leadership Program at Discover Financial Services. **CHRISTINE ROARK (MS 06)** is an applications engineer at Tech-X Corp. Chrissy and Adi, who met in the A&A Department, were married in 2009 and have a beautiful son.

PEIYING (JENNIFER) TSAI (MS 05) will be pursuing a PhD at McMaster University in the department of Mechanical Engineering. Jennifer's research topic will be related to magnetic fluids, thermomagnetic convection, and bio-physical transport with magnetic particles.

MAZYAR AMIN (MS 06, PHD 10) came to visit the department in July. After several years as a postdoctoral fellow at Saint Louis University, Mazyar accepted a position as assistant professor in the Engineering Technology Department of Miami University in Ohio. Mazyar is collaborating with Prof. Dabiri on a proposed book chapter for the *"Handbook of Research on Advances and Applications in Refrigeration Systems and Technologies."*

After working at Boeing, **LINH (NGUYEN) KANODE (BS 06)** took a detour from engineering and became a veterinary technician! She now works at the In-Service Support Center for the Naval Air Systems Command (NAVAIR) in Cherry Point, NC. Linh is married to alum **KYLE KANODE (BS 06)**, who is a U.S. Marine.

BHUVANA SRINIVASAN (MS 06, PHD 10) and **COLIN ADAMS (BS 05, MS 09)** paid a visit to campus before heading off to Virginia Tech, where they will both hold tenure track faculty positions in the Ocean Engineering Department. Colin and Bhuvana went on a dream trip to climb Mt. Kilimanjaro along with fellow A&A alums **ANNAMARIE ASKREN (BS 06)**, **JAYME HALE (BS 07)**, **MATT HEIKELL (BS 07)**, **THOM WEBER (MS 07, PHD 10)**, **BEI CHAN (MS 08)**, and **GREG RIXON (MS 12)**.

We were happy to see **BEI-JING CHAN (MS 08)** last year when she stopped by to visit. Bei works in product marketing for AU Optronics in Taiwan. Bei also joined fellow alums on an adventure to climb Mt. Kilamanjaro (see above).



Congratulations to **NAMIKO SAITO (BS 09)**, who recently received her PhD at California Institute of Technology. Namiko has accepted a position in the Tokyo branch of UBS, a Geneva based financial services company. Before leaving the U.S., Namiko came to the UW to present a seminar on Large-Eddy Simulations.

TIM EDMON (BS 10) is a repair and retrofit engineer working for the Structural Repair Manual (SRM) group on the 747 and 767 models at Boeing.

KYLE SHOUN (BS 10) is a design engineer at Northwest Aerospace Technologies in Seattle.

ERIC LIN (BS 11, MS 13) stopped by to say hello. Eric is an aerospace engineer at Atkins, a UK based engineering consultancy company.

EDISON AMAH (BS 12) received a prestigious NSF Bridge-to-Doctorate Fellowship to pursue a PhD at the New Jersey Institute of Technology, where he will be studying Efficient DNS Approach for Suspensions Subjected to Spatially Varying Electric Field.

In Memoriam...

Shane Coulter (MS 13)

Everyone in the UW A&A community was deeply saddened to learn that Shane Coulter died tragically in an avalanche in February. Shane will be remembered by classmates, teachers, and staff as a committed, kind friend and a thoughtful, talented engineer. Our sincerest sympathies go to his family as well as the families of the other skiers who were lost or injured in the avalanche.

Richard John Holden Bolland
(A&A Chair 61-76)

Professor John Bolland passed away on June 28, 2014 in Seattle, WA. John received his BE and ME degrees at the University of Canterbury, New Zealand and his PhD from Purdue University, USA, where he met his wife, Eve Habig. John worked as a structural design engineer for the NZ Civil Aviation Authority until his return to Purdue University in 1956, at which time he headed the aerospace Sciences Laboratory. In 1961, John accepted the position of Chair of the UW Department of Aeronautical Engineering (shortly thereafter renamed Aeronautics & Astronautics). John was a dedicated Chair and Professor in our department for many years. During the first eight of his 15 years as Chair, he doubled the size of the faculty and transformed the department into a strong, research-oriented program. John retired in 1997 but his influence is still felt today.

Harlow (Hal) Ahlstrom (BS 57, MS 59)

Dr. Hal Ahlstrom, 78, passed away peacefully on March 11, 2014 after a brief illness. Hal earned his BS and MS in Astronautics and Aeronautics at the UW in 1957 and 1959. He went on to earn his PhD in magnetohydrodynamics at CalTech in Pasadena, CA. Hal then returned to the UW to advance to a professorship in our department. Hal later spent time at the LeMay Institute of Aix-Marseille University in France. After leaving the UW in the mid-1970s he became director of inertial confinement fusion at the Lawrence Livermore National Laboratory in California. Hal returned to Seattle to join Boeing Aerospace in 1985 as Director of Engineering Technology, and retired after 20 years of dedicated service. Hal and his wife of 42 years, Radha, remained involved with the Department of Aeronautics & Astronautics over the years. He will be missed by all of us.

Louis Bernie Gratzer (BS 44, MS 51, PhD 68)

Bernie Gratzer, passed away peacefully on Friday May 30th, 2014 at the age of 93. Soon after receiving his BS and MS in our department, he joined the Boeing Commercial Airplane Company. While employed at Boeing, Bernie returned to A&A to earn his Ph.D.. After his retirement from Boeing, Bernie returned as an affiliate associate professor in our department. During this time he consulted on projects with NASA Langley and on the development of the 1987 America's Cup-winning yacht, Stars and Stripes. Since 1990, Bernie was senior vice president at Aviation Partners, Inc, a Seattle engineering firm focused on developing and marketing his patented blended winglet, and more recently, his split scimitar winglet design. Today there are over 6000 business jets and Boeing airliners flying these blended winglets.

WANT TO HEAR MORE FROM US?

Have news you would like to share in the next issue of Highflight?

You can update your alumni info online or give us a call **(206) 543-4791**. Visit aa.washington.edu or contact highflight@aa.washington.edu

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highflight@aa.washington.edu

HIGH fLIGHT

SEATTLE HAS LONG BEEN KNOWN for its success in commercial aircraft design and manufacturing. In recent years these deeply-rooted engineering assets have become fertile ground for an emerging industry in pursuit of commercial spaceflight and extraterrestrial

ROI. Private space start-ups like Blue Origin, Stratolaunch and Planetary Resources have gravitated to the Pacific Northwest, citing their attraction to the specialized resources found here: historic aviation heritage, unparalleled engineering excellence, entrepreneurial energy, and visionary investors. Washington has rolled out the red carpet as well, recently releasing a statewide aerospace strategy that includes increased support for both established and emerging space companies. The UW William E. Boeing Department of Aeronautics and Astronautics is an active player in this strategy, partnering with businesses in pursuit of new technology and challenging students to

explore the boundaries of their industry. Our department is both a pillar and a product of the community that surrounds us. We are proud to call Seattle home.

THIS PAST SEPTEMBER, the UW's Department of Aeronautics & Astronautics was part of the inaugural Space Angels Network Members' Expedition to Southern California. Space Angels Network coordinates events that connect its global investor network and encourage private investment in aerospace and aviation startups. The agenda was packed full of space company tours and meetings with industry leaders like SpaceX, XCOR,



graduates and faculty researchers. We are proud to be a part of the historic and emerging space industry, and we look forward to participating in the upcoming Space Angels Network Expedition as an institutional sponsor," Said professor and former chair James Hermanson.

Virgin Galactic, Masten Aerospace and more. This is one of many external-facing activities the department has recently supported, a vision championed by outgoing chair, Jim Hermanson:

"The William E. Boeing Department of Aeronautics & Astronautics at the UW is continuously and actively exploring new partnerships with industry. This important activity is of great benefit to our students,

Look for this event and other industry excursions on our department website and Facebook page.

www.aa.washington.edu

Space Angels Network Members' Expedition at Whittinghill Aerospace