ASTRONAUT SCHOLARSHIP FOUNDATION

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2010 Astronaut Scholar Meeting

2011 Astronaut Scholar Technical Conference Abstracts

May 7, 2011

Cocoa Beach, FL

Keynote Speaker

Jeffrey Hoffman

Jeffrey Hoffman is a veteran of five missions and has logged 1,211 hours in space. In 1985 on STS-51D, he made the first contingency EVA in an effort to rescue a malfunctioning satellite. On his second flight in 1990, STS-35, he flew with the ASTRO-1 ultraviolet astronomy laboratory. He twice flew with the Tethered Space Satellite, STS-46 in 1992 and STS-75 in 1996. Hoffman also flew on STS-61, the first Hubble Space Telescope servicing mission. Hoffman is currently a Professor of Aerospace Engineering in the Department of Aeronautics and Astronautics at the Massachusetts Institute of Technology.

Jeffrey Hoffman was inducted into the U.S. Astronaut Hall of Fame on May 5, 2007.

Joy Buolamwini

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2010-2011 Astronaut Scholar, Georgia Institute of Technology
Georgia Institute of Technology

Autism, Music, Education, and Global Development

Computer Science permeates nearly every aspect of modern life and has given me the opportunity to pursue my passions in many areas. This talk presents a sampling of various projects that leverage advances in computing to improve healthcare, support collaborative music creation, or further development efforts abroad.

Joy Buolamwini is a Computer Science major at the Georgia Institute of Technology, an entrepreneur, and a humanitarian. Not only is she a Stamps' President's Scholar, the highest merit based award given to only 5 out of state students in the university each year, but the Anita Borg Foundation recently identified her as a finalist for their annual scholarship competition which recognizes high achieving women studying computer science worldwide. She is currently doing research on employing social robots for the treatment and diagnosis of autism spectrum disorder. Furthermore, in addition to leading a software development education initiative with the Zambian Institute for Sustainable Development, Joy is currently working to develop a mobile phone survey solution to be used in Ethiopia to help assess the efficacy of nonprofit programs intended to eradicate trachoma and malaria.

Kaitlin Burlingame

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2010-2011 Astronaut Scholar, Washington University in St. Louis
Washington University in St. Louis

Measuring Localized Carbon Dioxide Levels in Microgravity

Crew members on both the International Space Station and Space Shuttle have developed symptoms of carbon dioxide (CO_2) overexposure at lower than expected ambient CO_2 levels. One potential cause for these symptoms is that CO_2 accumulates in the oral-nasal region in a microgravity environment. Consequently, astronauts would inhale higher levels of CO_2 than were detected by sensors in the ambient environment. This year, I had the opportunity to propose, design, build, and fly a microgravity experiment studying this problem as part of NASA's Reduced Gravity Flight Education Program. In order to investigate this accumulation in our experiment, CO_2 levels in the oral-nasal region were measured and compared to CO_2 levels measured in the ambient cabin environment. This data will contribute to projects to find better ways to monitor CO_2 levels and prevent astronauts from experiencing high CO_2 exposure.

Kaitlin Burlingame is completing her senior year at Washington University in St. Louis, majoring in Mechanical Engineering. This summer, she will intern at NASA Johnson Space Center before returning to Washington University to complete her final year in the combined BS/MS program.

Edward Brady Doepke

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2010-2011 Astronaut Scholar, University of Kentucky
University of Kentucky

Wing Warping for Autonomous Flight Control of Inflatable Wing UAVs

For several years groups at UK have worked to developed inflatable wing Unmanned Aerial Vehicles (UAV). The early work was done as a concept for packing large wings into small volumes for flight on Mars. More recently the technology has been investigated for low altitude deployable systems for military and commercial uses as well as rocket deployed High Altitude Long Endurance (HALE) aircraft.

As part of my work I hope to develop novel methods for controlling the shape of the wing during flight for both control of the aircraft and potentially reshaping the wing for different flight regimes. The flight control system will be integrated with an autopilot for autonomous operations.

Brady Doepke grew up in Morehead, Kentucky. After high school he studied pre-engineering at Morehead State University before transferring to the University of Kentucky to study Mechanical Engineering. In May 2005 he earned his B.S. in mechanical engineering and immediately began work on his M.S. Over the past four years at UK he has studied inflatable wing structures and motion dynamics in the Dynamics Structures and Controls Lab. He has also been the team lead and team pilot for the UK AIAA Design Build Fly Team. Recently he has also been working with the KY Institute for Aviation Education to develop an aircraft design competition for high schools in KY. Brady has also participated in three internships at Goddard Space Flight Center. Upon graduation he plans to pursue a PhD in either aerospace or mechanical engineering.

Tim Duquette

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2008-2009 Astronaut Scholar, Purdue University
NASA George C. Marshall Space Flight Center – Liquid Engine Systems Branch

New Cryogenic Fluid Management Test Capability at MSFC Advanced Propulsion Laboratory

As the Nation considers its next step in manned spaceflight, NASA and the aerospace industry are researching technologies to enable and enhance future exploration missions. Cryogenic Fluid Management (CFM) technology research is being conducted at numerous NASA centers in support of this effort. CFM has several purposes such as reducing propellant boil-off while in-orbit and properly conditioning the propulsion system for engine restart. Reducing propellant boil-off in orbit can significantly decrease the required launch mass, thus enabling and enhancing mission capability. At NASA's Marshall Space Flight Center, modifications to a nine foot diameter vacuum chamber at the Advanced Propulsion Laboratory are being made to allow testing of CFM technologies with liquid nitrogen. Addition of a liquid nitrogen feed system and a boil-off measurement system will provide the capability to test small or medium test articles in a vacuum environment at low cost. Facility development and installation is in progress and several test articles are scheduled for testing.

Tim graduated from Purdue University in December 2009 with a B.S. in Aeronautical & Astronautical Engineering. He joined NASA's Marshall Space Flight Center as a full-time employee after numerous stints as a co-op student. His primary role is supporting the Space Shuttle Main Engine Systems Team as part of the Liquid Engine Systems Branch. In this role, he supports day-of-launch flight operations, post-flight data analysis, and pre-flight readiness assessments. He intends to pursue advanced degrees in Aerospace or Nuclear Engineering in hopes of future work on nuclear space propulsion systems. Tim received the Astronaut Scholarship in 2008-2009.

Ryan East

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2006-2008 Astronaut Scholar, University of Oklahoma
NASA Lyndon B. Johnson Space Center (JSC)

Best Estimated Trajectory

One of Ryan's assignments is to maintain the Best Estimated Trajectory (BET) for the

International Space Station (ISS). The BET is a record of the as-flown trajectory of the ISS, and it is used to support quick data requests from universities or companies that usually have scientific payloads aboard the ISS.

Ryan has dreamed of becoming a flight controller in NASA's Mission Control Center (MCC) since he was ten years old. After participating in JSC's Cooperative Education Program, he joined NASA full-time in 2010 and is training to become a flight controller in the ISS Trajectory Operations and Planning Group. He earned a B.S. in Aerospace Engineering from the University of Oklahoma in 2008 and a M.S. in Aerospace Engineering from the University of Texas at Austin in 2009.

Debora Fairbrother

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1990-1992 Astronaut Scholar, Texas A&M University
Balloon Program Office Chief Technologist, NASA Goddard Space Flight Center / Wallops Flight Facility

NASA's Super Pressure Balloon Development

Extended duration stratospheric flights of large science instruments at mid latitudes is one of the goals of the NASA Balloon Program Office. The development of a large pumpkin shaped super pressure balloon that will fly at a near constant pressure attitude would accomplish this goal. The development effort has had numerous test flights over the years. The most recent was the flight of a ~422,400 cubic meter balloon in early 2011 from Antarctica. The balloon lifted ~1,800 kg to slightly over 33 km and flew one circumnavigation of the continent in just over 22 days. Debora will discuss the details of the successful test flight as well as show pictures, videos and flight data.

Debora Fairbrother was an Astronaut Scholar from 1990 to 1992 while completing a Master of Science in Mechanical Engineering from Texas A&M University. Her career has been in scientific research balloons ever since. Starting at Winzen International, a balloon manufacturer, and then transitioning to Winzen Engineering where she focused on balloon system research and development. She joined NASA's Balloon Program Office (BPO) in 1999. She is now the Chief Technologist for the NASA BPO located in Wallops Island, Virginia. She is responsible for the development and maintenance of the balloon technology roadmap as well as provides leadership for technology proposal efforts. Her recent focus has been in leading the Super Pressure Balloon development. She has worked on the research, development, fabrication, integration and test flights of the vehicle. She has supported field campaigns in New Mexico, Sweden, and Antarctica.

Cody Gette

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2010-2011 Astronaut Scholar, North Dakota State University
North Dakota State University

Laser Processing of Amorphous Silicon Films Prepared by Printing Silanes

Today's technology trends are moving toward Roll-to-Roll processing where fabricating electrical components can be enhanced by laser processing. While the bulk of electrical components are produced on silicon, many applications are trending towards using inexpensive substrate materials such as glass and plastic to reduce cost. Using a laser eliminates the need to use conventional ovens to heat films and allows electrical components to be processed without damaging the underlying substrate.

Experiments were performed at the Center for Nanoscale Science and Engineering to crystallize polymerized Si_6H_{12} spun-coat films and to optimize grain growth. Using sequential lateral solidification (SLS) the films were crystallized using a 355 nm wavelength laser and characterized using Raman Spectroscopy. These films were then used toward the fabrication of solar cells.

Cody will graduate from NDSU in May 2012 with Bachelor's degrees in Physics and Mathematics. He has worked as an Undergraduate Research Assistant at the Center for Nanoscale Science and Engineering since May 2008. He will be attending Leibniz Universität Hannover in Hannover, Germany for an engineering internship and language study this upcoming summer and will return to NDSU in the fall. After graduating from NDSU, he plans to pursue a Ph.D. in Physics.

Joseph Han, Ph.D.

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1999-2000 Astronaut Scholar, Texas A&M University
QuantumScape

Economic Trade-offs in Cluster Purchases

Contrary to common misconception, Moore's Law is a correlation of transistor density for VLSI manufacturing rather than a statement about chip frequencies. This doubling every eighteen months has led to obvious increases in core counts and cache sizes. As such, the

$/FLOP metric for computational clusters may not be the driving factor anymore. The total cost of doing an analysis will be discussed in the larger context of overall expenses.

Joseph recently joined a new startup using chemistry and physics to revolutionize global energy storage technology. Previously, he was part of the Office of the CTO at Penguin Computing where he was tasked with leading the company into new areas where it could apply its HPC expertise. Joseph has also worked at Intel Corporation in the TCAD Integrated Processing Applications Group. Joseph has held roles that dealt with simulations of kinetics, thermodynamics, and material property prediction and design using *ab initio* quantum mechanical electronic structure calculations, molecular dynamics and Monte Carlo simulations, and continuum methods. Due to the computationally intensive nature of the simulations, Joseph has been working with Linux and building clusters since 1996. Joseph has a B.S. and M.S. from Texas A&M University and a M.S. and Ph.D. from Stanford University in Chemical Engineering.

Scott Isaacson

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2010-2011 Astronaut Scholar, University of Minnesota
University of Minnesota

Graphene Growth on Palladium(111)

Graphene, a two-dimensional crystalline sheet of sp^2-bonded carbon atoms arranged in a honeycomb lattice, has garnered the interest of many researchers in recent years due to its remarkable structure and electronic properties. These unique properties have sparked interest in the practical applications of graphene, from its use in electric batteries to graphene-based electronics. For many of these applications, the fabrication of large-area, high-quality, single-layer graphene films is essential to their success. In this project, we studied graphene films grown by a surface segregation and precipitation process on a carbon-doped palladium (111) surface. Further investigation resulted in the development of a growth procedure capable of producing large-scale (> $1mm^2$), single layer graphene on Pd(111). In most cases, graphene islands imaged with a scanning tunneling microscope exhibited a Moiré pattern with a periodicity of 2.3 ± 0.1 nm, which implies that the growth of graphene on the Pd(111) surface is nearly epitaxial.

Scott graduated from the University of Minnesota in May 2011 with a degree in Chemical Engineering. He has had the opportunity to participate in a wide variety of research projects in several different settings, from industrial laboratories to academic cleanrooms to the National Institute for Materials Science in Japan. Scott is looking forward to working as an intern for 3M this summer, and then attending Stanford University in the fall to pursue a

Ph.D. in Materials Science and Engineering.

Erik Josberger

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2010-2011 Astronaut Scholar, University of Washington
University of Washington

Design of a Low Temperature Atomic Force Microscope (AFM) for Nano-Scale Optical Microscopy

We have designed an Atomic Force Microscope (AFM) system capable of operating at temperatures between 20K and 500K and in vacuum below 10^{-6} Torr. By implementing scattering Scanning Near-field Optical Microscopy (s-SNOM), we can measure the optical response of nano-scale materials and structures with an optical and spatial resolution of 10nm. A tunable broadband IR laser source allows us measure such responses across a large spectral range. The capabilities of this instrument offer insight into a wide variety of previously unstudied systems. One prominent example is the study of phase transitions at low temperatures: better understanding this phenomenon may help explain superconductivity.

Erik will graduate from the University of Washington in June 2012 with degrees in Physics and Electrical Engineering. He has worked for Professor Markus Raschke, studying nano-optics, and Professor Boris Blinov, studying quantum computing. After graduation, he intends to pursue a Ph.D. in experimental physics, where he can apply his passion for discovery and innovation to fascinating new systems and ideas.

Cole Kazemba

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2009-2010 Astronaut Scholar, University of Minnesota
Georgia Institute of Technology

Performance Characterization, Sensitivity, and Comparison of a Dual Layer Thermal Protection System

With the goal of landing high-mass cargo or crewed missions on Mars, NASA has been developing new thermal protection technologies with enhanced capability and reduced mass compared to traditional approaches. Two examples of new thermal protection system (TPS) concepts are dual layer and flexible TPS. Each of these systems introduces unique challenges along with potential performance enhancements. Traditional monolithic ablative TPS, which have been flown on every Mars robotic mission to date, use a single layer of ablative material. The new dual layer TPS concepts utilize an insulating layer of material beneath an ablative layer to save mass. A study was conducted on the dual layer system to identify sensitivities in performance to uncertainties in material properties and aerothermal environments. A performance metric which is independent of the system construction was developed in order to directly compare the abilities and benefits of the traditional, dual layer and eventually, flexible systems. Using a custom MATLAB code enveloping the Fully Implicit Ablation and Thermal Response Program (FIAT), the required TPS areal mass was calculated for several different parametric scenarios. Overall TPS areal mass was found to be most sensitive to the allowable temperature at the ablator/insulator interface and aerothermal heat transfer augmentation (attributed here to material surface roughness). From these preliminary results it was found that the dual layer TPS construction investigated could produce improvements over a traditional TPS in the specified performance metric between 14-36% (depending on the flight environments and total integrated heat load expected) with nominal material properties.

Cole Kazemba is currently pursuing his Master's degree in Aerospace Engineering in the Space Systems Design Laboratory (SSDL) at Georgia Tech under Dr. Robert Braun. At Georiga Tech he is conducting active research on Rigid Deployable Aerodynamic Decelerators and the dynamic stability of Supersonic Inflatable Aerodynamic Decelerators (SIAD's): two key technologies related to entry, descent, and landing (EDL) for future atmospheric entry applications. Cole has interned in the research process laboratories of 3M (2008-2010) and at NASA Ames Research Center (2010) and will be spending the summer working at the NASA Jet Propulsion Laboratory (JPL). He was a 2009 Astronaut Scholar from the University of Minnesota where he received his B.S. in Aerospace Engineering and Mechanics in 2010.

Whitney Keith

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2010-2011 Astronaut Scholar, University of Central Florida
University of Central Florida

Simulating the Effects of Rocket Exhaust on Cratering

It is estimated that the rocket exhaust of the Apollo Lunar Landers dispersed soil, at speeds exceeding 1000 meters per second damaging nearby equipment. With the consideration of larger payloads for future space exploration, NASA is concerned about potentially hazardous crater formation on the landing surface, due to increased rocket thrust. Physical experiments are not possible to test. Hence, a math model for soil displacement and rocket exhaust pressure is used to predict the formation of a crater under various conditions. Two types of craters may be formed: (a) Bearing Capacity Failure (BCF), a depression on the surface of the soil and (b) Diffusion Driven Flow (DDF), a cavity formed by separation of soil within a granule bed. The purpose of this research is to numerically approximate under which conditions craters will form by BCF and or DDF. The results of this could be a deciding factor on whether NASA builds a landing strip on the Moon or Mars for future exploration. This is a work in progress.

Whitney Keith is a junior in Electrical Engineering at the University of Central Florida. For the past year she has been an undergraduate research assistant for the Department of Mathematics under Dr. Brian Moore. This summer she will hold an internship position with FORD Motor Company in Global Product Development. In Fall 2011 she will begin working as an undergraduate research assistant in the Electrostatic Discharge Laboratory at UCF under Dr. Juin Liou.

Trent C. Kingery

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1998-1999 Astronaut Scholar, North Carolina State University
U.S. Marine Corps; Vertical Views Photography

Aerials

Major Trent C. Kingery is a U.S. Marine that is currently stationed at Joint Base Andrews, Maryland. He is an Aircraft Commander for the UC-35C/D business jets that fly civilian dignitaries and military Flag Officers within the Continental United States and Abroad. As the UC-35 Maintenance Model Manager, Major Kingery was a key member on the $82M UC-35/C-26 Navy Light Lift contract source selection board. This was a continuous effort that spanned almost a year and was awarded on March 1st, 2011. As the Model Manager, he is also responsible for scheduling and tracking the UC-35 Aircraft Survivability Equipment modifications for the UC-35 fleet and dealing with the Program Office regarding any aircraft deficiency/safety of flight issues. As an aircraft commander, Major Kingery flew over 120 combat hours in the UC-35 in Afghanistan and Iraq in the spring of 2010. While in the U.S., he currently trains reservists that drill at JB Andrews. Major Kingery is planning to return to Naval Air Systems Command in Patuxent River, MD in the summer of 2012 to continue his career as an acquisition officer.

Trent started his own business in November 2010 performing aerial photography in Southern Maryland, Virginia, and Western North Carolina. This “hobby” matured into a full business due to people continuing to ask "how much" were his aerial photos. This new business also allows Trent to give back to the community. Currently, Trent is gives back by donating 10-35% of sales to local/national charities and churches. He also created local high school incentive flights programs that allow stellar high school students and faculty to fly along with him free of charge on his photo flights. On his website, there are over 1,000 photos posted of Southern Maryland, Annapolis, and Western North Carolina. Go to www.verticalviewsphotography.com or "Like" his business on Facebook at "Vertical Views Photography".

Jarret M. Lafleur

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2005-2007 Astronaut Scholar, Georgia Institute of Technology
Georgia Institute of Technology

A Markovian State-Space Framework for Integrating Flexibility into Space System Design Decisions

An increasingly common objective in the design of new space systems is the incorporation of flexibility, or the capability to easily modify a system after it has been fielded in response to changing environments or requirements. Despite widespread interest in the topic, today's techniques for designing flexibility into space systems tend to be qualitative, subjective, deterministic, single-objective, and/or limited to consider only one future time period. To address these gaps, a quantitative, stochastic, multi-objective, and multi-period framework for integrating flexibility into space system design decisions is currently under development. Founded on five steps, the framework recommends techniques for quantifying system transition costs, demand environment evolution probabilities, and system performance, and further for transforming the integration of flexibility into a problem that can be efficiently characterized using Markov decision processes. Overall, the framework enables the selection of systems today, tailored to a decision-maker's budget and performance preferences, that will be best able to adapt and perform in a future of changing environments and requirements. To date, the framework has been demonstrated in the context of current NASA challenges in selecting a human space exploration architecture.

Jarret Lafleur is a Ph.D. Candidate in the Space Systems Design Laboratory at Georgia Tech. He is a current National Science Foundation (NSF) Graduate Research Fellow and a former Sam Nunn Security Policy Fellow and National Defense Science and Engineering Graduate (NDSEG) Fellow. His initial research on space system flexibility was prompted in part by the Defense Advanced Research Projects Agency (DARPA) F6 fractionated spacecraft demonstration program. Jarret received his B.S. and M.S. degrees in Aerospace

Engineering from Georgia Tech in 2007 and 2009. In addition to NASA Johnson Space Center, he has worked at the Naval Undersea Warfare Center, NASA White Sands Test Facility, and NASA Jet Propulsion Laboratory. Jarret received the Astronaut Scholarship during 2005-2007.

Omar R. Mireles, Ph.D.

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2003-2005 Astronaut Scholar, Georgia Institute of Technology
NASA Marshall Space Flight Center

Mission Enabling Capability of Space Nuclear Systems

Space nuclear systems constitute an enabling technology for planetary exploration missions. Long duration power, advanced propulsion, and effective radiation shielding are critical areas that require solutions in order to achieve aggressive robotic and manned space flight missions. Dynamic radioisotope and fission systems are under development to enhance and advance mission operations. Research conducted at NASA and the Department of Energy focus primarily on non-nuclear experimentally based hardware demonstrations. The fundamentals of space nuclear systems are discussed as well as technology advances that are required to achieve operations beyond low earth orbit.

Omar Mireles works in the nuclear systems group at NASA Marshall Space Flight Center, conducting experimental materials testing and hardware demonstration of space nuclear power and propulsion systems. He holds B.S. degrees in mechanical engineering and applied mathematics from New Mexico State University, M.S. in mechanical engineering from Georgia Tech, M.S. and Ph.D. in nuclear and radiological engineering from the University of Florida. Work experience includes numerous NASA centers, universities, and the U.S. Air Force. When not working Omar enjoys skydiving (instructing and wingsuit), SCUBA diving, flying, and hiking.

David Montague

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2010-2011 Astronaut Scholar, University of Michigan
University of Michigan

L-Functions and the Relationship between Prime Numbers and Nuclear Physics

Prime numbers have been the object of mathematical study since the time of the ancient Greeks. In modern times, a great deal of progress has been made, and one of the most fundamental tools for such study today is a special class of functions known as L-functions. The zeros of L-functions have been known for some time to be intimately related to many key number theoretic quantities, most famously including the distribution of the prime numbers (via the Riemann hypothesis). One of the most surprising developments of the 20th century was relating the zeros of these ostensibly purely mathematical objects to something with a very real physical interpretation – the spacings between energy levels in large atomic nuclei. Some have conjectured that the discovery of this relationship may lead to a proof of many important mathematical conjectures. In this talk, I will briefly introduce this field of math and its relationship with nuclear physics, and will then discuss my current research in number theory, including the study of the analytic properties of certain families of L-functions, and the distribution of their zeros.

David Montague recently graduated from the University of Michigan with a B.S. in mathematics. In addition to participating in three separate summer research programs across the country, he served as teaching assistant for the four semester honors theoretical math intro sequence at the University of Michigan. During the 2011-2012 school year, he will attend the University of Cambridge as a Churchill scholar before returning to the USA in 2012 to enroll in Stanford's math PhD program.

Jocelyn Passty, Ph.D.

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2002-2003 Astronaut Scholar, University of Colorado
GE Aviation

Low Emissions Combustion Technologies for Propulsion & Aeroderivative Engines

GE Aviation drives combustion research developing cutting edge technologies in flight with innovation that has extended from small helicopter engines to the engines powering some of the largest aircraft ever to fly. The advanced concepts developed for flight also carry over into the power industry with several derivatives working to power everything from oil rigs to cruise ships. Many challenges underlie combustion design including balancing emissions, durability, and cost. The development of engines from a singular, annular design to the advanced TAPS combustion system showcases the exciting work that is ongoing.

Dr. Jocelyn Passty is a Lead Professional Engineer at GE Aviation working on advanced combustion technology. She currently designs combustors for large commercial aircraft and industrial power systems. Jocelyn was a 2002 Astronaut Scholar at the University of Colorado, and she graduated in 2003 with degrees in Math and Russian. In 2008, she completed a Ph.D. from Northwestern University in Mechanical Engineering, specializing in combustion science. She and husband Ben live in Cincinnati with their two cats and enjoy dancing, biking, and catching the Reds when they are in town.

Lisa A. Schott

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1987-1990 Astronaut Scholar, Georgia Institute of Technology
Quietly Making Noise, LLC

Technical Entrepreneurship

Many engineers embark upon an entrepreneurial venture sometime during their career. This might involve starting a new engineering consulting business from scratch, forming a partnership to provide a range of technical services, offering consulting services in a specific niche “on the side”, or pursuing consulting opportunities after retirement from a corporate or academic career. Successful entrepreneurship is extremely challenging, especially in technical fields.

Lisa Schott will discuss her experience in starting several businesses and the journey that eventually led her to successfully operate, for the long term, the two ventures in acoustics and noise control that best fit her expertise and personality. Through this presentation, she hopes to inspire other Astronaut Scholars to consider entrepreneurial ventures and to be available for advice and mentoring. She will briefly discuss Preparation and Conceptual Development, Startup, Building and Growing the Business, Ongoing Operations, and Exit Strategies. Also included will be “The Four Truths I Didn’t Believe … Until They Happened”.

Lisa Schott is President and Principal Acoustical Consultant of Quietly Making Noise, LLC, a company that she founded in 2002. She provides a wide range of acoustical consulting services to clients with residential, commercial, and industrial projects. She graduated with highest honors from Georgia Tech with a bachelor’s degree in Mechanical Engineering. She was an Astronaut Scholar from 1987 to 1990, serves on the Board of Directors of the Astronaut Scholarship Foundation, and served on the Scholarship Committee from 1991 to 2007. She was named the Engineer of the Year for Technical Excellence in both 2009 and 2010 by the Florida Section of the American Society of Mechanical Engineers and was appointed to the Council of Outstanding Young Engineering Alumni of Georgia Tech in 2005. She is on the Advisory Board for the George W. Woodruff School of Mechanical Engineering at Georgia Tech. She has written many technical papers on acoustics and holds U.S. Patent 7,562,743 for an Acoustical Window and Door Covering which is marketed as Shut-Eye™

Acoustical Shutters.

Andrey Shur

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2010-2011 Astronaut Scholar, Harvey Mudd College
Harvey Mudd College

Bioinformatic Analysis and Functional Characterization of the *Bacillus* sp. 6A3 Mercury Resistance Operon

Dissolved mercury is a potent toxin in marine environments. The mer operon, which confers resistance to mercury, has been extensively studied in Gram-negative bacteria. Here, I set out to functionally characterize the mer operon of *Bacillus* 6A3, a Gram-positive marine bacterium isolated from a mercury-contaminated salt marsh. One of my aims has been to study whether the operon is sufficient to confer mercury resistance in laboratory model organisms *E. coli* and *B. subtilis*. Another goal is to identify interesting structural features in the transport proteins that would be investigated in a future study.

Andrey Shur is a Biology/chemistry joint major at Harvey Mudd college graduating in May of 2011. At HMC he helped students hone their technical writing as the Biology Writing Fellow as well as organizing and developing the student machine shop as the Head Machine Shop Proctor. Besides biology, he is passionate about engineering and computer science, and loves to build robots and read science fiction novels in his free time. After graduation, he is going to go on to be a lab technician at UCLA for a couple years before applying to grad schools.

Fiona Turett

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2008-2009 Astronaut Scholar, Washington University in St. Louis
NASA Lyndon B. Johnson Space Center (JSC)

Space Shuttle Safety and Mission Assurance

Due to the complex nature of human space flight and the inherent hazards, it is important to understand the risks associated with Space Shuttle operation and mitigate the risks to the extent practical. Safety and Mission Assurance ensures that all hazards are identified, analyzed, controlled, and accepted by program management. This is accomplished using probabilistic risk assessment, fault tree analysis, hazard analysis, failure modes and effects analysis, and other techniques. Due to the operational nature of the Shuttle program, it also includes mission support and failure analysis.

Fiona Turett graduated from Washington University in St. Louis in 2009 with a degree in mechanical engineering. As an undergraduate, she was the project manager for a nanosatellite project which placed second in the Air Force Research Laboratory's University Nanosatellite Program. After graduation, she moved to Houston, TX to work at NASA's Johnson Space Center, where she currently works as a systems safety engineer. Her responsibilities include Space Shuttle propulsion and energy systems and Orion propulsion.

Lauren Wielgus

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2010-2011 Astronaut Scholar, Tufts University
Tufts University

The MINERνA Experiment: Studying Neutrino Interactions at Fermilab

Neutrinos, a type of weakly interacting, light, neutral leptons, are difficult to detect due to their low interaction cross-sections. The MINERνA, or Main INjector Experiment for ν-A, is equipped to study neutrino interactions with high resolution. The collaboration includes about 80 physicists from 21 institutions. Current neutrino cross-section uncertainties in MINERνA's 1-10 GeV energy spectrum range from 15-20% for quasi-elastic events (QEL), to 20-40% for resonance production, to even 100% for coherent scattering. MINERνA will reduce the uncertainties on these cross-sections through a precise study of neutrino interactions with a range of targets, and determine the dependence of neutrino interactions on the atomic number of the target material. The detector is equipped for full kinematic reconstruction of the charged final state particles. This data will be critical for current and future neutrino oscillation experiments.

Lauren Wielgus is set to graduate from Tufts University on May 22nd with a B.S. in Physics. Lauren first discovered her passion for physics research working in a polymer physics lab her sophomore year of college. She has also pursued a summer research project on gravitational waves at the National Astronomical Observatory of Japan in Tokyo, and completed a senior thesis on the MINERνA neutrino experiment at Tufts. She will be attending the University of Wisconsin at Madison Physics Ph.D. program in the fall, and plans to focus on particle astrophysics.