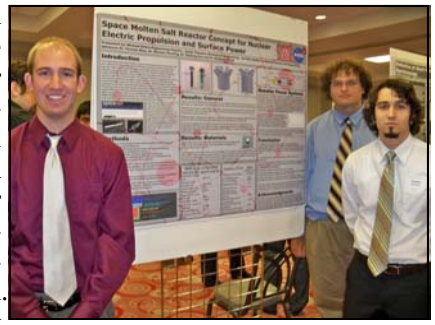
OSGC Observations
A publication of the Ohio Space Grant Consortium

Ralph Steckler Award– The Ohio State University and Wilberforce University

"Nuclear Power for Space Colonization Research and Technology Development, Phase I", The Space Molten Salt Reactor

By: Michael Eades

Undergraduate students (Michael Eades, Justin Flanders, and Niko McMurray) at The Ohio State University under the direction of Dr. Thomas E. Blue, Director of Nuclear Reactor Laboratory and Professor of Nuclear and Mechanical Engineering, working in collaboration with Edward Asikele and students at Wilberforce University along with their NASA Glenn Research Center Coordinator (Albert Juhasz) under the NASA Steckler Space Colonization Grant, have investigated how molten salt nuclear reactors with nuclear fuel dissolved in the molten salt can be applied to space colonization. They have developed a conceptual reactor design which they have named the Space Molten Salt Reactor (SMSR). Molten salt reactors that are similar in design to the SMSR have been built for non-space applications. These reactors have demonstrated high power densities, high temperature operation without pressurization, high fuel burn up and other characteristics that are ideal for space fission systems. However, little research has been published on the application of molten salt reactor technology to space fission systems.



Students showcase research on the SMSR at OSU's Undergraduate Research Day From left to right: Niko McMurray, Justin Flanders, and Michael Eades.

Winter, 2011

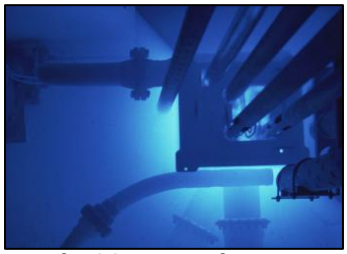
Inside this issue:

OHIO SPACE GRANT CONSORTIUM

History of the Molten Salt Concept

The Molten Salt Reactor (MSR) concept has been developed since the early 1950s. As a result, a body of relevant research exists upon which the SMSR can be built. Research into MSRs started as a part of a U.S. military effort to build an ultra-lightweight reactor for its Aircraft Nuclear Propulsion Program. The U.S. military wanted a reactor small enough to power an airplane, but one capable of doing so for several weeks of continuous flight. In this program, a land-based prototype 2.5 MWt reactor was built and tested in 1954. Designs were made for a prototype 60 MWt reactor. The program was canceled in favor of ICBM technology.

Work continued on MSRs at Oak Ridge National Laboratory (ORNL). The focus shifted from military to civilian applications. Specifically, it was noted that a MSR could efficiently breed U-233 from Th-232 with a thermal neutron spectrum. In this program, a 7.4 MWt reactor was built in 1964 and it ran for 5 years. In this time, large amounts of data were collected on materials, behavior of fission products, handing of fuel, and many other subjects. MSR research has continued and today there is renewed interest in the concept with MSR research being conducted at national laboratories and universities.



The OSU Research Reactor

Description of the SMSR

The SMSR is a conceptual space fission system with potential applications in surface power and nuclear electric propulsion in the 100kWe to 15MWe range. The SMSR utilizes a liquid fuel consisting of LiF-BeF_2-UF_4 with the uranium enriched to 97% U-235. The fuel is constantly circulating through the reactor core and other reactor systems, such as the heat exchanger. The core of the SMSR is almost entirely free of internal structure. The liquid fuel entirely fills the interior cavity of the vessel.

In a traditional solid fuel space reactor, solid fuel is placed in the core, heat is generated in the fuel, and that heat is transferred to a coolant that flows through the core. This establishes a number of contradictory goals for a space reactor. For example, to minimize shielding mass and the mass of the reactor vessel, it is desirable to have a small core volume, but for optimal heat transfer, a high surface area to volume ratio is desired for the solid fuel, thus increasing the size of the core.

The vision of the Ohio Space Grant Consortium (OSGC) is to enhance opportunities for all Ohioans to participate in NASA Science, Technology, Engineering, and Mathematics (STEM)-related research, education, workforce, and public service programs to build and sustain a diverse, well-prepared technical workforce for NASA and the Nation, and to lead in the promotion and development of aeronautics, space science and engineering, and earth science.

Director's Corner

It's been a little over a year since I assumed the title of "Director" of OSGC, and I guess to no one's surprise, the job has been very different from what I first envisioned! Thank goodness there is capable staff in Cleveland (Laura and Arela!) to help me out and keep things moving smoothly.

OSGC Director, Dr. Gary Slater, speaks to students at the OSGC Pre-Service Teacher Workshop held at OAI.

I (plus Laura and Arela) did pass our first hurdles by getting our five-year renewed funding of our base budget, and the final augmentation budget which arrived in September. Our scholarship and fellowship program, which I view as our hallmark effort, is in good shape with over 104 undergraduate and 11 graduate students currently being funded. (If your school has not filled their quota of scholarships--why not?) In addition, with the augmentation funds we were able to expand our scholarships for education majors. I attended the recent workshop run by Jim Fitzgerald at OAI, and the 21 students all seemed enthused about the program, and I believe will make a positive contribution in the K-12 education arena. Getting in touch with the education majors is not too easy for those of us in engineering--so if you can, please make an effort to establish contacts so we can continue to expand this program.

The next few months will be important for us as Congress is debating the funding bills for FY2011 (which of course is several months old already!) As I am writing this the current "lame duck" session is just getting started. How the old and new will work all this out, we just have to wait and see. As in past years there is specific mention of the Space Grant program in the NASA authorization, with different funding levels in the House and the Senate versions. The differences in these are reflected in the differences in our 2010 "base funding" and the "augmentation funding", so whatever comes out will certainly affect our future programs. In addition, the new Congress appears set on significant budget cutting. In one proposal, funding is to be set back to 2008 levels. If this occurs we will be back to the base budget of this year—without the augmentation funds. All we can do at this time is to point out to our legislative representatives the importance of what Space Grant funding achieves each year. The national Space Grant team is working hard to make sure the totality of our programs is made visible to our representatives in Washington.

The Obama Administration, including NASA Administrator Charlie Bolden, and Leland Melvin (the new Associate Administrator for Education) are seeking new directions and efforts in education funding. How this all comes out we will have to wait and see. My crystal ball is a bit fuzzy right now--but if I had to guess, I suspect we will have to deal with reduced budgets and an edict to increase efforts in K-12 and community colleges.

I am also looking forward to some of our collaborative programs, getting our website updated, and taking a month off in the Bahamas this Winter! (Note they have wireless on Elbow Cay in the Abacos, and I'll have my computer, so I can still claim I'm working a bit down there!)

We have made a few changes in our programs this year that I would like to summarize here:

- We have developed new grant application forms for faculty and student research and projects. They are just now being uploaded onto a revised website which we hope will open for business shortly.
- Due to increases in student fees, we added a supplemental to the basic stipend for graduate students to help with their fees. For next year we have changed the wording on the fellowship forms so that Ph.D. students, who have completed all credit hour requirements in their program, will not have to register as full-time students, thereby allowing them to eliminate or reduce their out-of-pocket expenses for fees. (They are still required to be full time on their research!)
- We have obtained additional money from NASA ESMD for additional summer internships. You will be getting (or have already gotten) information for your students regarding these opportunities. We are hoping to expand this effort in future years by working with more Ohio businesses. There are also a number of student opportunities through NASA Center internships, NASA Academies, and a new NASA Aeronautics Academy at Glenn Research Center and Langley Research Center. We will make these opportunities available to you and all OSGC students as they become available.

Mark your calendars for the 2011 OSGC Student Research Symposium scheduled for Friday, April 8, 2011, at OAI. Note that Diane DeTroye, Manager, Space Grant and EPSCoR Programs, NASA HQ Office of Education, is planning to attend. We are also having the AIAA represented and possibly some industry representation as well. If your schedules permit, we hope you can attend.

Please feel free to contact me at any time to talk about your ideas. In spite of the budget uncertainty I know OSGC will continue to thrive within our network of colleges and universities.

Sincerely,

Gary L. Slater, Ph. D.
Director
Ohio Space Grant Consortium
Email: gary.slater@uc.edu
Phone: (513) 556-3223

The Ohio Space Grant Consortium hosted the Eighteenth Annual Student Research Symposium on April 16, 2010. The day was filled with slide show and poster presentations from scholarship and fellowship recipients showcasing their research projects. This year poster presentations were evaluated and awards were presented for Best Junior Scholar (Sydney M. Barker, University of Cincinnati), Community College Scholar (Matthew J. Ourednik, Cuyahoga Community College), and Education Scholar (Kristin M. Elix, Ohio Northern University). During lunch OAI's President and CEO Michael Heil spoke to the group about leadership and encouraged them to continue pursuing their educational goals. This year's annual symposium will be held on April 8, 2011, at the Ohio Aerospace Institute in Cleveland. All OSGC students are requested to attend, and campus representatives and mentors are also encouraged to participate.

Ohio Senator Sherrod Brown visited the Ohio Aerospace Institute on May 24, 2010. Pictured with him are two OSGC scholars, Brittany Studmire (second from left) and Aimee Bogner (third from left).

OSGC and OAI co-hosted the HBCU Reception at the United States Air Force Museum in Dayton, July 7, 2010. Michael Heil, President and CEO, OAI (left), and Gerald Noel, Associate Director, OSGC.

NASA Aerospace Education Specialist Jim Fitzgerald speaks with students about NASA resources at the Pre-Service Teacher conference.

Education Scholars launch their rockets during the OSGC Pre-Service Teacher Workshop held November 12, 2010 at OAI.

Welcome New OSGC Campus Representatives!

OSGC is excited to offer a warm welcome to our new members!! We are also pleased to welcome back Roger Radcliff (Ohio University)!

John G. Weber, Ph.D.
Assistant Dean
School of Engineering
University of Dayton

Timothy Cameron, Ph.D.
Professor and Chair
Mechanical and Manufacturing Engineering
Miami University

Lesley M. Berhan, Ph.D.
Assistant Professor
Mechanical, Industrial, and Manufacturing Engineering Department
The University of Toledo

Jaikrishnan R. Kadambi, Ph.D.
Professor and Associate Chair
Mechanical and Aerospace Engineering Department

Visit http://www.osgc.org/ for more information about OSGC.

Interview with Chad O. Yoshikawa- OSGC Fellowship Recipient and Google Software Engineer

Chad O. Yoshikawa, an OSGC Fellowship Recipient from 2003-2006 shines as a prime example of what the OSGC Scholarship and Fellowship program works towards. Chad spent three years working towards his Doctorate in Computer Science at the University of Cincinnati while doing research for OSGC. Recently we were able to catch up with Chad, and he brought us up to date on his life since graduation and the perks of being a Google employee.

What made you decide to become a computer science major? What other areas interested you?

I was very fortunate to have great teachers and to be introduced to computer programming at a young age. When I was in elementary school, our school (Withamsville Tobasco) participated in a gifted program called SPAN where we were learned programming in BASIC. From that early experience I found that I really enjoyed the creativity of computer programming and so when it came time to choose a major I knew I wanted to study computing.

I was also interested in entomology and marine biology -- mostly because of the wildlife that was around the street where I grew up. Mechanical engineering/electrical engineering were also very interesting to me.

What do you consider your greatest accomplishment(s) in your college years?

My greatest accomplishment was winning the Everard M. Williams award for outstanding undergraduate in Computer Engineering at CMU. It was the culmination of four years of hard work and it was an honor to be recognized by the faculty.

Did you do any internships during college?

I had several internships during undergrad. My first was an internship with the Ohio Supercomputing Center (OSC) which paired me up with the Dr.'s Ghia in the Aerospace/Mechanical Engineering Departments at the University of Cincinnati. Following this, Dr. Urmila Ghia helped me get an internship at Lawrence Livermore National Lab in Livermore, California. Those experiences, being surrounded by graduate students and researchers, eventually led me to graduate school.

How did the research that you did with the OSGC Fellowship Program help in your career?

The OSGC Fellowship Program helped me tremendously. Without the fellowship, completing my PhD research at the University of Cincinnati would have been very difficult, and I'm sure my research would not have been as significant. The research that I performed under the OSGC Fellowship Program helped me learn about another area of computer science: theoretical computer science with an application of distributed networking and load balancing. Dr. Berman and I published some good results -- proving how certain network configurations are better than others -- in a few computer science conferences and the Journal of Combinatorial Optimization. Having this research background and experience helped me then get a job at Google.

Where have you worked besides Google?

Besides Google, I've worked at several high tech start-up companies before and after the dot-com boom/bust in the late 1990s. That was an incredibly exciting time and something that I'm happy to have been a part of -- akin to the gold rush of the 1800s.

What is the best part of being a Google employee?

The best part of being a Google employee is being able to have an impact, small or large, on so many people's day-to-day lives. Everyone at the company loves what they are doing and loves creating useful services, like Gmail, Google's search engine, and the Android operating system.

What kind of projects are you currently working on?

Currently, I work on Google Contacts -- a project that helps users maintain information about their friends, acquaintances, businesses, etc. Recently we launched an upgraded Contact Manager inside of Gmail.

What advice would you give to current computer science majors?

Try out a couple of theoretical computer science classes if you haven't already; the programming languages tend to change over the years (FORTRAN, C, C++, to Java) but the algorithms remain the same. Read up on approximation algorithms and online algorithms, e.g., online clustering algorithms. These are very relevant today because of the massive amount of data being operated on and the quick response time expected by users. A couple of practical books to read, that might not be on most course syllabi, include: Design Patterns by the 'gang of four', Effective Java by Josh Bloch, and any book on dependency injection frameworks such as Guice or Spring. (continued on page 5)

Interview with Chad O. Yoshikawa (continued)

How do you see the Internet advancing in the future?

Obviously the social aspect is pervading every piece of the Internet -- influencing your buying decisions through friend suggestions, entertainment through social-based online gaming, etc. So that will likely continue.

However, the biggest change, in my opinion, will be a result of increased bandwidth and processing power of personal devices like cell phones and video-enabled eye glasses: augmented reality. This, the layering of computer images on your field of vision, has roots in research that goes back at least a decade but is just now being made practical through improvements in hardware. Stores will be able to advertise with floating billboards, sports games can be played on a field with no equipment, consumers will be able to post reviews at the physical location of brick-and-mortar stores, etc. This will also spur on advances in computer security (preventing spamming of this augmented reality) and user reputation (being able to trust the information you see).

Personal Life- Hobbies/ Interests? Are you still a Bengals fan?

I'm a huge Reds, Bengals, Bearcats fan. Also, I recently started getting into saltwater aquarium keeping with a 'nano' 29 gallon tank. Still learning the hobby, but it's a lot of fun.

Personal life- Marriage/ Children?

My wife, Svetlana Strunjas, and I met in grad school at the University of Cincinnati. We're expecting our first child in June of this year.

Do you miss Ohio?

I do miss Ohio -- most of my family and many of my friends are in Cincinnati. Seattle is a great city, not too different from Cincinnati and Ohio in general, and many of the grad students in my group from the University of Cincinnati ended up here in the Northwest at Microsoft and Google. It doesn't rain as much as people think! Summers are completely dry and beautiful but we do get more than our fair share of rain in the winter.

I'd like to thank the Ohio Space Grant Consortium and in particular Laura Stacko, the late Dr. Kenneth De Witt, and Director Dr. Gary Slater for their generosity and hospitality over the years. I attended several of the OSGC meetings during the summer and always had a great time thanks to them. I'd also like to thank Dr. Urmila Ghia, Dr. Kirti Ghia, Dr. Ken Berman, Dr. Fred Annexstein, and Dr. Raj Bhatnagar from the University of Cincinnati for their help during grad school.

ESMD (Exploration Systems Mission Directorate) Summer Intern
Jesse E. Daniels– ZIN Technologies

Within my educational program at the Central State University, I was given the opportunity to intern at ZIN Technologies as a mechanical engineer located in Middleburg Heights. I had previous experience assembling and designing; in addition, I was greatly interested in working along with my supervisor on developing exercise equipment. Over the four months, I was working with Chris Sheehan, Nathan and Justin Funk on assembling, drawing schematics, designing, safety procedures and focusing on customer quality. The first couple of weeks I was assigned to assemble and to fix designs on the Egrometer which is an exercise bike. I also became familiar with Pro-E and a newer version of Master Cam which were used to draw and design.

The first project assigned to me was to develop a design of the CSLD (compact subject load design) which was to brainstorm and find the most compact way to attach the subjects harness to the CSLD while being suspended from the ceiling. The goal of this project was to find an efficient way to create a downward force as the subject runs on a vertical treadmill. The reason why the subject is running vertically is to implement no gravity. This design is going to be added into NASA's spaceship for the astronauts to exercise to decrease the effect of muscle and bone loss while in space.

The last project was to create pneumatic schematics for the OASIS (observation and analysis of Smectic Island in space) and the CSLD. When the CSLD was fabricated and assembled testing was done to ensure that all components were capable to handle design pressure with integrated safety factors. The schematics were used to give a brief summary of the design, specs and to show new users were the parts and custom parts are to be purchased.

In conclusion, I gained experience in designing in Pro-E, drawing schematics, familiarized with company procedures, and goals. I found that this experienced gained was very rewarding. In addition, I was able to relate course work material to my tasks at ZIN Technologies, and I have found great interest in working in the area affiliated with exercise equipment for a carrier option.

OSGC Summer Interns at NASA Marshall Space Flight Center

OSGC supported six interns at various centers and locations over this past summer.

Rachel Craft– Marshall Space Flight Center

Rachel D. Craft, a sophomore at Case Western Reserve University, spent her summer at NASA Marshall Space Flight Center in Huntsville, Alabama. Her work concentrated on Friction Pull Plug Process Control.

NASA Marshall Space Flight Center is the world's leader in the revolutionary solid state welding process called Friction Stir Welding (FSWing). As NASA expands its use of FSWing beyond linear welds, complimentary processes need to be developed. In the case of circumferential FSWs, a hole is left at the weld termination. To close this termination hole the Friction Pull Plug Welding (FPW) is required. This project will continue FPW development which not only includes a design of experiment approach toward establishing the acceptable process parameter window, but also enveloping the process sensitivity of the plug weld. Specific tasks include: establish test matrix using design of experiments (DOE), assist weld technicians in executing tests, document results, mark panels for post weld testing and weld characterization, compile data, document results and make final presentation to the Metals Engineering group.

Rachel worked under the direction of her mentor, Shane Brooke (EM32). Her project involves friction pull plug welding, which is used to repair or close out self-reacting friction stir welds. Basically, a metal "plug" is inserted in a hole in the weld and pulled through with great force while being rotated at high rpm. Along with the rest of her team, Rachel altered the current plug design in hopes of improving the weld process. The team made some test plugs, welded them, analyzed their weld microstructures, and looked for defects using nondestructive evaluation. They also tensile tested the plugs to determine their strength and compare it to that of standard plugs. From the data gathered, it looks like one of the plug designs is a failure, but the other two have promise. Shane plans to continue the research after Rachel's internship is over.

Rachel in TIG welding gear after learning how to TIG weld, holding a spatula made by welding together two pieces of Inconel, a Ni-based superalloy .

Courtnay N.C. Dollinger– NASA Marshall Space Flight Center

Courtnay N. C. Dollingner, a sophomore at Wittenberg University in Ohio, spent her summer at NASA Marshall Space Flight Center in Huntsville, Alabama, working with Dr. H. Philip Stahl on the Development of a Multivariable Parametric Cost Analysis for Space-Based Telescopes. Her assignments involved cost modeling work to develop a single variable cost model for normal incidence space telescopes to x-ray telescopes and develop a multi-variable cost model; and creating a horizontal sub-aperture test setup for an existing Zygo interferometer and computer generated hologram to measure the shape of x-ray mandrels.

Telescopes are always expanding the frontiers of humankind. The lessons learned, images produced, and theories challenged through the work of telescopes in the past have fascinated all humans, from the child who dreams about the images seen on NASA websites to the most intellectual and interested scientist. Unfortunately, science has constraints due to cost boundaries. Hence the necessity of understanding cost: creating a balance between the dream of scientists and the restrictions of the always limited budget. The cost of telescopes and factors that drive cost are important to the world of science to assist in creating a budget for a telescope that is best fit for a project. By analyzing collected data, statistical methods, paired with logic, can be used to determine what drives the cost of telescopes. Previous cost based models have focused their efforts on ground-based telescopes due to insufficient data for space telescopes and an existing precedence given to ground-based astronomy. Due to the growth of information and preference of space telescopes, the research and modeling shown in this project are driven towards space telescopes, though we can be guided by the understanding of ground telescope models. By separating the variables that effect cost, we advance the goal to better understand the cost drivers of space telescopes. The use of mathematics has an interesting relationship with science in this project and is part of a bigger picture—the significance of science versus money. An improved knowledge of cost could optimize science and create a harmony between the visions of scientists and the reality of a budget.

Courtnay and other interns at NASA Marshall Space Flight Center near the Optics Directorate.

Visit http://www.osgc.org/Opportunity.html for more information about Internships.

OSGC Summer Interns at NASA Marshall Space Flight Center

James C. Gallagher– John Hopkins Applied Physics Laboratory

James C. Gallagher, a senior at Ohio Northern University, spent his summer at the John Hopkins Applied Physics Laboratory studying Global Climate Change. Global climate change has been a topic of interest for many years. One of these effects is the cooling of the upper atmosphere. The collapsing of the upper atmosphere will affect atmospheric drag on satellites, so it is important to monitor this quantitatively. A long-term data set is needed for monitoring climate change because the upper atmosphere is greatly affected by the eleven year solar cycle, so the data must span several solar cycles. Several decades of data have been obtained ground based temperatures of the mesosphere using OH airglow. The problem is ground based observatories can only measure a temperature weighted by the OH emission rate profile. Since the OH emission rate profiles are subject to dynamical influences different from the temperature profile, making ground based mesospheric temperatures difficult to interpret.

Under the direction of Jeng-Hwa (Sam) Yee, James worked with data from the SABER (Sounding of the Atmosphere using Broadband Emission Radiometry) instrument on the TIMED (Thermosphere • Ionosphere • Mesosphere • Energetics and Dynamics) spacecraft. The satellite can provide temperature on OH emission rate profiles. Light produced by OH in the mesopause region of the atmosphere is used by ground based observatories to determine the temperature. The goal of this research was to use space based data to measure the OH emission rate and temperature profiles to assess the ground based observatories about possible misinterpretations they may observe. The results found that the OH emission rate profile is Gaussian shaped and SABER data was used to estimate what ground based observatories would report. Results show that on average the if the OH emission rate profile increases in altitude by less than 4 km while the temperature emission rate profile remains constant will result in a false decrease in temperature measured by ground based observatories. Increasing the width of the Gaussian has the same effect.

APL
The Johns Hopkins University
APPLIED PHYSICS LABORATORY

Eden F. Hummel– NASA Glenn Research Center

This summer Eden F. Hummel, a senior at Cleveland State University, had the opportunity to work with numerous people on varying projects pertaining to Photovoltaic Research Branch. Although Eden's assigned mentor was Mike Piszczor, she began the summer working aside Dave Scheiman who is also part of the Photovoltaic Branch. Working with him in the flash lab, Eden's main focus was to examine efficiencies and IV curves of provided solar cells. This data was measured at a 13 sun power level. Following this lab work, she continued examining solar cells in Microsoft Excel. Dave gave me previously obtained data to create numerous graphs comparing temperature to short circuit current, open circuit voltage, fill factor, and many other factors. Eden also developed graphs of the same factors, although in comparison to angle of incidents in previous tests taken of particular cells.

Towards the end of the summer Eden worked with Tom Kerslake from the Power and Communication Systems Analysis Branch. He has provided her with the task of developing a scalable LAPSS intensity map that can be applied to solar array panel, also referred to as gore, geometry during LAPSS testing. With this tool, a histogram of light intensity values experienced by cells in the solar cell string of interest will be produced. Following this work, Eden will calculate IV curves of solar cell strings under the LAPSS illumination field.

Ohio Wins NASA Exploration Systems Mission Directorate (ESMD) Grant!!

OH-SPACE! is a student summer internship program funded through NASA Exploration Systems Mission Directorate which focuses on research exploration with Ohio industry partners.

Students will be selected for hands-on experience working with one of the five partner companies. Ideal candidates will be undergraduate (beyond Sophomore year) students pursuing an engineering degree in a STEM-related field. Women and minorities are especially encouraged to apply. Chosen applicants will be expected to work full time with an industry partner for 10 weeks during the Summer , 2011 (or other arrangements can be made with the individual company). Students will be paid an $8,000 stipend.

The OSGC is excited to partner with the following five companies during Summer, 2011: Cornerstone Research Group, Inc. , Etegent Technologies , L-3 Cincinnati Electronics, Sierra Lobo, and ZIN Technologies.

Visit http://www.osgc.org/Opportunity.html for more information about Internships.

Robyn L. Bradford- NASA Academy

Last summer, OSGC was proud to support Robyn Bradford, a graduating senior finishing her Bachelor of Science Degree in Manufacturing Engineering at Central State University, as a participant in the NASA Academy at the NASA Glenn Research Center. Robyn tells us about her experience in the Academy, and her current research for OSGC.

So, what did you do for your summer vacation?

Everything! Last summer, I was a NASA Academy intern with the NASA Glenn Research Center in Cleveland, Ohio. My position was as a research associate for the Bio Science and Technology Branch. The NASA Academy was a crazy-busy and exhilarating ten weeks that emphasized group and individual supervised research, teamwork, and leadership.

For my individual research, I studied cobalt/alumina catalysts and the role they play in alternative fuel production via the Fischer-Tropsch process, a series of chemical reactions used in gas-to-liquid technology. The objective was to qualitatively construct calibration curves to link surface area to the amount of cobalt metal present in various species of cobalt/alumina catalysts. For the group project, my fellow interns and I chose to research and design a habitat to support NASA's exploratory missions. The title for the project was: Modular Adaptive Space Environments (MASE): A Universal Infrastructure.

I attended seminars, discussion panels, met top NASA officials, and traveled with my internship group. We went to California to tour Space X, the Jet Propulsion Lab, and Dryden Air Force Base. In Florida, we visited Kennedy Space Center, and in Maryland we went to Goddard Space Flight Center. Of course, the summer was more than just work. We had lots of fun too: skydiving, go-kart racing, putt-putt, cook-outs, fireworks for the 4th of July on the Mall in D.C., Cedar Point, paintball, and the list goes on. It was incredible! We even conducted an outreach project for 3rd through 6th graders through a local YMCA.

I enjoyed my experience so much, that I now serve on the NASA Academy Alumni Association's Recruitment Committee to help connect future interns with NASA Academy opportunities.

What type of research are you involved in for OSGC?

I've been researching protein crystallization since the fall of 2007 with my chemistry professor as principal investigator. The objective is to investigate the effects of pH and protein concentration on the process of crystallization in an effort to develop a reliable, yet economical protocol for growing large, high-quality protein crystals. We have already identified optimal conditions for protein crystal growth and are now in the process of designing and implementing experiments to test whether crystals will grow consistently.

What advice do you have for students entering the engineering field?

Start preparing yourself to be challenged. Look for real-life problems and start thinking about how you might solve them. Open your mind to new ways of thinking; and entertain thoughts of the unimaginable, because that's where innovation lives. And of course, apply to the NASA Academy because the experience will push you beyond your own expectations and open doors beyond your wildest dreams.

How has the OSGC scholarship been beneficial in your academic journey?

Having the financial support of the OSGC scholarship has been so valuable. I am using the funds for the 2010-2011 academic year to purchase data acquisition components for my senior design project. You can't imagine how much this stuff costs! Also, the experiences that I have gained through the research process and presenting at the annual symposiums have been invaluable. I definitely feel that my research activities have matured because of the practice and projects that I have been working on for the OSGC.

What did you enjoy most about your time at the Academy?

I would have to say, the variety of research, recreation, travel, and teamwork experiences that I was given through the Academy.

What are your future plans?

After I receive my Bachelor of Science Degree in Manufacturing Engineering, I plan to attend graduate school to obtain my Master's and Doctoral Degrees in Materials Engineering. I would like to work with NASA, in academia, or with one of the government labs as an engineering research scientist.

		
NASA Goddard	Aviation Museum	Kennedy Space Center - Standing underneath the Shuttle

Visit http://academy.grc.nasa.gov/y2010/profiles for more information on the NASA Glenn Academy.

Interview with Ashlie B. McVetta-
Former OSGC Scholarship Recipient and NASA Civil Servant

Ashlie B. McVetta was an OSGC Scholarship Recipient from 2003-2007 beginning as OSGC's first Bridge Scholar after graduating from high school. As an OSGC Bridge Scholarship recipient, Ashlie worked at NASA Glenn Research Center for two summers after completing her freshman and sophomore years at The University of Toledo and continued her research during her academic school year. Ashlie then received a Junior and Senior scholarship from the OSGC receiving a NASA/OSGC scholarship for all four years of her undergraduate education. She graduated from The University of Toledo in 2007 with a Bachelor of Science Degree in Mechanical Engineering. Since graduation, Ashlie worked for Jacobs Technology, Inc., as a government contractor for NASA Glenn Research Center. Recently, she took on a new position as a NASA Civil Servant in the area of Turbomachinery and Heat Transfer at the NASA Glenn Research Center as a Mechanical Research Engineer.

What sparked your interest in mechanical engineering?

Actually it was when I was about 6 years old, I was watching a National Geographic anniversary special about Apollo 11 and it completely captivated me. Since then I was hooked on stars and space and wanted to be an astronaut (or an Astronomer, I thought it was the same thing back then). As I got older my career aspirations matured I knew I wanted some kind of job that would allow me to work at NASA. In the 6th grade I was thinking about Meteorology but my cousin was going to school for Agricultural Engineering so engineering kind of came up. From 6th /7th grade on I wanted to be an Aeronautical Engineer. In high school I began exploring schools and began interning at NASA Glenn. I also had other interests in life; I loved cars and thought it would be neat to design tractors so I decided Mechanical Engineering was a broad enough major to be able to explore other opportunities if NASA didn't work out.

What was your research as an OSGC scholar based on?

The first year as a scholar my research was based on the work I did at NASA Glenn in The Multistage Compressor Facility. The remaining time as a scholar I focused my research on the design of the Powertrain system and a developing carbon fiber suspension for a student built FSAE (Formula Society of Automotive Engineers) Formula Car I participated with in college.

How do you feel that being an OSGC scholar helped advance your education/ career?

The OSGC helped me grow as an engineer with encouraging the research projects, networking with a diverse group of students and professors, and I gained confidence in myself as an engineer.

Any plans for future education/ career moves?

I would like to pursue a Master's Degree in Aeronautical Engineering. As far as career moves I would like to stick with NASA. It is such a great and interesting place to work.

Do you have any advice for engineering students today?

I think the biggest thing for engineering students is to prepare for your future. Especially now with the tight job market, as an engineer you need to market yourself and make yourself stand out. I think networking and involvement are two big keys to being a successful engineer and finding a job. Find a Co-op/internship and establish contacts; join an engineering club or group; attend conferences; or get involved with research. These are all ways to help get your name out there and gain experience that will help make you a more desirable engineer.

University of Cincinnati OSGC Scholar Selected as NASA Space Science Student Ambassador!

Congratulations to Davin C. Flateau for being selected as one of 50 students nationwide to represent the State of Ohio in NASA's Space Science Student Ambassadors Program! The Program is intended to engage university students to conduct activities that are designed for participation in NASA's Space Science educational activities and to help generate excitement about NASA scientific discoveries in space science (astrophysics, planetary science and heliophysics). Davin is a senior at the University of Cincinnati majoring in Physics. As a participant in the program, Davin will receive a stipend of $2,000 and up to $600 for travel and supplies. Davin shared the following summary of his experiences:

We've recently seen an explosion of discoveries of planets around other stars. New planets are being discovered at an exponential rate, most notably by the Kepler mission, which is slated to discover thousands of planets over the next few years. I'm currently investigating how small telescopes can successfully observe planets in other star systems passing in front of their stars. These planets are aligned just right to our line-of-sight so that they pass in front of their star from our point of view. Such planets are called "transiting extrasolar planets", and they're detected by watching the light from their host star dim ever so slightly as the planet passes in front of the star. From the nature of the dimming, we can figure out a lot about the planet, including size, mass, orbital period and its distance from its sun.

Because these events can be observed by small telescopes, I think this is an excellent opportunity for high school students to get directly involved in science. Astronomy is one of the few disciplines where "amateurs" with modest equipment often participate in gathering meaningful data, and even make exciting discoveries. Getting students directly involved with science is an important way toward sparking their interest in careers in math, science and engineering, and taking direct measurements of extrasolar planet transits, and even working toward looking for new planets, is a great way for them to get excited about scientific careers. In other words, they can see themselves doing it for a living.

I'm going to be working with high school teachers on how their students can observe these transits and analyze the data, through remote telescopes they can access via the internet, or even with telescopes of their own. A website will be the key to providing information and training materials toward this goal, and for teachers to network with each other. I'm also interested in facilitating partnerships with existing organizations in astronomy research and education toward this goal. This will be an ongoing project long after my Space Grant scholarship ends, but someday soon, I hope that a whole new generation of budding scientists will begin to be inspired by getting directly involved with the most exciting scientific discoveries of our time.

iSPACE Takes Initiative in Female STEM Education
Space: A Girl's Frontier

This past August, some very special girls converged on iSPACE where they engaged in a fun-filled, jam-packed week of hands-on STEM learning.

Thanks to a grant from the Ohio Space Grant Consortium, iSPACE was able to provide *Space: A Girl's Future*, a summer camp for forty 5th through 8th grade girls from the Greater Cincinnati Region.

The girls learned about our universe as astronomers do by observing light in a variety of ways. Participants "listened to light" (infrared) using an amplifier and remote controls for TVs, used indicator beads to observe presence of ultraviolet light even on very cloudy days, and made their own spectroscope for viewing the spectrum (ROY G BIV) in visible light. They then learned about some of the space exploration missions that are actively discovering information about the universe by gathering light in these ways. (SOHO, SOFIA, HERSCHEL, etc.)

They also designed, built and programmed robots to carry out specific tasks. This encouraged them to utilize various problem solving skills while simultaneously requiring them to master a number of mathematical and scientific concepts. Furthermore, the concept of a "robot" itself conjures up social and emotional images that beg questions such as, "What impact will robotic technology have in the working world?" or "Is it ethical to replace humans with robots?"

They investigated Newton's Laws of force/motion utilizing paper rockets with air launchers and experimented with activities in air pressure and Bernoulli's Principle and aeronautics basics. They explored topics relating to manned and unmanned flights such as reduced gravity and launch recovery systems by designing launch recovery systems and participating in V.E.E.P. (Vertical Egg Experiment Project).

Most importantly they made new friends and discovered that STEM could be their future.

Preliminary results based on pre and post assessments:

*100% of the girls showed increased content knowledge

*97.5% demonstrated an increased awareness of STEM careers

*72.5% of the girls showed an increased interest STEM careers

*67.5% said they thought they had the capacity to learn the skills needed for a career in science and/or engineering.

About iSPACE, Inc.

iSPACE, established in 2001, is a 501(c) (3) non-profit science center located in Sharonville, Ohio, on the campus of Scarlet Oaks. This organization provides interactive, hands-on/minds-on inquiry based programs aligned with state and national standards for students, educators, and families in 16 counties in the Greater Cincinnati region. iSPACE utilizes space and aeronautics as themes that inspire students in science, technology, engineering, and mathematics education, to improve academic performance, and to create career awareness in these areas.

New OSGC Grant Opportunities

OSGC has reformatted their Grant Program (formerly known as "Seed Grants") to include new opportunities for faculty and students at Ohio member universities. All grant opportunities are open to U. S. citizens. Non-U. S. citizens may participate, but cannot directly receive salary remuneration from NASA funds per the requirements stipulated by the OSGC NASA Training Grant.

•Faculty Research Initiation Grant Proposal (FRIGP) → **Proposal Deadlines: October 1 and April 1**

FRIGP is specifically meant as "seed funding" for untenured faculty to support new, innovative research to provide necessary results for a regular research grant opportunity with a funding agency such as NASA, NSF, etc. Funding is restricted to one year. Total OSGC budget request limited to $25,000.

•Curriculum Innovation Proposal (CIP) → **Proposal Deadlines: October 1 and April 1**

CIP is to support new, innovation curriculum development to support the development of STEM higher education in areas supported by NASA. Curriculum developments that that can be shared with other schools are especially preferred. Total OSGC budget request limited to $10,000.

•Student-Innovative-Creative-Hands-on Project (SICHOP) → **Proposal Deadlines: None**

SICHOP is specifically to aid in funding for undergraduate student "hands-on" projects. This can be an individual or a group project. A faculty mentor is required. Total OSGC budget request limited to $10,000.

•Informal Education Innovation Proposal (IEIP) → **Proposal Deadlines: None**

IEIP is to support informal education activities that support STEM education in areas supported by NASA. Collaborative proposals involving a combination of participants and ones that can be shared with other organizations are especially preferred. Total OSGC budget request limited to $5,000.

For more information, please contact the OSGC Main Office at (440) 962-3032 or email at osgc@oai.org

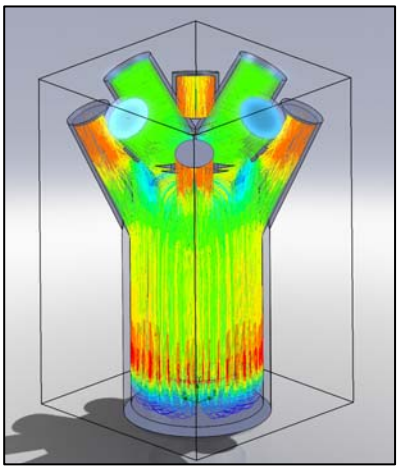
Visit www.ispacescience.org/index.php for more information about iSPACE.

Ralph Steckler Award (continued)

As another example, non-fissile neutron absorbing structures that are internal to the reactor core are detrimental to maximizing fuel burn up for the core, but the fuel clad is a non-fissile neutron absorbing internal structure which is a standard structure for a solid fuel reactor**.** The SMSR avoids this difficult optimization problem by moving the process of heat transfer outside of the core. In the SMSR, heat is generated in the core, and then the fuel flows out of the core into a heat exchanger to be cooled. No major cooling of a differential volume of fuel occurs until the fuel volume leaves the core. This allows the core to be mainly optimized for neutronics and the heat exchanger for thermal-hydraulics.

Properties of the SMSR

The SMSR core is about the size and shape of a medium sized office trash can, with a length of 74 cm and a diameter of 38 cm. Its size and mass are comparable to other proposed space fission systems that operate in the same power range. The core is made of silicon carbide composite. Power conversion can be achieved with either Brayton or potassium Rankine cycles.



A Computational Fluid Dynamics Model Showing a Velocity Profile of the SMSR's Core. Red Lines Indicate Areas of Faster Flow and Blue Lines Indicate Areas of Slower Flow.

A very important property of the SMSR is its high fuel burn up. In a solid fuel reactor, the physical limit of fuel burn up is usually determined by fuel-clad lifetime. In a molten salt reactor, no such limit exists because the fuel has no clad or organized structure which can degrade with increasing burn up. In addition, the lack of non-fissile internal structures, such as the clad, creates a neutronic environment that can better utilize fuel. Analysis with a Monte Carlo radiation transport code (MCNPX) predicts a burn up for the SMSR that is up to 5 times that of space fission systems of similar power levels.

Another beneficial result from utilizing a liquid fuel is that the SMSR is very self regulating. The SMSR fuel expands rapidly when heated. As the fuel expands, portions of the molten salt are pushed outside of the core. This creates a condition with less uranium in the core to fission and less moderation from the lithium and beryllium in the salt. The net result is a very large negative temperature reactivity feedback with a reactivity feedback coefficient of approximately 1.5-1.8 Cents/K. This reactivity feedback coefficient is about a factor of 10 times greater than the reactivity feedback coefficient for solid fuel space fission systems of similar power, which makes the SMSR very stable in its operation.

To minimize size and mass, space fission systems must use weapons grade uranium. For this reason, the SMSR was developed with three proliferation resistant features. The first of these is its high fuel burn up. With a high fuel burn up, the SMSR can perform the same mission with less weapons grade uranium. The SMSR's fuel is a liquid that can easily be pumped into the core at any point of assembly, even in space. This allows for mission and development architecture where the fuel is handed and manufactured in a facility equipped to handle special nuclear materials and the core and space hardware are assembled elsewhere.

The most unique proliferation resistant feature of the SMSR is poisoning of the highly enriched uranium with a few parts per million of U-232, which cannot be easily separated from the weapons grade uranium. An isotope in U-232's decay chain emits a very high energy gamma ray that makes the SMSR's fuel easier to track. Furthermore, if stolen, the SMSR's fuel would be less desirable for use in a nuclear weapon, because the high energy gamma rays could potentially damage the electronics in the weapon.

Students from Wilberforce University look into the reactor pool during an Irradiation.

Currently, students and professors are in the process of writing a proposal for Phase II of funding from NASA. If awarded Phase II, students will expand their analysis with more computationally intensive models that will be run at the Ohio Supercomputer Center. Research relating to the SMSR has been presented at OSU's Undergraduate Research Day and NASA's Phase I Steckler Forum and has been accepted for presentation and publication at the Nuclear and Emerging Technologies for Space. Students from Wilberforce University, under the direction of Dr. Edward A Asikele were also engaged in the research project.

A new proposal "Nuclear Power for Space Colonization Research and Technology Development - Phase II" was recently submitted to NASA seeking funding.

The Ohio Space Grant Consortium is now on Facebook and Twitter!

facebook

"Like" OSGC on Facebook to stay up to date with the most current Space Grant and NASA news and opportunities. You can also follow OSGC on Twitter @OSGC1.

twitter

Check out http://www.osgc.org/ for more information about OSGC.

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Ohio Space Grant Consortium Membership

Affiliate Members:
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- Ohio Northern University
- The Ohio State University
- Ohio University
- The University of Akron
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- Miami University
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