



Affiliate Members

- Air Force Institute of Technology
- Case Western Reserve University
- Cedarville University
- Central State University
- Cleveland State University
- Ohio Northern University
- The Ohio State University
- Ohio University
- The University of Akron
- University of Cincinnati
- University of Dayton
- The University of Toledo
- Wilberforce University
- Wright State University

Participating Institutions

- Marietta College
- Miami University
- Youngstown State University

Community Colleges

- Columbus State Community College
- Cuyahoga Community College
- Lakeland Community College
- Lorain Community College
- Owens Community College
- Terra Community College

Community Liaisons

- Drake Science Center
- Walter R. Schuele Planetarium

Government Liaisons

- NASA Glenn Research Center
- Air Force Research Laboratory

Lead Institution

Ohio Aerospace Institute (OAI)

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OAI Collaborates to Explore Algae as Renewable Fuel



The Ohio Space Grant Consortium's lead institution, the Ohio Aerospace Institute (OAI), is participating in a collaborative effort to advance research in Ohio pertaining to algae as a renewable fuel source for aviation vehicles. Viewed as a high-potential project, Congress appropriated funding for 1 year through the 2009 Department of Defense Appropriation Bill. This funding was subsequently awarded to three Ohio non-profit organizations (OAI, Edison Materials Technology Center – EMTEC, and the Center for Innovative Food Technology – CIFT) by the Air Force Research Laboratory at Wright-Patterson Air Force Base. OAI project manager, Carol Cash, along with Ryan Noble, an aerospace engineer, and Daniela Ribita, a chemical engineer, are working with CIFT and EMTEC to explore the technical and economic feasibility of producing jet fuel from algae in Ohio.



Algae to Fuel Team at OAI: Top (Left to Right): Michael Heil, Carol Cash, and Donald Majcher. Bottom (Left to Right): Ryan Noble and Daniela Ribita.

Ohio is a major manufacturing and electricity-generating state with many industries that produce heat along with energy. This waste heat could potentially be used as a thermal control source during the algae growth stage. In addition, portions of Ohio along the Ohio River rank very high in carbon dioxide production and emissions. These waste streams could significantly contribute to enhanced algae growth, as carbon dioxide is an essential nutrient for algae. Furthermore, Ohio's extensive range of flat agricultural fields may be used to produce as much as 100 barrels of algae oil per acre per year. Optimization of technology within this field could result in substantially high annual returns on a per acre basis for algae farmers.

Algae are considered to be a very promising renewable fuel source because of their ability to replicate quickly and produce significant quantities of oil. The process of converting algae into fuel involves the growth of algae species either in man-made raceway ponds or photo-bioreactors. Once at an appropriate growth stage, algae can be harvested and isolated through a dewatering process. Natural oils are then extracted from the algae and sent to a refinery for processing into fuel or other products, such as bio-gas or plastics.

While algae are a potential fuel source, algae growth and the subsequent oil extraction are processes not necessary in crude oil-based fuels where oil is obtained directly from the ground. To determine the degree of environmental impact these additional processes may have on producing algal oil in Ohio, Daniela, the project engineer, has been investigating life-cycle analysis models which could further be developed and used in both economic and environmental studies. Data for these studies will be obtained from Ohio organizations that are actively growing algae and extracting the oil, including Phycal, Univenture, Independence Bioproducts and the University of Toledo.



Ryan Noble and Daniela Ribita at OAI.

Various Ohio entities will need to collaborate and benefit from each other's resources in order to economically optimize large-scale algae growth and extraction processes. Ryan Noble compiled a database of Ohio companies who provide a wide range of products and services including: fertilizer, waste water, old and novel technologies, automated process control, and chemicals, to name a few. Through an organizational workshop to be conducted in spring 2010 at OAI's Cleveland location, this stakeholder database will be used to explore the interest and capabilities of local businesses in developing a new industry sector in Ohio.

Ashley M. Verhoff, University of Cincinnati

Winner of the 2009 Herman Schneider Award

Ohio Space Grant Consortium Scholarship Awardee

Growing up near Wapakoneta, Ohio, Ashley Verhoff developed a passion and respect for the universe early in life. As an elementary school student her class took frequent trips to the Neil Armstrong Air & Space Museum inspiring Ashley's dream of working with NASA as an astronaut. She fondly remembers the support of her family, waking her in the middle of the night for meteor showers and glimpses of far off planets.

After graduating as Valedictorian from Kalida High School Ashley incorporated her love of the night sky with a passion for mathematics, science, and physics by beginning undergraduate studies in Aerospace Engineering at the University of Cincinnati (UC).

Ashley received an OSGC scholarship her junior and senior years at UC. As a junior she presented research pertaining to "Optical Tracking and Verification for Autonomous Satellite Research." Her senior year she concentrated on "AEROFLO Computational Fluid Dynamics Software and Separated Flow inside an LPT Cascade."

In 2006, Dr. K. N. Ghia informed Ashley about a co-op opening at the National Air and Space Intelligence Center. She interviewed the same day and was accepted for the position.

Ashley spent her first two co-op quarters

in 2006 at the National Air and Space Intelligence Center at Wright-Patterson Air Force Base where she focused on analyzing aerospace intelligence for use in military operations and foreign policy.

"Ashley's work was so rich with analytical discoveries that her work received much visibility across the senior levels of the US National Space Security Community. NASIC thought so highly of the work Ashley had developed that she was asked to develop a briefing to give to a space intelligence conference that is held only once every 18 months. Ashley provided a stellar presentation to the conference and several senior analysts from other intelligence agencies and even heads of delegations from other countries raved about her analytical discoveries and the processes that she initiated to satisfy some of the major intelligence gaps we had at the time."

-Mr. Chirag Parikh

Her remaining four quarters in 2007 and 2008 were spent at NASA Glenn Research Center with the Mechanical Components, Bioscience and Technology, and Space Propulsion Branches. Her first two quarters were spent researching lunar dust in relation to the design of

equipment for future missions of extended duration. Ashley did extensive research into the effects of lunar dust on polymer seals of the Low Impact Docking System that will be used for docking and berthing between the Orion Crew Exploration Vehicle and the Altair Lunar Lander. She also subjected human lung epithelial cells and mouse macrophage cells to lunar dust constituents to evaluate their vitality.

Her final two quarters were spent in the Space Propulsion Branch where she assisted in the design, testing, and analysis of the boilerplate Crew Module Reaction Control System thrusters to be used on the Ascent Abort-a flight that will test the Launch Abort System that will propel the crew to safety in the event of complications.

Ashley was also involved with the analysis and design of a rocket engine injector that could be used with methane fuel and analysis of data which will validate

analytical models of dynamic response of the Orion Service Module Propulsion Subsystem.

She describes the opportunity to impact the aerospace community before graduation as the best part of her co-op experience.

In 2009 Ashley was selected to receive the prestigious Herman Schneider Award. This award is presented annually to a student that demonstrates exceedingly distinctive leadership qualities while completing their co-op assignments. She was also selected to receive the Presidential Leadership Medal of Excellence and the Bradley Jones Award from the University of Cincinnati. Ashley was also involved in achievements of the UC RockCats Team at the 2009 Praxis Battle of the Rockets (see page 7)

After completing her current co-op at NASA Glenn, Ashley will begin doctoral studies in Aerospace Engineering at the University of Michigan, focusing her research on rocket propulsion and hypersonic flight. She plans to return to NASA Glenn after graduation and hopes to one day inspire future generations of engineers as a professor.

OSGC is proud to have supported Ashley through her undergraduate years, and we are excited to see her excel in the future!



Ashley in the lab at NASA GRC

The University of Akron Robotics Team

A Seed-Grant Awarded to The University of Akron

By: Thomas V. Vo, Electrical Engineering, Masters Program

Over the past few years it has been amazing to watch the Robotics Team at The University of Akron grow. For the past year I have been working as the graduate advisor of this group with our faculty advisor, Dr. Tom Hartley. The robotics team has been no stranger to competition over the years, but our most notable achievements thus far took place at Robo-Games 2009.



Robo-Games is basically the "Olympics" of robotic competitions and was held this past June 12-14 at Fort Mason Festival Pavilion in San Francisco, California. To name a few, categories in this year's competition included various sized combat, sumo, stair climbing, fire fighting, ribbon climbing, and bartending robots. Our team entered six robots in five categories and placed gold with Daedalus I (Maze Solving), silver with Juggernaut (340 lbs Combat) and Selene I (Ribbon Climber), bronze with and Z Tank (3kg Autonomous).

The United States claimed complete domination of this Olympic competition finishing with, 31 gold, 30 silver, and 24 Bronze medals.

In addition to my role as graduate advisor of the robotics group, I am also working with high school students through the NASA/OSGC/University of Akron Collaboration High School Summer Bridge Internship Program. Students in this program are working on the development of a humanoid robot that will compete in the Kung Fu event at the 2010 Robo-Games, scheduled to take place this spring in San Francisco. I think it's great that high school students have an opportunity like this to get involved with robotics. It is also nice to be able to contribute to the OSGC program, which has really helped me along the way.



For more information on how to compete in the 2010 Robo-Games please visit :

<http://robogames.net/index.php>



The University of Akron Robotics Team at the 2009 Robo-Games



OSGC Co-Hosts HBCU Conference at OAI



OSGC co-hosted an HBCU conference held at the Ohio Aerospace Institute in July. The two-day event included sessions with Mr. Vernon Wessel, Associate Director at NASA Glenn, Mr. Joe Gordon from the Air Force Research Laboratory, and various technical sessions.

The second day concluded with a job fair showcasing education and employment opportunities to participants. To name a few, representatives from NASA, AFRL, The University of Akron, The University of Toledo, Miami University, and the Ohio State University were on site to talk with students and hand out information about programs and job opportunities.



OSGC also distributed scholarship and fellowship information and was able to introduce many students to the Space Grant network that pertained to their respective states. The University of Akron's new campus representative, Dr. Craig Menzemer (pictured left with Julie Zhao) was also in attendance to discuss programs at UA with students.





Summer Interns



Joshua E. Allen – NASA Glenn Research Center

After graduating from Solon High School. Joshua Allen's love of math and computers led him to pursue Computer Engineering at Wilberforce University.

Currently a senior, Joshua has been working in a co-op program under the instruction of Ms. Lynda Elonen Wright as a student engineer trainee at NASA Glenn Research Center (GRC).

As a junior, Joshua interned with Science Application International Corporation (SAIC) where he mastered the art of writing programming code. While working for SAIC Joshua came in contact with Ms. Wright, who

runs the co-op program at NASA GRC. He sent his resume and received an acceptance letter a few months later.

He currently focuses on supporting the data systems branch of the testing division, implementing software and hardware for Labview, and taking inventory of data systems hardware to prepare for security audit of experiments.

While at GRC, Joshua participated in a class that detailed the history of the center and took a tour of the major facilities

Joshua will be working as a Co-op at Glenn until he com-

pletes undergraduate course work in 2011. After his co-op is complete he hopes to secure a full time position at Glenn.



Matthew D. Rippl – Air Force Institute of Technology

Matthew D. Rippl finished his undergraduate studies in Mechanical Engineering at Wright State University this spring and spent his second summer as an undergraduate intern at the Air Force Institute of Technology (AFIT).

Matthew's interest in Mechanical Engineering was influenced by experiences as a child accompanying his father to work on a ship at a base in Columbus. Matthew remembers his dream of becoming an Engineer coming to life as he explored tanks and Hummers and even got to take a few rides

Working with Lt. Col. Frederick Harmon and Lt. Ryan Hiserote this summer, Matthew has been responsible for investigating the feasibility of a Hybrid Electric Propulsion System for small aircraft. Developing a familiarity with the facility and staff at AFIT over the years has given Matthew the capability to complete his research efficiently. By the end of the summer he hopes to have developed a working prototype for testing in the lab.

Matthew recommends AFIT highly to other students that desire to pursue graduate work, and was thrilled at the opportunity to help other student with their master projects over the summer.

Matthew received a OSGC scholarship his Junior and Senior years at Wright State. He has already begun work at AFIT in pursuit of a M.S. in Aeronautics, and hopes to conclude in 18 months.



Matthew at the Springfield Airport in front of an F-16 Jet.

Joseph V. Balla – Marshall Space Flight Center

By: Joseph V. Balla

Rockets, planes, and the space shuttle have always fascinated me since I was young, and it seemed to me that the best way to be work on these things was to get involved in Aerospace Engineering.

After having a great experience during my internship at Marshall last summer, I decided to apply for this summer and was lucky enough to get an internship offer.

My summer has been nothing short of crazy, and I'm loving every minute of it! I am living in an apartment with a co-op student I met last summer along with another friend.

I am working with Dr. Kurt Polzin in an electric propulsion research laboratory on multiple projects ranging

from simulating the response of Pulse Inductive Plasma Thruster drive circuits to demonstrating liquid metal purification techniques to potentially be used as part of a lunar surface reactor.

The most exciting part about working for Dr. Polzin is the 'full-service' mentoring I receive. Outside of the lab he has set-up many other learning activities. Dr. Polzin introduced me to a member of the von Braun team and has encouraged me to travel to professional conferences such as the AIAA's Joint Propulsion Conference.

If I had to give some advice to someone just starting their first internship it would be that you can never make enough contacts, and that opportunities don't always present themselves, sometimes you have to make them happen, and go that extra mile.



Joey Balla and Dr. Kurt Polzin in front of a Linear Aerospike Engine (near) and the XE" Nuclear Thermal Rocket (back) at MSFC.

The remainder of my summer looks to be filled with a lot of work. However, in my spare time I hope to get a chance to go skydiving.

Joey will be receiving a Senior Scholarship from the OSGC for his studies at the Ohio State University this year.

Thomas Gambone, II—ZIN Technologies

Thomas Gambone II, a third year Computer Engineering student at The University of Akron, spent his summer working at ZIN Technologies as a general engineering intern. Tom met Dr. Paul C. K. Lam, former OSGC director, near the end of high school. Dr. Lam arranged for Tom to participate in a two-year summer internship with ZIN Technologies.

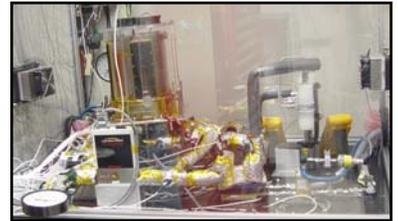


The ZBOT Team: Back (Left to Right) Jeremiah Friend, Thomas Gambone, Front (Left to Right) Nasser Rashidnia, Jim Ogrin, and Kevin Magee.

This year Thomas worked as an OSGC sponsored intern and became part of the Zero Boil Off Tank (ZBOT) project. He worked alongside and was mentored by Jeremiah Friend, Kevin Magee, Jim Ogrin, and Nasser Rashidnia. Other mentors included, Robert Brock, Anthony Bruzas, Chris Lant, Greg Pruett, and Craig Totman.

The basic principle behind the ZBOT project is to optimize cryogenic liquid storage design concepts for use in long-duration space exploration life support and propulsion systems. The team is currently running initial tests and perfecting interactions of internal components. Once finalized, ISS crew members will be trained to install the ZBOT in the ISS for testing. Before the ZBOT is ready to be deployed the team must improvise a way to fit all the hoses and gauges in a box under a foot in diameter. The ZBOT is anticipated to be in orbit by 2012.

Tom worked extensively with software programs in relation to the ZBOT project. He developed an application able to communicate with a pressure sensor that was causing problems and an application used for review of test data in a manner similar to that which it is displayed during live testing. Tom was also responsible for mechanical upgrades to the thermal stability chamber that surrounds the tank breadboard.



The Zero Boil Off Tank (ZBOT) at ZIN Technologies

Last summer Tom was an ESMD intern at ZIN and describes his favorite experience to be working on the Passive Pneumatic-Subject Load Device (PP-SLD). This project developed a more effective alternative to bungee cords for use on the ISS' treadmills.

In the future Tom is exploring his options of attending graduate school, and hopes to become more involved with research throughout his career. He was also involved in the Akron Robotics team, which ranked quite well at this year's Robogames, an international robotics competition held annually in San Francisco, California (see page 3). Tom is also receiving an OSGC Junior Scholarship for his study at The University of Akron this year.

Eileen N. Boyd—Kennedy Space Center



Eileen on the launch pad at KSC.

Eileen Boyd, a Chemical Engineering major at The University of Akron spent her summer at Kennedy Space Center in Cape Canaveral, Florida. She was supported by the Ohio Space Grant Consortium as a Exploration System Mission Directorate (ESMD) intern.

Eileen spent her time at KSC working with Philip Metzger to determine the effects of rocket exhaust expressed from lunar and Martian landers has on soil on Mars and the Moon. By the end of the summer they had determined that soil particles traveled at very low angles and very high velocities when blown by the Lunar Module and it will be necessary to install a berm or barrier to block the particles from damaging the lunar outpost. Fine particle analysis was done to help characterize the size and shape of lunar soil.

While at KSC Eileen was able to see two rockets and a shuttle launch. Although the launches were loud and the weather unbearably hot, Eileen still counts seeing the launch of Discovery as one of the best experiences of her life. In fact, she even got to see a GOES-O rocket launch on her birthday! She also participated in trips to see the shuttle on the launch pad and debris from past launches.



Discovery heading to the launch pad.

As she returns to Akron to finish up undergraduate studies Eileen hopes that the future will hold opportunities to work with NASA Glenn and Langley Research Centers, and one day obtain a permanent job with NASA.

"I really enjoyed my experience at KSC. The beautiful atmosphere and the friendly people made it even better."



Pre-College



Rock-It With Physics at Kettering Middle School

A Mini-Grant Awarded to Ms. Melanie Byers



Under the instruction of Ms. Melanie Byers, 110 7th graders at Kettering Middle School got the opportunity to design and deploy their own rockets.

Rock-It With Physics provided the class with a hands-on opportunity to wrap up their physics unit. Data was gathered from control rockets to compare to the experimental student designs.

Students created an experimental design plan for their rocket than made necessary adjustments during the final construction. They were also able to personalize their rocket with stickers and glitter.

On the day of the launch, impending storms could not diminish the students' excitement, and the preschool even came to watch and cheer on the pupils.

The launch went successfully for most of the students, although some parachutes did not deploy. The biggest complaint was the smell after the launch, and the loud "POP" each rocket made.

While enjoying themselves immensely, the students learned about potential and kinetic energy and were able to identify the energy transformations from acoustic, mechanical, electromagnetic, heat, and chemical during the stages of the rocket launch.

The class conveyed their enthusiasm to the OSGC through countless thank you notes. All the students noted that they had a great time, and enjoyed the opportunity learn outside conventional worksheets. There is no doubt that these students will always remember the fun they had learning about physics and building rockets.



Pre-College Opportunities for Teachers

Waste Limitation Management and Recycling Design Challenge (WLMR-DC)

Coming into the third century, astronauts will be living and working on the moon. Transportation of supplies into space is extremely expensive and costs about \$20,000 per kilogram! The creation of a system that will enable the filtering and re-use of water will help reduce this expense and provide the necessary resources for cooking, cleaning, and drinking.

Teachers are encouraged to create small engineering teams of up to 6 students to meet this challenge. Students will enjoy the experience of applying science and math in a real world situation.

Applications must be received Feb. 1, 2009

For more information please visit:
<http://wlmr.nasa.gov/index.php>

What If No Gravity? (WING)

Grades: 6-9

Along with a teacher or mentor, WING encourages students to form groups and design an experiment designed to operate in a lunar environment. Proposals must be designed by students and submitted to NASA no later than **November 2, 2009**. Winning teams will be selected to deploy their experiment in the 2.2 Second drop-tower at NASA Glenn to gather and analyze data.

Dropping in a Microgravity Environment (DIME)

Grades: 9-12

The DIME program follows the same criteria as the WING program, but proposals are expected to reflect more complex and challenging project ideas.

For more information please visit:
<http://spaceflightsystems.grc.nasa.gov/DIME.html>



Higher Education



University of Cincinnati Students Win Mars Lander Event

A Seed-Grant Awarded to the University of Cincinnati

2009 has been a year of firsts for Aerospace Engineering students at the University of Cincinnati. This was the first year for a new student group, the UC Students for the Exploration and Development of Space (SEDS). Formed by 3 seniors, the UC SEDS is a local chapter of an international organization dedicated to the exploration of space. The UC SEDS sponsors the participation of the spacecraft design track class in a design-build-fly competition.

The UC SEDS and OSGC sponsored the UC RockCats in the first ever Praxis, Inc. Battle of the Rockets 2009 on April 4th in Culpeper, VA. This intercollegiate rocket competition required entrants to design and fly a rocket and Mars lander craft. The precision altitude competition required teams to deliver the lander to precisely 1,200 feet and provide for the stable and upright descent of the lander and rocket.

Through contact with Dr. Gary Slater, the OSGC's University of Cincinnati campus representative, the group was able to obtain a grant from the OSGC that along funding from The UC Department of Aerospace Engineering, UC College of Engineering, and L3 Communications. The team also received invaluable material contributions from Soller Composites and Water Jet cutting services from Woodrow Corporation helped make the project a reality.

Dr. Grant Schaffner, a newly hired adjunct professor, was the advisor for the UC RockCats team. Dr. Schaffner's first efforts in a professorial role were deeply educational for his students. Dr. Schaffner possesses a rare insight into engineering talents, the education of these talents, project management, and demonstrated an authentic desire to form his students into talented engineers, and compassionate people. The art of interacting with one's peers, especially under conflict, is an education in itself; one Dr. Schaffner seamlessly wove into lectures on more traditional aerospace sciences.

The efforts of the UC RockCats and Dr. Schaffner were well rewarded with the title of Champion of the Battle of the Rockets 2009. The UC RockCats achieved an altitude of 1,207 feet. They were 99.5% accurate to their target altitude, far above the 80% of the second place team. The team's competition rocket was approximately five feet tall, three inches in diameter, and weighed about 3 kg. The Mars lander featured an electromechanical mechanism to detach the parachute upon touchdown as well as a machined aluminum structure. All were built by the student team in the UC Space Systems Lab.

These exciting firsts establish a strong precedent for Aerospace Engineering undergraduates to excel in space science design-build-fly competitions in the coming years. Aerospace Engineering senior and OSGC Scholarship recipient, Nathaniel Woggon has assumed the role of President of the UC SEDS and is currently investigating competitive opportunities for the 2009-2010 senior class.

A fall competition will be held on October 31, 2009 in Culpeper Virginia.

Please visit the Praxis Battle of the Rockets Webpage for more information on contests and events. <http://www.rocketbattle.org/Main.html>

The Ohio Space Grant Consortium would like to congratulate all involved in the competition on a job well done, and hope to hear of more future success! OSGC would also like to extend a special thank you to Ryan Noble, 2009 SEDS President, for all his contributions to this article and for sharing his enthusiasm with us!



The finished rocket on the launch rail at the competition. Upon completion, it measured approximately 5ft tall and had a mass of 3 kg.



Melissa Schaffer took the lead on the design of the teams' Mar's lander.



The University of Cincinnati's SEDS team left to right (back) Ashley Verhoff, Alex Handley, Adam Clark, Zachary Kier, (front) Rachael Edgerly, Melissa Schaeffer, Isaac Ozinga, and Ryan Noble holding their award at the competition. This plaque now hangs in the department office.

Congratulations to 2009-2010 OSGC Scholarship and Fellowship Recipients!

The University of Akron

Eileen N. Boyd
Ryan T. Croston
Renee L. Petty
Antonio J. Samuel
Thomas M. Gambone, II
Tanya Lee Miracle
Thomas V. Vo

Cedarville University

Bethany G. Harpole
Jonathan F. Juhl
John T. Weston
Amber M. Ellett
Daniel E. La Croix

Central State University

Robyn L. Bradford
Christopher L. Burts
Mya A. Porché
Alicia W. Burse
Jesse E. Daniels
Candace A. Johnson

University of Cincinnati

Robert C. Charvat
Robert R. Hansen
Nathanial R. Woggon
Sydney M. Barker
Adam R. Gerlach
Maisha M. Murry

Cleveland State University

Mourad Elboustani
Aimee Lee McConnell
Garth P. Olszko
Brittany M. M. Studmire

University of Dayton

Julian S. Frias
Lauren E. Cosby
Lydia M. Everhart
James M. Hoffman
Joel E. Schmidt
Alan L. Jennings

Marietta College

Paul M. Paslay
Brandon S. Baylor
Dean T. Bendele
William T. Ragan

Miami University

Aaron D. Rohe, Senior
Holly N. Stonecker, Senior

Ohio Northern University

Bailey M. Blake, Senior
Sean P. Lemke, Senior
Jeffrey W. Carter, Junior
David A. Rogers, Junior
Christopher J. Slattery, Junior

The Ohio State University

Joseph V. Balla
Katrina J. Altman
Patrick M. Wensing
Krista M. Kecskemety
Daniel R.E. Foster

Ohio University

Matthew A. Smearcheck

The University of Toledo

Emily E. Roth
Mike Orra

Wilberforce University

Joshua E. Allen
Courtney R. Lee
Jasmin N. Artis
Devon L. Kennedy
Brandon J. Leake
Danielle N. Richards

Wright State University

Navjot K. Brar
Peter I. Heinig
Marlon D. Twyman
Adam M. Blake
Melissa A. Jones
Caleb J. Barnes

Youngstown State University

Michelle K. Fleming
Brooke R. Johnson

Ohio Space Grant Consortium
22800 Cedar Point Road
Cleveland, Ohio 44142

Dr. Gary L. Slater, Director
Dr. Gerald T. Noel, Associate Director
Laura A. Stacko, Program Manager
Arela B. Leidy, Program Assistant

Telephone: 440.962.3032 or 800.828.OSGC (6742); Fax: 440.962.3057; Email: OSGC@oai.org