

Oklahoma Space Grant Consortium  
Lead Institution: The University of Oklahoma  
Director: Dr. Victoria Snowden  
Telephone Number: 405.325.6559  
Consortium URL: <http://okspacegrant.ou.edu/>  
Grant Number: NNX11AB54H

## **PROGRAM DESCRIPTION**

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Oklahoma Space Grant Consortium is a Designated Consortium funded at a level of \$575,000 for fiscal year 2012.

## **PROGRAM GOALS**

*Consortium Goals and SMART Objectives from your 2010 base proposal and budget (or as amended in subsequent submissions)*

### **OKLAHOMA GOALS FOR NASA OUTCOME 1**

**WORKFORCE DEVELOPMENT GOAL:** *To enhance state economic and workforce development in aeronautics and space, while providing applied learning experiences for students and faculty.*

#### **SMART Objectives to achieve Goal:**

- Develop linkages between Oklahoma aerospace industry, researchers, and students that foster the creation of market driven technology products.
- Award competitive grants/fellowships to faculty and diverse student populations to facilitate hands-on learning related to state economic and workforce development.
- Provide University Career Services personnel support to increase their knowledge of employment opportunities within aerospace-related industry and at NASA Centers.

**FELLOWSHIP GOAL:** *To use the NASA mission, facilities, human resources, and programs to provide information, experiences, and research opportunities for students at*

*all levels to support the enhancement of knowledge and skills in the areas of science, technology, engineering, and mathematics.*

**SMART Objectives to meet Fellowship Goal:**

- Educate students at all levels by encouraging and supporting interdisciplinary and multi-disciplinary research experiences and education programs.
- Provide support to the science and technology workforce pipeline by including greater participation of individuals who are underrepresented in science, mathematics, engineering and technology, in NASA student programs.
- Increase the number of NASA student support opportunities through partnerships and industry collaboration and cooperation.

**HIGHER EDUCATION GOAL:** *To support Higher Education research capability and opportunities that attract and prepare increasing numbers of students and faculty for NASA-related careers.*

**SMART Objectives to meet Higher Education Goal:**

- Use NASA mission-based programs to demonstrate the integrated education applications of science, technology, engineering, and mathematics for use in student learning activities.
- Provide access to and promote utilization of NASA-related materials and information resources.
- Increase the number and diversity of students and faculty from underrepresented and underserved communities in NASA-related STEM fields.

**RESEARCH INFRASTRUCTURE GOAL:** *To establish OSGC as a valuable State resource and catalyst for aeronautics and space-related research, education, and state economic and workforce development.*

**SMART Objectives to meet Research Infrastructure Goal:**

- Create and foster opportunities for faculty and student research at all OSGC affiliates in areas related to NASA's strategic interests.
- Develop and foster interdisciplinary programs to assure the development and transfer of publications in aeronautics and space-related research and education.
- Leverage Consortium and State strengths to meet academic needs and the agenda for economic development.

**OKLAHOMA GOALS FOR NASA OUTCOME 2**

**PRECOLLEGE GOAL:** *Increase the number of teachers and students, especially those in underserved and underrepresented communities, who are involved in NASA-related education opportunities.*

**Objectives to meet Precollege Goal:**

- Develop opportunities for elementary and secondary education teachers to learn effective use of NASA-content, STEM based, materials and programs in the classrooms.
- Introduce students to Space Exploration to encourage an interest in STEM disciplines.

## **OKLAHOMA GOAL FOR NASA OUTCOME 3**

**INFORMAL EDUCATION GOAL:** Improve public understanding and appreciation of science and technology, including NASA aerospace technology, research and exploration missions.

**SMART Objective to meet External Relations Goal:**

- Provide instructional materials and technologies derived from NASA research and scientific activities that meet the needs and requests from within the community.

### **PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, & 3)**

*Provide concise, meaningful highlights or anecdotes (no more than three) that are directly related to work completed in 2012, highlighting student and/or project accomplishments. Specify alignment to an Outcome.*

### **PROGRAM ACCOMPLISHMENTS**

*Refer directly to the consortium goals and SMART objectives in your 2010 base proposal when describing your accomplishments.*

**Outcome 1:** *Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals:* (Discussion of achievements and progress related to your Fellowship/Scholarship, Higher Education and Research Infrastructure programs). *(Employ and Educate)*

### **OUTCOME 1**

**OUTCOME 1 Highlight 1:** For the first time, Southwestern Oklahoma State University (Weatherford, Oklahoma) OSGC students designed and built a vehicle to compete in the NASA Great Moon Buggy Race held at the Marshall Space Flight Center in Huntsville, Alabama. Cameron University, another OSGC affiliate with an on-going Moonbuggy program mentored the new Oklahoma team. The team of 8 females, (two Native Americans) and 4 males, (one a Native American), performed exceptionally well. They finished 17th out of 48 college level teams and were the 3rd highest rookie team. Twenty-five percent of the team was Native American. Engineering Technology student Kelli Simon said, "We were challenged from the beginning with this moon buggy, but having the chance to see our work go from concept to reality has been an overwhelming experience. We made some huge accomplishments through all of this and I am humbled and so very proud to be a part of this team." Kelli was an intern at NASA Langley last summer and is interning with Boeing in Seattle this summer. Computer Science student, JJ Stout said, "The chance to hear Rover Pioneers tell their stories, and the chance to talk to them was absolutely spectacular. On top of this, seeing a Saturn V rocket was beyond amazing."

**OUTCOME 1 Highlight 2:** At Southeastern Oklahoma State University in Durant, Oklahoma, Abraham Greywolf Blackburn (Chickasaw/Choctaw, Chemistry Senior) was funded through a combination of NASA OSGC and NASA OK EPSCoR funds to carry

out paid research on a biofuels project. When Abe began NASA-funded laboratory research, he was having trouble passing upper-level core courses in his major, in part due to having to commute a long distance to his off-campus fast-food job. After 3 semesters of low but consistent on-campus NASA-funded research employment, Abe is now excelling in his major courses, earning a 3.5 GPA in his last 19 hours of core Chemistry courses, and is eager to work in the chemical industry in the future. He is on target to graduate in December 2013.

**OUTCOME 1 Highlight 3:** University of Oklahoma (Norman, Oklahoma) student, Jared Christen, was selected from among 8 applicants to serve a computer science internship in the OSGC Lead Office for the 2012-2013 academic year. When interviewing for the position, Jared said he hadn't thought of NASA as a possible career opportunity until responding to the announcement. He subsequently accompanied the OSGC on the annual spring break, consortium-wide, VIP NASA Site Visit to Jet Propulsion Lab. All students participating in the activity are required to submit their resumes two months prior to the OSGC Director, who then forwards them to the contact person at the site being visited. Students are connected with scientists during the trip for possible internships. Jared was selected from 15 applicants from the trip for a ten-week internship June 18 - August 23, 2013. His JPL mentor is Dr. David Henriquez of the Simulation and Support Equipment Group. Emails from Jared this summer to the OSGC Lead Office indicate he is now focused on a NASA career

**Outcome 2:** *Attract and retain students in STEM disciplines through a progression of educational opportunities for students, teachers, and faculty:* (Discussion of achievements primarily focused on your Higher Education programs not discussed in Outcome 1 and your Precollege programs). (*Educate and Engage*)

## **OUTCOME 2**

**OUTCOME 2 Highlight 1: Speedfest**, an exciting, high-speed aircraft competition intended to foster enthusiasm for aviation and unmanned aircraft design was conducted for the third straight year. Created in 2011, Speedfest receives support from the Oklahoma NASA Space Grant Consortium, Spirit Aerosystems, ZAI Inc., UML, and the Oklahoma State University School of Mechanical and Aerospace Engineering.

**Speedfest III**, on April 19, 2013, featured two racing classes: Alpha (Advanced) Class which is open to collegiate teams, and India (Invitational) class, which is open to high school teams. A total of 14 teams from all over the country competed in Speedfest II, including 150 students and teachers. **Speedfest III** also featured demonstrational flights including: aerobatics of helicopters and airplanes, giant scale airplane aerobatics, a vertical takeoff demonstration of the Speedfest II Alpha class winner, and flyovers of several manned aircraft. The official gate count for Speedfest II was over 800 people.

**OUTCOME 2 Highlight 2:** The University of Oklahoma Center for Spatial Analysis (CSA) conducted a Geospatial Summer Institute built around an intensive hands-on experience in Geographic Information Systems (GIS), Global Positioning Systems

(GPS), and remote sensing as well as introduction to the professional field by interaction with GIS professionals. Students from all eight Space Grant affiliate universities in Oklahoma and from any academic discipline can participate. Nominations are submitted by each of the OSGC academic affiliates and the students earn three credit hours from the University of Oklahoma and ArcGIS I certification. Affiliates strive to nominate students in proportion to their respective campus demographics.

**OUTCOME 2 Highlight 3:** For the seventeenth consecutive year, **Mission to Planet Earth (MTPE)** was conducted on the University of Oklahoma campus by the lead office. Participants involved two pre-service STEM teachers competitively selected from each of the eight academic affiliates. Participant enrollment included three African Americans (one male and two female), and three Native American females. The ten day, summer in-residence institute utilized NASA content, facilities, and resources to teach these students how to utilize the excitement of aviation and space to Educate and Inspire their future students. The Department of Education Oklahoma Common Core provides the foundation for the institute curriculum. Throughout the ten days, teachers learn NASA related science, technology, engineering and mathematics content, are exposed to the engineering design process, and are provided a new iPad for their future teaching experiences. These pre-service teachers signed an agreement that to keep the iPad for their future classroom usage they must: 1) attend, actively participate in, and complete all MTPE program components, 2) attend and actively participate in the iPad Training Seminar, (September 27-29, 2013), 3) attend, and actively participate in, the Johnson Space Center Tour as a follow-up to MTPE October 13-16 of 2013, and, 4) provide on-going longitudinal tracking information following their graduation.

Throughout the institute participants learned numerous NASA iPad applications and how to integrate them across all disciplines. A course highlight was a one day mini ground school where students learn the basic science principles of flight. The following day, each team of three teachers takes turns at the control of University owned aircraft and instructor with landings at different airports within a one hundred mile radius.

**Outcome 3:** *Build strategic partnerships and linkages between STEM formal and informal education providers that promote STEM literacy and awareness of NASA's mission: (Achievements and progress of Informal Education programs). (Engage and Inspire)*

### **OUTCOME 3**

#### **OUTCOME 3 Highlight:**

**OUTCOME 3 Highlight 1:** Graduate research assistants at the Center for Spatial Analysis at the University of Oklahoma provided GIS consultation and assistance on an as-needed basis for students, faculty, researchers and the general public through a **GIS Helpdesk**. This year 5 students have provided a total of 40 hours of service to 5 fellow students, 2 researchers, 3 faculty and 1 member of the general public for a total of 11.

Assistance provided includes data preparation and acquisition, cartography services, GIS analysis, troubleshooting and tutoring, and contributed to PhD dissertations, class projects, faculty research, course development and conference presentations.

**OUTCOME 3 Highlight:** The Center for Spatial Analysis demonstrated geospatial research and applications with 41 other public agencies and private industries to inform state legislators of the importance of geospatial science and technology across the state of Oklahoma.

## PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Student Data and Longitudinal Tracking:** Number of program student participants employed by NASA, aerospace contractors, universities, and other educational institutions; Number of undergraduate students who move on to advanced education in NASA-related disciplines; Number of underrepresented and underserved students participating.

**OSGC Student Data and Longitudinal Tracking:** During the FY12 program year 18 students are pursuing advanced degrees in STEM disciplines, 1 is seeking a STEM position, 2 accepted STEM positions at NASA contractors, 71 accepted STEM positions in industry, 3 accepted STEM positions in K-12 academia, 7 accepted STEM positions in academia, and 63 went on to positions in non-STEM disciplines. The remaining students have not yet received the degree that they were pursuing while they received their Space Grant award. **For the FY12 program year, a total of 63% of students taking the next step are in STEM Fields or pursuing advanced degrees in STEM fields.**

Total number of significant award among all nine OSGC university affiliates:	<b>74</b>
Total number awards of underrepresented groups	<b>23</b>
Total number of awards to males	<b>45</b>
Total number of awards to females	<b>29</b>

National Center for Educational Statistics Percentages 2011 data for Oklahoma

Underrepresented Groups: **27.97%**

Total number of OSGC awards made to underrepresented groups: **31.1%**

Total number of OSGC awards made to females: **39.2%**

- **Minority-Serving Institution Collaborations:** Summarize interactions. Reference the names of projects with MSI collaborations.

The Oklahoma Space Grant Consortium embraces diversity in our Consortium membership: five of our eight university members are minority serving institutions: Langston University (Oklahoma's only HBCU), Cameron University, East Central University, Southwestern Oklahoma State University, and Southeastern Oklahoma State University. Southeastern has the highest number of Native Americans students registered

of any other public institution within the state. The Cheyenne Arapaho College, although not yet accredited, is hosted on the Southwestern Oklahoma State University (SWOSU) campus.

Three major annual OSGC programs involve every one of the eight academic affiliates with each of the institutions competitively selecting two student participants: *The Summer Geospatial Institute* offered by the Center for Spatial Analysis, *Mission to Planet Earth Summer Teacher Institute*, conducted by the University of Oklahoma, and *NASA Center Site Visits*, also led by the University of Oklahoma. Thus, there is on-going, strong interaction with the minority serving institutions within OSGC.

For the 2012 Reporting Period, all eight academic affiliates contributed to, and have an equal and active role in two proposal submissions in December 2012 for the Space Grant competitive CAN submitted by the Oklahoma Space Grant Consortium. Outcome of the proposals results are pending. Proposal submission names: SOARING and NASA TEAMS.

- **NASA Education Priorities:** *Accomplishments related to the “Current Areas of Emphasis” stated in the 2010 Space Grant solicitation. Report on areas that apply to work proposed in your proposal and budget.*
  - Authentic, hands-on student experiences in science and engineering disciplines – the incorporation of active participation by students in hands-on learning or practice with experiences rooted in NASA-related, STEM-focused questions and issues; the incorporation of real-life problem-solving and needs as the context for activities.

Cameron University’s on-going Moonbuggy Project provided students the opportunity to apply what they learn in class to design and fabricate a two person Moonbuggy. The NASA Moonbuggy Project provided students with hands-on experiences in engineering design and fabrication. Students worked as a team on a complex project that had to be completed within budget and within time constraints. Students became more prepared to enter the workforce once they have completed the Moonbuggy Project. The Moonbuggy Project supported 7 students. Two students graduated with STEM degrees. One of these students is pursuing a Master’s Degree at the University of Oklahoma in a STEM major. The remaining 5 students are continuing their education at Cameron University in STEM fields.

Nathan Adams participated in the 2010 Southern Nazarene University OSGC sponsored Summer Research Experience. In summer 2012 he participated in the Summer Airborne Research Program at NASA’s Dryden Research Facility in California. He will attend the University of Oklahoma as a mathematics graduate student in Fall 2013.

The Oklahoma Space Cowboys, from Oklahoma State University, were selected for NASA’s Reduced Gravity Education Flight Program (RGEFP) to conduct experiments

aboard reduced gravity aircraft. RGEFP gives undergraduate students the opportunity to propose, build and fly experiments in reduced gravity. The team performed the experiments aboard a microgravity aircraft that produces periods of weightlessness for up to 25 seconds at a time by executing a series of approximately 30 roller coaster-like parabolas over the Gulf of Mexico. During the free falls, the students gathered data in the unique environment that mimics space.

- Diversity of institutions, faculty, and student participants (gender, underrepresented, underserved).

All eight academic affiliates are required to make competitive awards, at a minimum, to closely reflect their campus demographics for underrepresented minorities and gender. This also includes selection of participants for the three consortium-wide programs addressed above within the section: **Minority-Serving Institution Collaborations.**

- Engage middle school teachers in hands-on curriculum enhancement capabilities through exposure to NASA scientific and technical expertise. Capabilities for teachers to provide authentic, hands-on middle school student experiences in science and engineering disciplines (see above).

As a result of the three Professional Development Workshops for Teachers implemented by STARBASE (open to grades 5-12), 100% of the 40 teachers said 1) their knowledge of NASA related STEM increased and 2) that the information and materials from this workshop would be useful in their classrooms.

- Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers.

Center for Spatial Analysis participated in a two and a half day summer conference for Latina high school students in Oklahoma City. Utilizing NASA-related materials, the purpose was to encourage completion of high school, pursuit of higher education and showcase current OSGC STEM majors at the University of Oklahoma.

The First Tech Challenge Robot building competition hosted by Southwestern Oklahoma State University expanded from one event to three regional qualifiers and a statewide championship. Forty-four junior and senior high school teams represented a 19% growth in participation over 2010-2011. Of the 326 non-college student participants, 27% were female and 37% were minorities. Of the 140 teachers and other adults who came with the teams, 33% were female and 22% were minorities.

- Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges.

The Center for Spatial Analysis developed collaboration with Dr. James Bothwell, an assistant professor at Oklahoma City Community College. CSA and Dr. Bothwell developed new methods to automatically identify differences in climate change patterns from models. The research collaboration resulted in two journal publications and two conference presentations in 2012. The research also contributed key ideas in a proposal currently under review by NSF.

- Aeronautics research – research in traditional aeronautics disciplines; research in areas that are appropriate to NASA's unique capabilities; directly address the fundamental research needs of the Next Generation Air Transportation System (NextGen).

Oklahoma State University assembled a team led by students and faculty in the College of Engineering, Architecture and Technology (CEAT) to compete in NASA's XHab (eXploration Habitat) Innovation Challenge sponsored by the National Space Grant Foundation. OSU was one of the 3 teams in the country selected for the final round of participation at Johnson Space Center. As part of the project, the OSGC sponsored team designed, developed, and tested a module for the XHab Academic Innovation Challenge. This included both technical engineering and outreach efforts. The technical effort began with a point of departure design and will evolve based upon student design decisions, analysis and testing. The technical portion of the effort will be led by OSU students in the School of Mechanical and Aerospace Engineering (MAE) as part of spacecraft and systems engineering design coursework. They were assisted by students in architecture, architectural engineering, and human and environmental sciences as part of their senior design effort. The team has partnered with industrial affiliates ILC Dover, NextGen Aeronautics, and additional university partners at OSU.

- Environmental Science and Global Climate Change – research and activities to better understand Earth's environments.

The major project partially sponsored by OSGC was evaluating coastal and inland floods by hurricanes and the other is on assessing climate predictions by different climate change models. The coastal environment is said to be highly vulnerable under climate change scenarios that predict sea level rise and intensified hurricanes. It is important to model the combined effects of inland and coastal floods due to hurricanes. Ms. Nicole Grams developed a Master's thesis to compare water depths predicted by numerical models and observed by stream gauges and water marks in the field, and then identified geographic factors that contribute to over- and under-estimations by the models. While she was working on a manuscript out of the thesis work for journal publication, she gave three research presentations at national, regional, and university meetings.

- Enhance the capacity of institutions to support innovative research infrastructure activities to enable early career faculty to focus their research toward NASA priorities.

This is another area of emphasis of the OSGC. Some funding of the OSGC was made available to faculty identified research and technology projects related to NASA interest areas. Preference was given to projects that involve Oklahoma industries, particularly small manufacturers who do not have easy access to engineering support. Funding was competitively awarded to students and faculty to work with these companies. This provided the students with a relevant hands-on experience in NASA-related technical areas. Additionally, “seed funding” supported faculty who involved students in projects leading to larger proposals directly to NASA, and / or to support cooperative efforts between NASA Space Grant and NASA EPSCoR.

This seed funding has had a significant impact in the last year in that it has resulted in part, for 3 different successful research proposals and 3 publications

### IMPROVEMENTS MADE IN THE PAST YEAR

*Succinctly describe improvements and/or adjustments made last year that demonstrate significant change(s) within the consortium. The improvements and/or adjustments that brought about change may have been in management, resource allocation, project design, project evaluation, etc.*

With consensus among the academic affiliates, Dr. Sherri Brogden was brought on board to administer an evaluation instrument widely accepted in the field and for which she brings special expertise: The STEM Semantics Survey and a modified Career Interest Questionnaire (Tyler-Wood, Knezek, & Christensen, 2010). These evaluation models were validated over a ten year period by researchers at the Institute for the Integration of Technology into Teaching and Learning, and will yield data for dissemination in scholarly journals and professional meetings. Permission has been granted for their use by one of the authors, Gerald Knezek, PhD. Both Summative and Formative assessments will be administered on three consortium-wide programs beginning with the 2013 funding: Mission To Planet Earth Summer Pre-Service Teacher Institute, , Geospatial Information Systems Summer Institute, and the Workforce Development NASA Site Visit trip each spring break.

### PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

OSGC represents a state-wide partnership of universities, State Government, City Government, industry, an aerospace education organization, and an air and space museum. These members work together to enhance opportunities for Oklahomans to

understand and participate in NASA's Mission by supporting programs in science, technology, engineering, mathematics, and other aeronautics and space-related disciplines throughout the State. Each member plays an active role in the development and implementation of Space Grant programs based on that affiliate's mission, human and financial resources.

A representative from each of the affiliates comprises the Advisory Committee which meets twice a year at the lead institution. In addition, conference calls are conducted several times a year for input to program direction to meeting the changing needs of NASA, the State, economic environments, and funding opportunities to leverage funding.

### **University Affiliates**

- The University of Oklahoma – lead institution
- Oklahoma State University
- Cameron University
- Langston University – a Historically Black College and University
- East Central University
- Southeastern Oklahoma State University
- Southern Nazarene University
- Southwestern Oklahoma State University

### **Academic Affiliates**

- Applications Engineering Programs
- Center for Spatial Analysis

### **Industrial Affiliates**

- Frontier Electronic Systems Corporation
- Science Applications International Corporation

### **Informal Science Education Affiliates**

- Tom Stafford Air & Space Museum
- STARBASE Oklahoma

### **City Government Affiliate**

- Norman Economic Development Coalition

**The National Space Grant Office requires two annual reports, this Annual Performance Data Report (APD) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.**