Oklahoma Space Grant Consortium
University of Oklahoma
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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 fellowship and scholarship 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 (OSGC) is a Designated Program Grant Consortium funded at a level of $845,000 for fiscal year 2011.

PROGRAM GOALS

The program goals for the Oklahoma Space Grant Consortium within our Program Elements – Fellowships, Higher Education, Research Infrastructure, Precollege and Informal Education - are aligned with Outcomes 1, 2, and 3. Our Workforce Development Goals intersect all of our Program Elements.

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.

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.

***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 attracts and prepares increasing numbers of students and faculty for NASA-related careers.

***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.

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 GOAL 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.

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, OR 3)

NASA OUTCOME 1 Higher Education – Employ and Educate

Informational seminars at Langston University held with Aerospace Industries increased during this period. Seven students have received interviews from Boeing Aerospace. Two OSGC students completed internships at Tinker Air Force Base and are now full time employees.

Matthew Stangl, a Southwestern Oklahoma State University Computer Science major, served as a summer intern at NASA-Langley Research Center where he was tasked with the development of a mobile application for the NASA Technical Reports Server. His mentor was so pleased that Matthew continued to work ten hours per week throughout the academic year 2011-2012 to program the search application of the web site.

An Oklahoma State University team was one of the three teams in the country that was selected for the NASA XHAB competition at the Johnson Space Center. The competition involves the development and testing of an inflatable space habitat.

Another Oklahoma State University team was selected by NASA to perform experiments involving deployment of inflatable structures in the zero-g simulator.

Fellowships were provided to 5 science and math students as a stipend for their participation in the 6 week NASA summer Research Experience for Undergraduates (REU) at Southern Nazarene University. This REU supports the higher education goal of teaching students about the research process. Laura Mino, a female underrepresented minority biology student, and an environmental studies student, participated in 2011 to

study microbial communities in an Oklahoma wetland using gas chromatography. She remarked that "*I am learning techniques in this project that will help me prepare for a career in ecosystem remediation. I enjoy working with a professor outside of the classroom to learn skills directly applicable to a career."*

PROGRAM ACCOMPLISHMENTS

Outcome 1: Contribute to the development of the STEM workforce in disciplines needed to achieve NASA's strategic goals: (Employ and Educate)

Oklahoma Space Grant Consortium made 225 competitive awards in the Fellowship/Scholarship category. Females received 63% of the awards and 37% of the awards were to males. Underrepresented minorities received 44% of the awards. *This exceeds the OSGC assessment metric specified of awarding 200 awards with 27% awardees being underrepresented minorities.*

Oklahoma Space Grant Consortium made 59 competitive awards in the Higher Education category. Females received 27% of the awards and 78% of the awards were to males. Underrepresented minorities received 34% of the awards. *This exceeds the OSGC assessment metric specified of 27% of awardees would be underrepresented minorities.*

Oklahoma Space Grant Consortium made 10 competitive awards in the Research Infrastructure category. Females received 50% of the awards and 50% of the awards were to males. OSGC metrics for assessment did not specify number of awards or percentage of awardees.

Nine papers were accepted for publication in peer reviewed journals. *This exceeds the assessment metric of five papers would be accepted.* OSGC affiliates submitted nine proposals for non-NASA funding of which six were funded for a total value of 8.06 million dollars. *This, too, exceeds the assessment metric of submission of three grant proposals.*

Oklahoma State University (OSU) assembled a team led by students and faculty in the College of Engineering, Architecture and Technology (CEAT) to participate in research opportunities in NASA's microgravity simulator. The effort's research goals paralleled that of NASA's Xhab program. For the design effort, the team has partnered with industrial affiliates ILC Dover and NextGen Aeronautics and additional university partners at OSU.

Oklahoma State University contributed to the joint NASA OSGC and Oklahoma NASA EPSCoR project, "*Tissue Equivalent Detectors for Space Crew Dosimetry and Characterization of the Space Radiation Environment"*. The science goal was to develop, fabricate, and test progressively sophisticated compact, tissue-equivalent ionization chambers and proportional counters in order to investigate alternative tissue equivalent and tissue-like materials, anode designs, spectrometer circuitry, and

approaches to neutron/charged particle discrimination for real-time space radiation dosimetry. Initial testing was accomplished by OSGC with student developed high-altitude balloons.

Three companies participated in the research effort which contributed to the assessment metric of having five University/Industry research collaborations.

Outcome 2: Attract and retain students in STEM disciplines through a progression of education opportunities for students, teachers, and faculty.

HIGHER EDUCATION

At Southern Nazarene University, projects planned by the OSGC program helped students gain meaningful hands on experiences, knowledge, and skills to retain them in STEM related areas. Thirty-five percent (35%) of the students receiving scholarship support either graduate, go to graduate school, teach, and/or work in aerospace related careers.

Two of the three University of Oklahoma significant award recipients, one an undergraduate and the other a graduate student, completed their degrees and are working in STEM fields. The third is continuing her education in a STEM field.

At Southeastern Oklahoma State University, six significant award recipients are continuing their undergraduate STEM education. One has graduated, and entered a graduate program.

The Center for Spatial Analysis at the University of Oklahoma has developed a minor in Geospatial Information Science to attract students from diverse disciplines to geospatial information science and prepare them for the workplace.

PRECOLLEGE

Langston University, an HBCU, had pre-service teachers in the School of Education work with underrepresented students in middle schools as mentors and tutors to provide them with learning experiences to make STEM area courses interesting. Four middle schools in the surrounding areas participated in hands on experience either at their school or on the University campus. Participants this year included 200 middle and high school students on campus to interact with faculty and college students.

At STARBASE, elementary and secondary pre-service and in-service teachers participated in STEM workshops and on-site STEM classroom educational enrichment. OSGC STARBASE affiliate served 4,200 pre-college students, and three higher education students, participated in STEM classroom educational enrichment related to NASA content.

As part of the University of Oklahoma Student Flight Project, 18 of the 21 fourth through twelfth grade students wanted to become pilots after taking the controls of the airplane to take-off, fly for 30 minutes, and land with the help of a University Flight Instructor,

Another University of Oklahoma project was a STEM hands-on remote sensing workshop conducted at Hydro High School with seventh grade geography students over the course 9 days. Following the activity, the teacher of one the seventh grade boys reported he went from barely making passing grades and no interest in education to wanting to go to college and become a geographer for the state wildlife department! The student now has a desire to do well academically and his grades show the change.

The University of Oklahoma Center for Spatial Analysis participated in Latinas Without Borders conference to encourage completion of high school, provide information on pursuing higher education and demonstrate STEM majors.

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

Stafford Air and Space Museum developed strategic partnerships with statewide higher education entities and is receiving increased public awareness. Aerospace projects at the universities receive exposure through the permanent displays at the museum. The first of these is the Southwestern Oklahoma State University-Mission Control exhibit which was hosted to honor over 30 local Southwestern Oklahoma State University graduates who worked with NASA Mission Control during the last 5 decades. This was done in conjunction with SWOSU homecoming, where the graduates were recognized again. Many of the graduates said they had never received that kind of recognition before.

STARBASE collaborated with 41 non-affiliate organizations on NASA related STEM projects and public relations events including one Open House exhibit to promote NASA's Mission to motivate students.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Student Data and Longitudinal Tracking:** The data from National Center for Educational Statistics Postsecondary Education, serves as the benchmark for the National Space Grant College and Fellowship Program in making awards. The data IPEDS: 2009-10 and 2010-11 shows Oklahoma demographics as the following:

Native American 10%
Asian, Pacific Islander 3%
African American 10%
Hispanic 5%
White 69%

The Oklahoma Space Grant Consortium made competitive awards in several different program areas. Total significant awards = 150; Fellowship/Scholarship = 141; Higher Education/Research Infrastructure = 9; 77 of total awards were to underrepresented minorities. This represents 51.3% of awards. 72 were awarded to male students; 78 to female students.

Oklahoma Space Grant Consortium met or exceeded competitive awards within each of the underrepresented categories.

- **Diversity:** All eight academic affiliates are required to make competitive awards, at a minimum, to closely reflect their campus demographics for underrepresented minorities and gender. In addition, our informal education affiliates strive to include student participants that also reflect the National Center for Educational Statistics. Illustrative examples include:

At Cameron University 42.9% of the student awardees were female and 28.6% of the student awardees were underrepresented minorities.

Seventy-five (75%) percent of Langston University students receiving scholarships are underrepresented minority students.

At the University of Oklahoma, 44% of the competitive awards were made to underrepresented minorities, exceeding the campus demographics for African American, Native American, and Hispanics.

Southern Nazarene University's award demographics: 55% of the student receiving funds were female, 45% were male. 29% were underrepresented minority, 40% of the faculty participants were female. None of the faculty participants were underrepresented minority. Awards to underrepresented minorities paralleled campus demographics: 29%.

At our informal education affiliate, STARBASE, student demographics for their Middle School Participants reflected:

51% Male,
49% Female
28% American Indian/Alaskan Native
11% African American
12% Hispanic/Latino
8% Multi-racial

- **Minority-Serving Institutions:** The Oklahoma Space Grant Consortium embraces diversity in our Consortium membership: five of our eight university members are minority serving institutions: Langston University (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.

Southwestern has developed strong rapport with the Cheyenne Arapaho College through the development of a one hour accredited course in Robotics for the students within the College.

Three major OSGC programs involve every one of the eight academic affiliates with each of the institutions 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.

- **NASA Education Priorities**:

  - **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.**

The Moon Buggy Project at Cameron University provided students with hands-on experiences in engineering design and fabrication. Active participation by students included entering their Moon Buggy in the national competition at Marshall Space Flight Center. Student Aaron Cobb explained that CU's team overcame many obstacles before and through the course of NASA's Great Moonbuggy Race, but overcame their adversity

through teamwork and diligence. He said that was part of what earned them the *Pit Crew Award.*

At STARBASE, 4,200 pre-college students and three higher education students participated in STEM hands-on, minds-on classroom educational enrichment. Revised curriculum focused on STEM-related scenarios and problem-solving.

The University of Oklahoma Center for Spatial Analysis developed a hands-on GIS lab for high school AP biology class with final exercise in solving an environmental conservation scenario using geospatial science methods.

Authentic hands-on engineering learning experiences at Oklahoma State University involving Space Grant include: Speedfest international aerospace design contest, ASTRO balloon program, XHab, Zero-gravity team, Rocket design team.

- **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.

Southeastern Oklahoma State University hosted a summer workshop aimed at a mixture of pre-service teachers and interested STEM students involving programmable, autonomous robots and NASA/Mars exploration content. This provided SE undergraduates with hands-on experience, plus provided future educators experience and materials for their future endeavors.

Mission To Planet Earth, conducted by The University of Oklahoma, was an 11 day summer teacher institute for 16 pre-service and in-service educators with students in grades 3–8. These teachers were selected by each of the OSGC academic affiliates to represent state-wide participation. MTPE employed hands-on STEM activity lessons including remote sensing, topographical maps, GPS, flight in university owned aircraft with teachers at the controls, hands-on aviation, model and hands-on rocketry, robotics, and how to integrate this NASA content into the existing curriculum to motivate students and meet district-wide and state education objectives.

As a follow-up to Mission to Planet Earth, the teacher participants took a trip to Johnson Space Center for a 2 day tour and hands-on STEM activities workshop. Each teacher gave a 5 minute presentation of how they used materials received from MTPE through pictures and student produced pieces.

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

Partnership was created with the Explorations in Computer Science and Robotics Summer Program at East Central University.

The University of Oklahoma Center for Spatial Analysis participated in two and a half day summer conference for Latina high school students to encourage completion of high school, pursuit of higher education and showcase STEM majors.

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

STARBASE forged a partnership with Tulsa Community College's Engineering Alliance office by exchanging information about STEM initiatives and supporting a summer student engineering camp grant proposal.

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

STARBASE incorporated lesson on STEM Careers and Renewable/Non-renewable Energy in our STEM curriculum.

The University of Oklahoma Center for Spatial Analysis is collaborating on two externally funded research projects investigating climate change impacts, forecasting and mitigation.

Southwestern Oklahoma State University provided a Balloon Sat program where student built small satellites to study temperature and pressure in the atmosphere.

- **Diversity of institutions, faculty, and student participants:** Diversity is a theme within The Oklahoma Space Grant Consortium not only in student awards, student participants, faculty, participating institutions, but in the composition of the state-wide Consortium Leadership Committees.

A partnership was created with Native American Voices Project at East Central University to encourage Native Americans to apply for the various NASA-sponsored awards, especially related to research in the STEM fields.

The University of Oklahoma Center for Spatial Analysis developed program for a high minority population middle school and high school according to the National Center for Education Statistics.

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

The Oklahoma State University XHAB project involves the development and testing of an inflatable space habitat and includes testing of deployment of inflatable structures in the zero-g simulator.

IMPROVEMENTS MADE IN THE PAST YEAR

A major improvement in the management structure of the Oklahoma Space Grant Consortium was the development of spreadsheets to improve the ease of reporting results to the lead office by the nine affiliates. Another improvement was the redesign of the budget planning spreadsheets used by affiliates for proposal development. These improvements increased the efficiency and accuracy of the data for reporting purposes.

The University of Oklahoma Center for Spatial Analysis revised Bachelor of Arts and Bachelor of Science degrees in geographic information science to improve rigor and better prepare students for the workplace, and developed new minor in geospatial information science and implemented successful internship program.

All academic affiliates have prioritized their significant awards on STEM fields.

Southwestern Oklahoma State University's The First Tech Challenge Robot building competition 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

STARBASE provided one-on-one assistance to classroom teachers on implementing inquiry-based educational strategies. They also expanded STARBASE 2.0 afterschool STEM programs for middle school students to the Oklahoma City area.

The Stafford Air & Space Museum now displays the connection between NASA and Southwestern Oklahoma State University clearly and obviously through the addition of a SWOSU graduate/ NASA veterans mission control display.

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.

University Affiliates

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

Academic Affiliates

Center for Spatial Analysis

Industrial Affiliates

Frontier Electronic Systems Corporation
Science Applications International Corporation

Informal Science Education Affiliates

Tom Stafford Air and Space Museum
STARBASE Oklahoma, Inc.

City Government Affiliate

Norman Economic Development Coalition