North Carolina Space Grant Consortium
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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 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 North Carolina Space Grant Consortium is a Designated Consortium funded at a level of **$785,000** for fiscal year 2009.

PROGRAM GOALS

NC Space Grant's FY2009 program goals and objectives, as described in the Consortium's 2005-2010 Strategic Plan, are aligned with NASA's Education Framework. A common thread is to expand programs to more citizens of NC and involve women, underrepresented minorities, and persons with disabilities.

Fellowships and Scholarships (NASA Outcome 1)
Equip the future STEM workforce by (1) engaging 15 to 25 students per year in hands-on aerospace-related research projects, (2) engaging 10 to 20 students per year in aerospace-related study projects, (3) facilitating positive mentor relationships between 25 to 45 students and faculty members per year, and (4) providing venues for 25 to 45 students to conduct research presentations annually. ***All goals were exceeded in FY2009.***

Research Infrastructure (NASA Outcome 1)
Strengthen North Carolina's aerospace-related research infrastructure by (1) providing 5 seed grants per year to new or transitioning faculty members whose research is directly aligned with NASA's priorities, and (2) facilitating research collaborations between NC Space Grant member institutions and NASA field centers. ***All goals were exceeded in FY2009.***

Higher Education (NASA Outcomes 1 and 2)
Better equip the future STEM workforce by (1) providing 10 to 15 extramural, aerospace-related work/study experiences to students per year, (2) facilitating positive mentor relationships between 10 to 15 students and faculty members per year, (3) providing venues for 10 to 15 students to conduct research presentations annually, (4) developing 4 sustainable interdisciplinary and/or distance learning courses which engage 10 to 20

students each and are focused on enriching students understanding of complex aerospace issues *(Outcome 1)*. Enhance Precollege educators' knowledge of aerospace issues by providing professional development workshop and training opportunities for 25 precollege educators per year *(Outcome 2)*. ***All goals were exceeded in FY2009.***

Informal Education and Public Outreach (NASA Outcome 3)
Enhance informal educator knowledge of aerospace issues by providing professional development training for 25 informal educators per year by partnering with organizations such as museum, science centers, and civic groups, to provide informal educator development workshops and training opportunities**.** ***All goals were exceeded in FY2009.***

PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, OR 3)

NC Space Grant supports students and faculty in innovative, hands-on NASA-related research through the Fellowship and Scholarship, Higher Education, and Research Infrastructure programs (Outcome 1). The following quotes from student participants demonstrate the impacts of NC Space Grant programs on students:

"This internship is one of the best experiences in applying the principles and theories learned in the classroom. This internship has been so great for me it helped me examine, explore and clarify my career goals and options. During these past ten weeks, I tested my personal aptitudes, abilities, and interests in relation to my career choice and job demands. I also gained job-hunting skills such as interview and resume preparation. JSC is a great place to evaluate and be evaluated by potential employers. It was very easy to develop references and professional contacts which may lead to future job offers." (Yawo Amengonu, Graduate student at UNC-Charlotte, 2009 Graduate Research Fellow/ NASA Johnson Space Center internship).

"This internship has been a positive experience for me both educationally and personally. I was exposed to the processes, structures, and routine within an industrial company, all with which I had no prior experience. My projects at LORD Corporation allowed me to apply physics and engineering principles learned in college and incorporate creativity in designing test procedures and set-ups. I continued to learn new troubleshooting techniques and new material in other fields such as electrical engineering. The projects encouraged me to think critically in analyzing and solving problems. I was also able to interact with other engineers daily and learn from their knowledge and experiences. The positive work environment and atmosphere encouraged me to perform at my best without feeling over-pressured or stressed. I have enjoyed this valuable experience and hope that I can return to work with LORD Corporation in the future." (Frances Low, Undergraduate student at UNC-Chapel Hill, 2009 NC Space Grant/ LORD Corporation Summer Internship)

PROGRAM ACCOMPLISHMENTS

Below is a summary of NC Space Grant's FY2009 program accomplishments as they relate to the NASA Education Strategic Framework:

Outcome 1:

Fellowships and Scholarships:

- Provided **13 Graduate Research Fellowships** and **33 Undergraduate Research Scholarships** to students representing all of its member institutions. **NC Space Grant affiliates supported an additional 100 students** involved in research and higher education efforts on their respective campuses under the direction of a research mentor. Nine of these research projects had significant partnerships with NASA centers that included a NASA research mentor and the students working

on-site at the NASA center (NASA Ames, Glen, Kennedy, Langley and Marshall).
- Provided **13 Undergraduate Scholarships and 1 Community College Transition Scholarship**, enabling lower division students an opportunity to explore STEM-related research on their campus.
- Partnered with the State of NC Undergraduate Research and Creativity Symposium (SNCURCS) to provide a statewide platform for Undergraduate Research Scholar presentations. **Twenty-five NC Space Grant Research Scholars and Fellows participated in the symposium**. In addition to SNCURCS, **a total of 56 students presented their research at other symposia** across the state and region.

Of the **160 awards** to students, 46 (28.75%) went to students from historically underrepresented minority groups. This exceeds the target ratio of 27.1% set by the 2005-2010 NC Space Grant Strategic Plan and is consistent with the enrollment percentage of minority students in NC (27.9%) as published in the National Center of Education Statistics Digest (US DoED, 2006).

NC Space Grant **partnered with the LORD Corporation** to develop a summer internship program for undergraduate and graduate students. LORD is a worldwide leader in adhesives and coatings, vibration and motion control, and magnetically responsive technologies. This program provided support for three students (included in F/S student data) to participate in a 10-week internship at LORD.

The partnership continued with the Pisgah Astronomical Research Institute (PARI) through support of **NC Space Grant/ J. Donald Cline Astronomy Scholarship**. The scholarship gives the student an opportunity to engage in research at PARI. The scholarship was awarded in 2009 to Mr. Steven Harenberg, undergraduate student in astronomy and physics at UNC-Chapel Hill, who presented his research at the 215th meeting of the American Astronomical Society in January 2010.

Research Infrastructure:
Supported **nine New Investigations awards** to faculty to conduct projects directly aligned with NASA priorities. All projects involved undergraduate and/or graduate students, which provided practical training for future aerospace workforce opportunities (see student research award data). Two projects are described below:
- Dr. Brett Taubman, Assistant Professor of Chemistry at Appalachian State University, is using ground-based in-situ measurements and remote sensing technologies to quantify the impacts that different aerosol sources have on the Southern Appalachian Mountain radiation budget. This research was recently awarded a three-year, $499,970 NASA grant to collect data about particulate matter (aerosols) in the region's atmosphere, promote climate science awareness and improve science, technology, engineering and mathematics education (STEM). The three-year project is dubbed CAN-DOO *(*Climate Action Network through Direct Observations and Outreach).

- Dr. Taher Abu-Lebdeh, Assistant Professor of Civil Engineering at NC A&T State University, is working on the chemical stabilization of lunar soil using modified sulfur-cement as a stabilizer additive. This technology will be useful in long-duration surface missions to the Moon that require a lunar base; roads will provide a strong surface for many heavy loads and stabilization of the subsurface is critical for the stability of the road.

Higher Education Course Development:

Awarded seven higher education course development projects. Two projects are described below:

- Dr. John Chadwick, an Assistant Professor of Geography and Earth Sciences at UNC-Charlotte, has developed a new undergraduate course in which students assemble small "near-space" capsules that contain a suite of simple science experiments. The capsules are launched on a high-altitude weather balloon that carries them to 100,000 feet into the stratosphere above 95% of the mass of the Earth's atmosphere to the edge of space. Course materials and instructions will be shared with faculty at other North Carolina universities.
- Dr. Charles Lillie, an Associate Professor of Math and Computer Science at UNC-Pembroke, developed a new advanced course in spatial data management covering concepts of information visualization. The course was designed to appeal to computer science, information technology, and engineering students, as well as professional engineers and scientists who work with 3D visualization applications. This course produced an application that can be used in subsequent courses, by other UNCP departments, or by other organizations.

Outcome 2:

Awarded three K-12 Professional Development awards and collaborated with partners to achieve its strategic goals of equipping the future STEM workforce and enhancing precollege educator knowledge of aerospace issues. One example is:

- UNC-Chapel Hill's Morehead Planetarium and Science Center developed the PLANETS (Portable Learning for All North Carolina Elementary Teachers and Students) professional development series for elementary teachers that serve in North Carolina's most economically distressed counties. **Through six workshops, the program reached 102 K-3rd grade teachers.**

Outcome 3:

Awarded two Informal Education and Public Outreach awards that were highly leveraged through partnerships with informal education venues and community groups. NC Space Grant also participated in events throughout the state to engage students and the general public in STEM careers and NASA activities. Example:

- Provided funds to support the outreach component for the Morehead Planetarium and Science Center's PLANETS program. Staff transformed its *Earth, Moon and Sun* show with up-to-date digital animation, and **presented 97 planetarium shows for 2,000 students at 16 elementary schools** in economically distressed counties.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Student Data and Longitudinal Tracking:** Total awards = 160; Fellowship/Scholarship = 60, Higher Education/Research Infrastructure = 100; 46 of

the total award represents underrepresented minority F/S and HE/RI funding. During the FY09 program year 8 graduated and are pursuing advanced STEM degrees, 1 accepted a STEM position with a NASA contractor, 21 accepted STEM positions in industry, 1 accepted a position with NASA, 3 accepted a STEM position with academia, and 4 are in non-STEM fields. For all students that were significantly supported in the period spanning FY06-FY09, 18 graduated and are pursuing advanced STEM degrees, 4 accepted a STEM position with a NASA contractor, 34 accepted STEM positions in industry, 3 accepted a position with NASA, 6 accepted a STEM position with academia, and 6 are in non-STEM fields. The remaining students have not yet received the degree that they were pursuing while the received their Space Grant award.

- **Course Development:** Three new courses were developed and four courses were revised in FY2009. These include courses in remote sensing, spatial visualization, high altitude ballooning, astronomy, and aerospace engineering.
- **Matching Funds:** In FY2008, the NC Space Grant was required to match $585,000. In fact, NC Space Grant provided $855,200 in matching support, which is 46% more than what is required. Matching funds came primarily from waived overhead from the member universities and from funds provided by the NC General Assembly.
- **Minority-Serving Institutions:** The composition of the NC Space Grant Consortium fosters diversity across all program elements. Four of the 12 Affiliate institutions are classified as HBCUs. Although UNC-P is not designated as a historically minority institution, it serves the Lumbee Indian population in southeastern NC. In FY09, NC Space Grant provided research support for 48 students attending HBCU Affiliate universities, an increase of 45% from FY08.

IMPROVEMENTS MADE IN THE PAST YEAR

In FY2009, NC Space Grant made great strides in cultivating relationships between students, faculty, and industry. Through leveraged partnerships with industry and research centers, NC Space Grant made available $40,000 beyond its core funding to student internship programs providing more hands-on research opportunities for students in industrial settings.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

NC Space Grant has adopted an efficient organizational structure that proactively enables each member university to play a significant role in management of the program. Overall direction, policies, rules of governance, and budgetary priorities are established through consensus by the Consortium Executive Board (CEB), which consists of the Campus Directors from each of the following universities:

Appalachian State University
Duke University
Elizabeth City State University (HBCU)
NC A&T State University (HBCU)
NC Central University (HBCU)
NC State University, Lead Institution
UNC - Asheville
UNC - Chapel Hill
UNC - Charlotte
UNC - Pembroke
Winston-Salem State University (HBCU)

In addition, the consortium has key partners throughout the state and region that provide programmatic guidance and support to help NC Space Grant achieve its strategic goals and objectives. Consortium partners include:

Kenan Institute for Engineering, Technology & Science (Nonprofit)
*LORD Corporation (Aerospace industry)
NASA Langley (Government)
NC Community College System (State Government)
*Pisgah Astronomical Research Institute (Nonprofit)
University of North Carolina General Administration (Education)
Virginia Space Grant (Education)

**In FY2009, these partners provided leveraging funds to NC Space Grant to provide opportunities for students to engage in research opportunities.*