

Nebraska Space Grant Consortium
University of Nebraska at Omaha
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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 Nebraska Consortium is a Designated Consortium funded at a level of \$575,000 for fiscal year 2011.

PROGRAM GOALS

Goal 1: To deliver a fellowship program that offers aerospace-related research opportunities to diverse student populations at Space Grant academic affiliates throughout Nebraska. Contribute to the STEM workforce pipeline by providing a progression of educational opportunities for talented Nebraska students, preparing them to pursue careers in aerospace science and industry.

Objective 1.1: Offer a statewide competitive fellowship program that provides meaningful experiences, allowing students to acquire and enhance workforce development skills that will better prepare them for employment in the aerospace fields.

Objective 1.2: Provide workforce development opportunities to prepare undergraduate and graduate students for employment in STEM disciplines at NASA, industry, and higher education. These opportunities will provide meaningful, hands-on experience through courses, competitions, and other initiatives in the scientific and technical disciplines necessary for space commerce and exploration.

Objective 1.3: The suite of higher education opportunities for students results in employment and advanced education that will ultimately benefit the aerospace industry.

Goal 2: To raise the aggregate quality and quantity of Nebraska's aerospace research endeavors to the highest level of national competitiveness.

Objective 2.1: Ensure the fair and equal distribution of funds to faculty researchers at academic affiliates through the research mini-grant competition that uses a peer review selection process to ensure statewide balance and alignment with NASA and Nebraska Space Grant priorities.

Objective 2.2: Provide a statewide research program that responds to the needs of NASA, the national aerospace industry, and Nebraska to increase the national competitiveness of Nebraska researchers.

Objective 2.3: Provide a statewide research program that includes faculty mentoring students to develop qualified undergraduate and graduate students prepared for employment in STEM disciplines at NASA, industry, and higher education through authentic NASA-related research experiences.

Objective 2.4: Stimulate, motivate, and support the development of Nebraska faculty to become nationally competitive.

Goal 3: To strengthen the Nebraska STEM education base from elementary through university levels with emphases on NASA content, teacher training, and delivery to underrepresented groups.

Objective 3.1: Provide NASA-related professional development and training opportunities to Nebraska educators, who through deeper understanding and enhanced skills will better educate and inspire students

Objective 3.2: Engage in limited student involvement activities that will serve underrepresented students, offer activities that will recruit students to NASA-related careers, or provide summer opportunities on university campuses for secondary students.

Goal 4: To increase public support for NASA through informal education and spreading NASA's mission to Nebraska citizens and beyond.

Objective 4.1: Support informal education programs throughout Nebraska that use NASA themes and content to enhance skills and learning of students, educators, and the public on STEM content areas, and that strengthen the nation's future workforce.

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

Education Outcome 1

Alexandra Toftul spent the Summer of 2011 at Marshall Space Flight Center (MSFC) where she continued working on a project in the Electric Propulsion Lab that she started in her Spring 2011 internship at MSFC. Toftul spent the last year off campus, participating in four NASA Center internships. In July of 2011 Toftul presented her

internship research at the 47th Annual AIAA Joint Propulsion Conference and Exhibit in San Diego, CA. She also had a publication in the Review of Scientific Instruments, February 2012 issue. Toftul will graduate in May of 2012 with a Bachelor's degree in Electrical Engineering from the University of Nebraska – Lincoln (UNL). She will continue at UNL to obtain a Master's degree in Electrical Engineering. When asked if her internship experiences enriched her education she said her internship work has led to her master thesis topic. "I hope that the arrangement of graduate work collaboration with my former internship mentor will strengthen ties between the University of Nebraska and NASA, and perhaps leads to a greater degree of collaboration between the University of Nebraska and the aerospace industry."

Education Outcome 2

The NASA Nebraska Space Grant supports the student chapter of the American Institute of Aeronautics and Astronautics (AIAA) at University of Nebraska – Lincoln (UNL). Since the chapter's inception in 2008, the students have progressed from CanSat to Design-Build-Fly, and added the Intercollegiate Rocket Engineering Competition last year. This year, with support from the NASA Nebraska Space Grant, the students competed in the University Student Launch Initiative (USLI) and placed third in altitude. Chapter members are also receiving support for the first Nebraska team to participate in NASA's Lunabotics Competition in May 2012. Augmentation funding will support two teams to continue this progression of opportunities with the RockOn! Workshop in June 2012. Team members include students from mechanical, civil, electrical, and computer engineering. The chapter is comprised of 30 undergraduate students, 2 graduate students, 1 faculty mentor, and 1 administrator.

Education Outcome 3

The NASA Nebraska Space Grant Director, Dr. Scott Tarry, is now also the Executive Director of the Strategic Air and Space Museum in Ashland, Nebraska. Dr. Tarry's joint appointment has led to an extraordinary partnership opportunity between the university's research and formal education programs, and the Museum's informal education programs and attractive general public venue. This summer the museum will be offering several teacher training workshops and K-12 aerospace camps that will include NASA curriculum such as high altitude ballooning, and meet the new state science standards.

PROGRAM ACCOMPLISHMENTS

Outcome 1

Some outcome data for metrics are not available as we are only 7 months into the funding period for projects. In these cases, we reported FY 10 data that was available in August 2011. In the statewide fellowship competition, 91% of active academic affiliates received at least 1 fellowship award. Little Priest Tribal College did not have any applications. There is another fellowship competition for this affiliate this spring and will make an award to a qualified student from this institution to reach our target of 100%. To date, 44% of fellows already presented at the NASA Nebraska Space Grant Annual Conference (Goal: 70% will have 1 publication or presentation) with additional presentations and publications to be reported when final fellowship reports are due in

June 2012 (Goal: 100% of significant fellowship awardees will complete a final report that details how they met their proposed outcomes). Exit interviews will take place after the final reports are due in June 2012 (Goal: 80% of significant fellowship awardees will indicate that their experience has influenced them to pursue a STEM-related career or employment, or reaffirmed their decision to pursue a STEM-related career or employment). NASA Nebraska Space Grant placed 14 interns, exceeding the goal of 5 interns, from Summer 2011 to Spring 2012. Interns were placed at Johnson, Marshall, Ames, Goddard, JPL, Ad Astra Rocket Company, Lockheed Martin, and Honeybee Robotics.

NASA Nebraska Space Grant met our goal of at least 2 new courses related to aerospace science and engineering developed this year, and 5 courses revised to enhance NASA-related content. NASA Nebraska Space Grant supported 5 teams of Nebraska students engaged in aerospace-related competitions including Microgravity University, CanSAT, Design Build Fly, USLI, and the FAA Airport Design Challenge.

Develop and implement 3 new programs over the next five years for a progression of STEM opportunities for faculty and students. This year's project is a new partnership with the UNL College of Engineering to support the annual career exploration trip held over spring break. This program was developed to improve the retention rate of freshman and sophomore engineering students. This program, which included a trip for 40 students to Johnson Space Center in March 2012, will allow students to explore internship, co-op, and career opportunities in the aerospace industry.

In FY 10 42% of Space Grant significant awardees who graduated and entered the workforce as their next step, reported employment with NASA, aerospace contractors, universities, or other educational institutions. The data for FY 11 will not be available until August 2012 (Goal: 45%). In FY 10 41% of awardees pursued an advanced degree in a NASA-related discipline. The data for FY 11 will not be available until August 2012 (Goal: 45%). In FY 10 42% of awards were to women and 14.9% were to underrepresented minorities, exceeding state percentages. FY 11 data will not be available until August 2012 (Goal: meet or exceed the state enrollment percentages according to the Chronicle of Higher Education). In FY 10 191 underrepresented students were served. The data for FY 11 will not be available until August 2012 (Goal: 50). In FY 10 64% of student researchers pursued a higher academic degree in a STEM related field, or employment in a STEM-related field following their research experience. The data for FY 11 will not be available until August 2012 (Goal: 60%).

Seventy-one percent of academic research affiliates submitted a research mini-grant proposal to date (Goal: 75%). There is another competition in May 2012 for augmentation funding. All research mini-grant awards were endorsed by a NASA collaborator, or aligned with the NASA Vision, Mission Directorates, or NASA Center Priorities, exceeding the 90% goal. Seventeen researchers made new NASA contacts or strengthened existing collaborations with NASA scientists (Goal: 5). Eighty-five percent of mini-grant awards included at least 1 student research experience (Goal: 75%).

In FY 10 50% of funded researchers submitted an application for continued funding of their research elsewhere. The data for FY 11 will not be available until August 2012 (Goal: 50%). Eighty-five percent of funded researchers submitted for NAS 2012 (Goal: 90%). Several were unable to present at the annual conference due to scheduling conflicts, however they presented their research at a national conference instead. Hank Miller, Nebraska Indian Community College, received a research mini-grant for his project entitled, "A Water Quality Study of the Missouri River and Its Tributaries through Point Source Monitoring and GIS Buffer Studies; From the Santee Reservation to the Macy Reservation." Miller collaborated with the Iowa Space Grant, University of Northern Iowa, University of South Dakota, University of Nebraska-Lincoln, and other environmental agencies (Goal: At least 1 research mini-grant per year will link minority serving institutions to Nebraska research universities).

Outcome 2

NASA Nebraska Space Grant met its goal of supporting 4 teacher workshops that offer NASA content-based education resources or demonstrate how to incorporate NASA resources in the classroom, including the Nebraska Association of Teachers of Science keynote speaker Jeff Goldstein, a teacher to attend the KickSTART II workshop led by NASA Aerospace Education Specialist Angelo Casaburri, a teacher to attend the National Science Teachers Association conference in Indianapolis, and a High Altitude Ballooning Workshop for teachers at the Strategic Air & Space Museum in June.

All teacher travel grant recipients have indicated in their travel report how they will implement NASA-related materials in their classroom. Judith Stucky, Westside High School, received a travel grant to attend the National Mars Educator Conference in November. Upon her return she immediately began implementing material she gained at the conference into her Physics class. She showed them an animation of the rover landing on Mars, and used data from the video to calculate kinetic energy of the rover at four points in its descent, the power at those points, the momentum, and the force. During a department meeting she shared all the resources with the science staff and the career center.

Outcome 3

The NASA Nebraska Space Grant met the goal of supporting 3 informal education activities that align with NASA's informal education goals and required criteria, including a public lecture with Astronaut Mark Kelly, the Nebraska Robotics Expo, and a new science theater at the Omaha Children's Museum. A new Grants Specialist started full-time at the end of September 2011 and he will be working with teachers to continue the Native American Family Science program at Nebraska's tribal schools to enhance learning and inspire higher performance in STEM-related studies (Goal: 50 families).

PROGRAM CONTRIBUTIONS TO PART MEASURES

- Student Data and Longitudinal Tracking: Total awards = 85; Fellowship/Scholarship = 57; Higher Education/Research Infrastructure = 28; 15% of the total awards represent underrepresented minority F/S funding. All students are still enrolled in

their degree program. We will have updated numbers this summer as the students make the next step in the academic or professional careers.

- **Diversity:** Nebraska is home to two tribal colleges, both affiliates of the NASA Nebraska Space Grant. The College of Saint Mary, also an affiliate, is a female only institution. Thirty-three percent of the total awards were to females, 15% to underrepresented, and 2.4% to persons with disabilities. Nebraska Space Grant always strives to encourage women, minorities, and persons with disabilities to apply for fellowships/scholarships. We will continue this effort and work to increase the percentage of female participation through the end of the grant year.
- **Minority-Serving Institutions:** We continue to work with the Nebraska Indian Community College (NICC) faculty members to support research and student engagement. Bobbie Jo Goodteacher, an NICC student, was funded by Nebraska Space Grant to complete a water quality research project with her faculty mentor at NICC. Goodteacher plans to pursue a four-year degree at a university when she graduates from NICC with her Associate's Degree in Natural Resources/ Environmental Science in 2013. Our primary contact at Little Priest Tribal College (LPTC) moved to another institution and we have been having discussions with LPTC President Paul Robertson regarding a science camp this summer and identifying other opportunities for their students and community. Additionally, we have met with Diego Rodriguez, NASA MUREP, to begin discussions about bringing MUREP programs to the Nebraska Tribal Colleges.
- **NASA Education Priorities:** The UNL Rocketry Team competed in the USLI rocketry competition with 42 other university teams from around the country. UNL's Microgravity Team collaborated with JPL and Cbana labs to design and conduct an experiment related to sensors on the ISS. A team from Pleasanton High School participated in the Student Spaceflight Experiment Program (SSEP), whose experiment, designed by 5 female high school seniors, was one of 11 chosen to participate in Mission 2 to the ISS. This SSEP Nebraska team partnered with UNK staff scientists and lecturers in the areas of chemistry, biology and physics as well as research and design teams from John Deere. Faculty from UNK and UNMC visited Pleasanton High School and discussed how STEM skills are vital for success and the benefits of working in a STEM field. Although our primary contact at LPTC moved to another institution, we have been in touch with the college President, Paul Robertson, about how we can partner in the future on projects that benefit both the LPTC students along with the reservation community. A UNO Space Grant fellow developed a design for an energy recycling system as a part of the FAA Airport Design Competition. Dr. Wang at UNL receiving funding to develop a new lab section and purchase a Sunphotometer for undergraduate course Physical Meteorology so students can measure atmospheric optical thickness and transmissivity in the visible spectrum. The mobile instrument will also be used in the Satellite Remote Sensing of Atmosphere and Atmospheric Radiative Transfer courses. Dr. Sara Myers was first funded by Nebraska Space Grant as a graduate student fellow for her student research in the Nebraska Biomechanics Core Facility at

UNO. After graduate school Sara pursued her doctorate in Exercise Science. During her Ph.D. dissertation research she worked closely with Dr. Nick Stergiou on research related to changes in astronaut's musculoskeletal system from living in weightless environments. After receiving her Ph.D. she became a full-time faculty member at UNO/UNMC and has recently submitted a pre-proposal for our upcoming EPSCoR competition and for the new NASA Early Career Faculty program.

- Course development: Dr. Griffith Elder received funding to develop an Advanced Topics in Algebra course at UNO, and Dr. Neal Grandgenett and Dr. Neal Topp developed a new course entitled, "Mobile Technologies and STEM Education," for UNO's College of Education. Five courses were revised including UNL's Engineering AIAA student competition classes; Dr. Langan's adding observational techniques into the curriculum for several Astronomy courses at UNL; Dr. Wang's new hands-on lab section for "Satellite Remote Sensing of Atmosphere."

IMPROVEMENTS MADE IN THE PAST YEAR

The most significant improvement in the past year is the NASA Nebraska Space Grant Director's transition to the Strategic Air & Space Museum. Through a dual appointment at the University of Nebraska at Omaha and the Museum, Dr. Tarry will facilitate greater visibility and programming for NASA projects in Nebraska.

NASA Nebraska Space Grant continues to play a major role in the Nebraska Summer of Innovation project. At least two grants have been leveraged, and a third is pending. The connections established through the Summer of Innovation Capacity Building Grant, and the larger implementation grant, continue to flourish.

More in-depth engineering programs are also emerging with NASA Nebraska Space Grant. The UNL Engineering trip to Johnson Space Center in March provided great visibility for Space Grant opportunities to the freshman engineering class. The goal of the program is to retain students in engineering majors, while also recruiting them to engage with the NASA activities on campus.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

Academic affiliates of the Nebraska Space Grant Consortium include:

- Chadron State College, 4-year public college and graduate degree granting institution
- College of St. Mary, 4-year private college, all women's institution
- Creighton University, 4-year private university and graduate degree granting institution
- Hastings College, 4-year private college
- Little Priest Tribal College, 2-year public community college, Tribal college
- Metropolitan Community College, 2-year public CC, over 110 off-site locations

- Mid-Plains Community College, 2-year public CC, 2 site locations
- Nebraska Indian Community College, 2-year public CC, Tribal college
- University of Nebraska – Lincoln, 4-year public university and Master’s and Ph.D., graduate degree granting institution, Flagship of the University of Nebraska system
- University of Nebraska at Kearney, 4-year public university and graduate degree granting institution
- University of Nebraska at Omaha, 4-year public university and Master’s and Ph.D. degree granting institution, Lead institution for Space Grant
- University of Nebraska Medical Center, 4-year public university, Master’s and Ph.D. granting medical institution
- Western Nebraska Community College, 2-year public CC

Industry, government, and non-profit affiliates and partners include:

- 99th Pursuit Squadron Civil Air Patrol: Offers informal aerospace education outreach targeted to underrepresented populations
- CALMIT- Center for Advanced Land Management Information Technologies: Research projects and internships in the field of agricultural remote sensing
- Girl Scouts: Offers informal aerospace education targeted to female populations
- Nebraska 4H: Projects in robotics, agriculture, and geospatial research
- Nebraska Department of Aeronautics: State government division that offers internships and projects in aeronautics
- Nebraska Department of Education: Lead organization for the Summer of Innovation grant
- Nebraska Academy of Sciences: Partner in delivering annual research conference
- Nebraska Aviation Council: Includes representatives of aeronautics industry throughout the state; developer of the Nebraska STARBASE Rocket Team
- Strategic Air and Space Museum: Foremost aviation museum in the Midwest; offers informal STEM programming
- Tuskegee Airmen: Offers internships and aeronautics outreach targeted to underrepresented populations
- Nebraska Star Party, Inc.: One of the largest gatherings of amateur astronomers in the country; offers both informal and teacher-training programs
- Honeybee Robotics: Offers unique industry internship opportunities for Nebraska Space Grant students