

NASA Nebraska 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 Nebraska Consortium is a Designated Consortium funded at a level of \$845,000 for fiscal year 2010.

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

Troy Munhofen, a student at Nebraska Indian Community College (NICC), received a NASA Nebraska Space Grant fellowship for his participation in a water quality research project at the college. His experience working on this project has given him the skills he will need for his NASA internship this summer. His success from

working on this project has given him the confidence to pursue his bachelor's degree at a local university. In addition to working with his faculty mentor on this project, he has also recruited 2 freshmen NICC students to learn about the project and keep it going as he will be graduating soon. Upon graduation he will not only be working on his bachelor's degree but will be teaching courses at NICC and continuing to encourage fellow students to participate in STEM research opportunities at NICC.

Alexandra Toftul was selected as an intern at Marshall Space Flight Center for the spring of 2011. Toftul is a research assistant at the University of Nebraska- Lincoln and is majoring in Electrical Engineering and Mathematics. Her involvement in this internship centered on propulsion research and development, where she gained experience in the process of component design, development, and testing. She will be returning to Marshall in the summer of 2011 as well.

Dr. Bill Spurgeon, a faculty member at Western Nebraska Community College (WNCC), attended the Integration of Design and Hands-on Learning Workshop sponsored by the Missouri Space Grant. The concepts learned in this conference will be used to revise the curriculum in the Introduction to Engineering class at WNCC.

New Space Grant researcher, Dr. Vincent Wolf at UNO, is using existing Hubble Space Telescope (HST) ultraviolet (UV) spectra of extreme helium stars measured in 2000-2001 along with spectra taken using the International Ultraviolet Explorer (IUE) satellite in 1980 and again in 1990 to measure the rate of temperature change of these stars. The measured rates of temperature change will help distinguish between the two proposed models for producing these rare stars. He is collaborating with the HST scientific staff at NASA's Goddard Space Flight Center.

Education Outcome 2

Recruiting students from the community colleges to continue with their 4-year degree is a priority for the Nebraska Space Grant. Jonathan Spurgeon completed his studies at Western Nebraska Community College (WNCC) where he recently received an Associate's of Science degree in Physics. While at WNCC, Jonathan received a Nebraska Space Grant fellowship to conduct space imaging research with his faculty mentor. Jonathan then enrolled at the University of Nebraska – Lincoln (UNL) to major in Physics and credits his WNCC fellowship for providing some necessary background for classes at UNL. Concepts that were necessary to obtain results in his research project at WNCC were later taught in some junior level physics courses at UNL. The fellowship also aided him in obtaining a research position at the university's physics department. Jonathan plans to obtain his PhD and wants to work for NASA in the future.

Two new programs in Nebraska this year illustrate the progression of educational opportunities, and strive to attract and retain students in STEM disciplines. Two teams from Omaha Public Schools have experiments onboard STS-134 through the Student Spaceflight Experiments Program (SSEP). This program has received much attention and press coverage in Nebraska, and has led to the expansion of the program to Lincoln and rural Potter-Dix teams who will have experiments onboard STS-135.

The second program was offered as a new course at Metropolitan Community College in early 2011. This program was the pilot for the new Nebraska High Altitude Ballooning program. Seventeen students enrolled in the credit course, including formal and informal educators, and college students from Nebraska. The goal was to test the

curriculum and ballooning materials before we grow the program across the state. A professional evaluator was brought in to the project from the beginning. The resulting evaluation was extremely favorable.

Teacher training is an important component of Education Outcome 2. Dr. Linxia Gu, University of Nebraska – Lincoln, is implementing long-term collaborative partnerships with K-12 STEM teachers. She is involving the teachers in engineering research and helping them translate their research experiences and new knowledge of engineering into classroom activities. This past year, the participants gained research experience in building the Venturi apparatus on an inclined plane to simulate reduced gravity, understanding the impact of reduced gravity on fluid dynamics, and will become familiar with current research questions in space travel. The teachers will learn to build and utilize biomechanical test equipment and software, analyze the experimental data, and design effective outreach activities. They will provide connections with local middle and high school students and help to build sustainable follow-up with K-12 students.

Education Outcome 3

The NASA Nebraska Space Grant works to increase public support for NASA through informal education and spreading NASA's mission to Nebraska citizens and beyond. The KidZone Kearney Area Children's Museum, located in the middle of the state, was a new partner in FY 2010. The Space Exhibit is the virtual anchor for the entire Science Zone Space Exhibit. It includes a significant element in astronomy and technology that focuses on space and the solar system. A kid-sized space vehicle and an interactive and educational computer kiosk with access to the NASA Kids Club website is the basis for children to learn about space operations. In addition to being educational and age appropriate, this website is also appealing and fun for kids. This project promotes an interest in space operations early on and is the first step in preparing children to learn about and become excited about space and a possible future career. Approximately 200 people visit the exhibit each week.

Another new partner, the J. M. McDonald Planetarium at the Hastings Museum was investigating ways to further bring the vastness and beauty of the universe down to Earth sparking greater interest in astronomy and space science. After attending the 2010 WAC Planetarium Conference in Omaha, staff at the planetarium were thrilled to have found the perfect way to do this: bringing in NASA's ViewSpace exhibit. This is a permanent exhibit near the planetarium and will feature breathtaking images, videos, and information. The Nebraska Space Grant helped fund the materials needed to complete this project. Approximately 38,000 people will visit the exhibit each year.

PROGRAM ACCOMPLISHMENTS

Outcome 1

The Nebraska Space Grant offers a statewide competitive fellowship program that offers aerospace-related research opportunities to diverse student populations at Space Grant academic affiliates throughout Nebraska. We are especially pleased to report that Nebraska Space Grant-funded Fellows Tom Frederick and Tyler Wortman received 5-year NSF Fellowships.

Jennifer Balmat, Chadron State College, wrote in her final report, “Through this experience, I have grown beyond a ‘textbook’ understanding of geology. I have developed strong geologic field, laboratory, and technical skills that will allow me to investigate these and other geologic questions.”

100% of student fellows and researchers have an assigned faculty mentor who ensures meaningful experiences that allow the students to acquire and enhance workforce development skills to better prepare them for employment in the aerospace fields.

Final reports and exit interviews have not yet been completed as we are still in the performance period. 100% of student fellows that receive significant awards will complete final reports that detail how they met their proposed outcomes. And 80% of student fellows who receive significant awards will indicate in exit interviews with Space Grant staff that their experiences have influenced them to pursue STEM-related careers or employment, or reaffirmed their decisions to pursue a STEM-related careers or employment.

2 UNO students, Angela Burgett and Colby Ranslem, attended the Connecticut Helicopter Workshop sponsored by the Connecticut Space Grant. They received instruction on aerodynamics, rotorcraft principles, wind tunnel testing, and more.

11 interns were placed at NASA and in the aerospace industry. These placements include JPL (2 students), Goddard Space Flight Center, UNL, Lockheed Martin (2 students), Honeybee Robotics (2 students), Marshall Space Flight Center, Johnson Space Center, and Ad Astra Rocket Company. Kyrik Weidman, a Hispanic male engineering student, was selected as a spring 2011 intern at Johnson Space Center.

We exceeded our target of 4 courses with at least 7 new or revised courses related to aerospace science and engineering supported by Space Grant this year.

We met our goal of 5 teams of Nebraska students engaged in aerospace-related competitions or design projects each year. This year, student teams included CanSat; FAA University Design; Microgravity University; Nebraska High Altitude Ballooning; and Design, Build, Fly.

Dr. Liubov Kreminska, a female faculty member at the University of Nebraska at Kearney, was funded for her work with Dr. Felix Miranda, Chief, Antenna and Optical Systems Branch, NASA Glenn Research Center; Dr. Anatoly Khizhnyak, MetroLaser, Inc.; and Dr. Herman Batelaan, University of Nebraska-Lincoln. The title of her project is, “The Study of Diffraction of Laser Beams Marked with Optical Singularities.” The research involves a relatively new branch of optics, namely optics of singularities. The project also involves a female undergraduate student researcher.

At least 75% of mini-grant awards included a student research experience. Melissa Emory, University of Nebraska at Omaha, stated in her final report, “Working with a faculty mentor has provided the opportunity not only to learn a great deal from him, but also provided insight into the work of mathematics professors, and to experience what mathematics research actually is.”

41 presentations and 12 posters were presented at the Annual NASA Nebraska Space Grant Conference April 15, 2011. This conference, held in conjunction with the Nebraska Academy of Sciences, allows students and faculty researchers to share the results of their Space Grant and EPSCoR funded work.

We have connected faculty from research universities with faculty and students at Little Priest Tribal College (LPTC). My Soul Earth Kearnes had faculty mentors from

LPTC and the University of Nebraska at Omaha (UNO) who helped her transition from her community college fellowship project to a research project at UNO. My Soul is working with Dr. Jeff Peake in Geography / Geology at UNO and the cooperation between the faculty mentors has served as a model for future tribal college students.

Outcome 2

The NASA Nebraska Space Grant supported at least 4 teacher workshops this year that offered NASA content-based education resources or demonstrated how to incorporate NASA resources in the classroom. These activities included Dr. Gu's project at UNL, the UNO Teacher Education Aerospace Education Workshop, and 2 graduate course offerings of the 4 Earth Systems Science courses at UNL. Teachers will be surveyed to ensure 60% of participants will use the resources from the teacher workshops in their curriculum.

Outcome 3

We exceeded our goal of supporting at least 3 informal education activities per year that align with NASA's informal education goals and required criteria. Support was directed toward the space exhibit at the Kearney Children's Museum, the NASA ViewSpace exhibit at the Hastings Museum and Planetarium, the Omaha Children's Museum mobile planetarium project, Aim for the Stars camps, and others.

Several events were held on the tribal reservations this past year. We exceeded our target of 50 families served through the rocket program, the telescope program, and the two evening Star Parties.

In collaboration with the University of Nebraska Medical Center, the NASA Nebraska Space Grant served 40 Native American students in a STEM camp on the UNO campus during the summer of 2010.

NASA 2010 Education Priorities

One of the best experiences for college students in terms of authentic, hands-on experiences in science and engineering is the Microgravity University program offered through NASA. The Systems Engineering Educational Discovery (SEED) project under the supervision of Dr. Carl Nelson at the University of Nebraska-Lincoln, was selected for spring 2011 flight. This project involved 6 male and 2 female engineering students. Although one of the last states to participate, this is the third consecutive year Nebraska has fielded a team in Microgravity University.

In addition to the annual fellowship competition, community college initiatives over the last year have included the new High Altitude Ballooning course at Metropolitan Community College, the addition of Mid-Plains Community College as an affiliate (currently underway), and the strengthening course offerings at Western Nebraska Community College.

Dr. Dave Byers is working with Yuri Gawdiak, Director of the NASA NextGen Joint Planning and Development Office on a project investigate and quantify the costs and benefits associated with the Ground Management Program. The research will also evaluate the operational efficiencies and effectiveness resulting from the Ground Management Program implementation.

Additionally, Dr. Byers serves as an advisor for the Nebraska FAA Design Competition Team. NextGen relies on innovative strategies for improving safety of the air transportation system at all levels. The safe movement of aircraft is of interest to the FAA, NASA, and local communities. The team research involves the experimental application of a low-cost, off-the-shelf technology solution for monitoring aviation activity at airports that do not have controlled airspace. This technology has the potential for providing advisory alerts for the separation of aircraft.

Fellowship recipient Catherine May and her advisor, Dr. Jun Wang, collaborated with Dr. Charles Ichoku, NASA Goddard Space Flight Center, to study Satellite Remote Sensing of Aerosols. Their research cites the rapidly growing concerns among the scientific community about aerosols on climate change. Wildfires in North America contribute more carbon monoxide, nitrous oxides, and particulate matter into the atmosphere. The study used fire events previously observed by satellite remote sensing instruments aboard NASA's Terra and Aqua satellites to address the issue of predicting smoke plume injection heights.

The institutions that comprise the NASA Nebraska Space Grant are quite diverse. We have community college affiliates, two tribal colleges, an all-women's college, and all the research universities in the state. The participants are diverse as well, with underrepresented faculty members and students. Finally, the participating institutions represent the geographic distribution of the state as well.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- Longitudinal Tracking: Total awards = 44; 21% 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.
- Course Development: Nebraska Space Grant funded at least 7 new or revised courses targeted at the STEM skills needed by NASA that are developed with NASA support.
- Matching Funds: Nebraska Space Grant requires a 1:1.5 cost share for research infrastructure and higher education mini-grants. Teacher training, informal education, and travel mini-grants require a 1:1 cost share.

Minority-Serving Institutions: Several programs were held on the tribal reservations this year and included both student and faculty training. A fall collaborative meeting with the Iowa Space Grant regarding a joint Native American program was beneficial in responding to the needs of the students and faculty at the tribal colleges. Finally, Fr. McShane at Creighton University is conducting a project that involves underrepresented groups, including Winnebago High School on the Winnebago Reservation. This project focuses on research and development of the LAAS system within aviation by researching and expanding the Cosmic Ray Observatory Project. The research concluded with an expanded knowledge and emphasis on the outreach and feasibility of existing Cosmic Ray Observation.

IMPROVEMENTS MADE IN THE PAST YEAR

The Nebraska Space Grant was honored to host the 2010 Western Region Space Grant Conference in Omaha in September 2010. The event was a tremendous success with nearly 100 attendees, including Nebraska affiliates from across the state. The event offered Nebraska students, faculty, and affiliates the opportunity to showcase their research, outreach, and facilities. The post-meeting comments were extremely positive and complimentary on a well-organized and executed conference.

Summer of Innovation planning was a major focus this year. In fall 2010, we established a new partnership with the Nebraska Department of Education. We submitted a successful NASA Summer of Innovation Capacity Building proposal. This provided us with four months to work on identifying and building capacity with the formal and informal middle school education audiences across the state. This endeavor was more successful than we could have imagined. A statewide task force was established, along with a STEM out of school time web portal that is now supported by Space Grant.

This planning grant exceeded everyone's expectations and identified new collaborators around the state. Upon the release of the 2011 Summer of Innovation opportunity from NASA, Nebraska was well positioned to succeed with Space Grant as a collaborator. The statewide proposal, Nebraska BLAST!, includes Space Grant delivering two of the four strands of teacher training each summer. Nebraska BLAST! was one of nine projects selected for funding in 2011 and preparations are underway for this exciting initiative.

The separate efforts begun with new collaborators from the planning grant continue as well. Jeff Cole with the Nebraska Community Learning Center Network is spearheading an effort for middle school after school programs in STEM. This group is pursuing a grant from the Mott Foundation with partners including Nebraska Space Grant, the Department of Education, Time Warner Cable, the Omaha Henry Doorly Zoo, Nebraska Educational Television, and others.

Another emerging opportunity for the Nebraska Space Grant is our partnership with the Strategic Air and Space Museum in Ashland, Nebraska, which is equidistant between the state's two population centers, Omaha and Lincoln. We are developing a comprehensive, standards-based educational program that will involve university STEM researchers and educators. Based, in part, on the partnership of Ohio State University and the Center for Science and Industry in Columbus, Ohio, our efforts will seek to infuse NASA content in both formal and informal educational programming at the state's aerospace museum. Working groups of faculty and educators are being formed around substantive areas such as robotics, aeronautics, astronomy, and high altitude ballooning.

Other new programs introduced this year include the Nebraska High Altitude Ballooning Program and the Student Spaceflight Experiments Program (SSEP). Nebraska Space Grant took on a leadership role with SSEP in delivering a community experience for teams from across the nation at Kennedy Space Center when students traveled for the launch attempt.

In terms of process improvement, the Nebraska Space Grant is implementing exit interviews this year for 50% of our significant awardees. Not only will this provide us

with the student's perspective on the fellowship experience, but it will also allow us to provide individualized mentoring for the student as to future NASA and career opportunities.

We recently met with the Campus Coordinator from the College of St. Mary to identify process improvements for implementing the fellowship program on that campus. We developed a plan for a "brown bag lunch" a few times each semester where the students and faculty can interact with Space Grant staff and we can bring in Space Grant researchers from other institutions conducting research related to their discipline.

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
- Ad Astra Rocket Company: Now working with Nebraska Space Grant to offer unique industry internship opportunities for Nebraska students