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 Space Grant Consortium is a Designated Consortium funded at a level of $575,000 for fiscal year 2012.

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, & 3)

Education Outcome 1

Amy Kessner spent the past two summers interning at NASA's Goddard Space Flight Center. During her experiences, she gained many skills to improve her as a researcher. She has presented the research conducted while at NASA at several conferences and

recently submitted her thesis work for publication. Amy will graduate in May 2013 with her Master's degree. She hopes to work at NASA when she graduates and pursue her Ph.D. while working there. In her exit interview, Amy said of her internship, "It has reaffirmed by decision to pursue a STEM-related career. NASA shows that there is always more to learn and explore."

Education Outcome 2

The NASA Nebraska Space Grant has been able to attract and retain students through the successful progression of opportunities offered in conjunction with the UNL College of Engineering. This year the students continued their participation in the University Student Launch Initiative (USLI), NASA Lunabotics, RockSat-C, and Design-Build-Fly (DBF). The USLI team spent 18 months designing, building, and then launching a reusable rocket to ascend one mile with a specific payload. The Lunabotics team will compete in May 2013 at Kennedy Space Center. The team learned how to successfully design, contrast, and test a robotic vehicle capable of performing a specified mission. This year, their design has a much better drive system and they overhauled the excavation method, hoping for more success in the current year's competition. The RockSat-C team was formed after UNL students entered the Intercollegiate Rocket Engineering Competition a few years ago. A team of enthusiastic younger students were led by a senior who organized them for the task of designing, building, and flying a completely student-built, high-powered sounding rocket. After success in the competition, the students were confident they could participate in RockSat-C. In this competition, students test their own payloads on a sounding rocket launched at NASA Wallops Flight Facility. In collaboration with NASA scientist Matt Showalter, the team is planning on scaling down an EHD pump developed by NASA Goddard. The DBF team competed in April in Wichita, KS. The team designed, fabricated, and demonstrated the flight capabilities of an unmanned, electric-powered, radio-controlled aircraft to best meet the specified mission profile. Additionally, we are supporting the UNL Robo Ops team, one of eight teams selected nationally to compete at NASA's Johnson Space Center in the RASC-AL competition in June 2013.

Education Outcome 3

The NASA Nebraska Space Grant capitalized on its strong partnerships in delivering a high profile science outreach event to promote STEM literacy. On September 15, 2012, we launched three high altitude balloons with student and faculty experiments from Memorial Stadium during halftime of the Nebraska Cornhusker football game. There were approximately 90,000 people present. The balloons and payloads were tracked throughout the second half of the game and through a website that was heavily promoted. Partnering organizations included the Strategic Air & Space Museum, UNO, UNL, 4-H, Nebraska Athletics, Omaha and Lincoln Public Schools, and Metropolitan Community College. Retired Nebraska Astronaut Clay Anderson was on hand at mid-field to promote the program and to speak with students before the game. This was a unique way to promote STEM education and activities in the state to tens of thousands in the stands, and many more thousands watching on tv and online.

PROGRAM ACCOMPLISHMENTS

Outcome 1

Project funding periods coincide with the academic year as much as possible. Therefore, we are only 7 months into many projects. In these cases, we reported FY 11 data that were available in June 2012. In the statewide fellowship competition, 100% of eligible academic affiliates received at least 1 fellowship award, up from 91% the previous year. To date, 40% 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 2013 (Goal: 100% of significant fellowship awardees will complete a final report that details how they met their proposed outcomes). Exit interviews for FY 12 students will take place after the final reports are due in June 2013. One hundred percent of FY 11 students reported their experience had influenced them to pursue a STEM-related career or employment, or reaffirmed their decision to pursue a STEM-related career or employment (Goal: 80% of significant fellowship awardees). In his exit interview from his summer 2012 JPL internship, Joseph Bartels said the internship helped him both academically and professionally. The skills he learned during his internship helped him in his research at UNL and he was able to make contacts for collaboration in the future. Shawn Schumacher interned at JSC last summer and said the experience exposed him to Electrical Engineering which he was unfamiliar with as a Mechanical Engineering major at UNL. Shawn thought this exposure would greatly benefit him in his future educational goals. Eric Fritz interned at JPL for the last two summers. He said he was exposed to computer programming which he knows is something that will benefit him his future. He said the internship reaffirmed his decision to stay and pursue a STEM career as he had questioned it before he participated in the internships. Eighty-eight percent of students interviewed said they want to pursue a career with NASA. Unfortunately, the NASA Nebraska Space Grant was only able to fund 6 interns in the summer of 2013 (Goal: 5 interns per year), down from 14 interns in the summer of 2012. Previous augmentation funding had been used to supplement the number of interns funded each year.

Some select student highlights: Laura Judd is pursuing a Master's degree in Earth and Atmospheric Sciences at UNL. Last summer, she conducted airborne research aboard NASA's P-3B aircraft with the Student Airborne Research Program. Adrian Sanabria-Diaz, an undergraduate Physics student at UNK, is the president of the UNK Physics Club. Over the summer, he interned at UNL in the Nebraska Center for Materials and Nanoscience which exposed him to numerous opportunities for graduate school. Carly Baumann, an undergraduate at UNL, is an officer of the American Meteorological Society Club on campus. In 2012, she interned at JPL following the transport of dust over Kuwait.

NASA Nebraska Space Grant exceeded our goal in FY 11 of at least 2 new courses related to aerospace science and engineering developed this year with 6 new courses. FY 12 data will be available in August 2013.

NASA Nebraska Space Grant supported 7 teams of Nebraska students engaged in aerospace-related competitions, exceeding the goal of 5. Teams included Microgravity University, Lunabotics, Design Build Fly, USLI, RockSat-C, and RASC-AL.

A five year goal of the program is to 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 Johnson Space Center. Undergraduate students from three Nebraska schools, Metropolitan Community College, UNO, and UNL, along with faculty from Western Nebraska Community College and UNO, traveled to JSC to take part in a pilot Career Exploration Workshop. The workshop was created to expose Nebraska students to the career opportunities available at NASA through a hands-on engineering activity. Students completed a challenge that included a Mars rover with mining tasks.

Eighty percent of academic research affiliates submitted a research mini-grant proposal to date (Goal: 75%). 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. Eighty-five percent of mini-grant awards included at least 1 student research experience (Goal: 75%).

In FY 12, 65% percent of funded researchers submitted for the Nebraska Academy of Sciences 2013 (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.

The NASA Nebraska Space Grant faced a difficult time in recruiting the Tribal colleges to participate in the regular funding cycle last spring. Over the past several months, the management team has made numerous trips and presentations to each Tribal college. The results are already evident in strengthening prior connections and establishing new ones. We will continue to provide the necessary support to the Tribal colleges to ensure their continued participation. While we did not meet the goal of 1 research mini-grant linking minority-serving institutions to Nebraska research universities, we are confident we can exceed the goal next year.

Outcome 2

As discussed above, the AIAA Chapter and associated teams participating in challenges and competitions provides excellent recruiting and retention among the aerospace students. The progression of opportunities has led to nationally competitive teams that are benefiting NASA through their contributions.

New course development and course revisions are a goal of the NASA Nebraska Space Grant. A physics special topics course in high altitude ballooning was offered at Metropolitan Community College (Metro). Metro is a large two-year college in Omaha. The course focused on scientific inquiry through the development of scientific payloads

launched to near space on weather balloons. Dr. Kendra Sibbernsen designed and instructed the course. She had students work in small groups to design the payloads, participate in the launch and retrieval of the equipment, analyze the data, and present the results of their research.

Six students from Nebraska attended the Space Career Day held by the Space Foundation in conjunction with the National Space Symposium in Colorado Springs. The students were able to hear panels of aerospace company presentations about workforce opportunities and network with them afterwards. After attending the Space Career Day, Zoraya Hernandez, an undergraduate student at UNO, is changing her career goal from professional pilot to engineering in the aerospace field.

Blake Ross, a disabled Computer Science student at Western Nebraska Community College, is working on an autonomous Arduino-based RC car. He is collecting data and working on control from a simple Bluetooth adapter that connects wirelessly to a smartphone to determine the accuracy of the GPS. He is planning to participate in a competition on June 8 in Boulder, CO.

The NASA Nebraska Space Grant will meet its goal of supporting 4 teacher workshops. In partnership with the Strategic Air & Space Museum, the Nebraska Space Grant sponsored a Teacher Night with retired Astronaut Clayton Anderson and science demonstrations to take back to the classroom. Over 300 teachers attended this inaugural free event.

In response to NASA's interest in training pre-service and in-service teachers, the Nebraska Space Grant created the Nebraska Education Space Ambassadors (NESA) program. This program will pair pre-service and in-service teachers for training from NASA Education specialists at Kennedy Space Center to increase the skills of STEM educators in Nebraska. The initial cadre of 20 teachers will serve as ambassadors who will train other teachers across the state. This will increase the number of teachers trained in NASA content and will increase the number of workshops overall delivered across the state.

Kelly Lane and Kathryn Dearing, students at the College of St. Mary (CSM), developed the CSM Elementary Science Outreach Program. They recruited other CSM students to provide hands-on science activities and lessons for Omaha elementary schools. The program includes NASA content and activities, and they developed a website that offers science-learning resources for the elementary teachers. They have reached over 90 elementary students to date this year.

Outcome 3

The NASA Nebraska Space Grant sponsored several informal education activities that align with NASA's informal education goals. We partnered with the Strategic Air & Space Museum on education outreach activities at the Nebraska State Fair and at the River City Rodeo. Thousands of students and members of the general public were

reached through these events. A team from Omaha North High School participated in the Real World Design Challenge, which allows students to use professional engineering software to develop technical skills needed to complete an engineering challenge. Several members of the Strategic Air & Space Museum Education staff traveled to Johnson Space Center to meet with the Education staff about possible collaborations and incorporating NASA content into museum exhibits and activities. Finally, we are targeting May for the next Native American Family Science Night at Walthill Public School. The Strategic Air & Space Museum will again be a partner on this event and take the mobile observatory, and other demonstration activities to enhance learning and inspire higher performance in STEM-related studies (Goal: 50 families).

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Student Data and Longitudinal Tracking:** Total awards = 85; Fellowship/ Scholarship = 32, Higher Education/Research Infrastructure = 53; 8 of the total awards are underrepresented minority F/S funding. All students are still enrolled in their degree programs. We will provide updated numbers this summer through OEPM as students begin to make the next step in their academic or professional careers.

- **Minority-Serving Institution Collaborations:** We have renewed interest in the NASA Nebraska Space Grant program this year from Nebraska Indian Community College (NICC) and Little Priest Tribal College (LPTC). NICC student proposals in Environmental Science were selected for funding after campus visits to promote the Space Grant program. The student projects include community outreach and are providing the underrepresented students with internship experience in the summer. Our faculty contact, Hank Miller, is working with several other students to generate more proposals and interest for the next funding cycle. Additionally, we are modifying our campus visits to accommodate more non-traditional female students who mostly attend evening classes. Hank Miller attended the High Altitude Ballooning workshop sponsored by NASA Nebraska Space Grant at the Strategic Air & Space Museum. He is anxious to share this knowledge with students at the Tribal College with student experiment launches.

  New contacts at LPTC include Bridget Quinn, the Academic Dean, and Janyce Woodard, the Environmental Science Instructor. We have an opportunity this summer to support the Summer Science Camp for community outreach. Recent discussions have centered on more student engagement in NASA projects that are also important to the Tribal community such as those involving environmental science.

- **NASA Education Priorities:** *Accomplishments related to the "Current Areas of Emphasis" stated in the 2010 Space Grant solicitation. Report on areas that apply to*

work proposed in your proposal and budget.

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

  As mentioned above, we are continuing our projects with the two Tribal Colleges, both of which are affiliates of the NASA Nebraska Space Grant. Another affiliate, the College of St. Mary, is a female only institution. We have a diverse composition of affiliates, including 4 community colleges, 3 Ph.D. granting institutions, and 4-year state and private colleges. Our affiliates are located statewide, including the underserved panhandle of Nebraska. To date in FY 12, 40% of the fellowship awards were to females, 20% to underrepresented students, and 3.5% to persons with disabilities. Through our fellowship program, we strongly encourage women, minorities, and persons with disabilities to apply. Recently, our office has made numerous trips to all our affiliates, including the Tribal colleges to encourage a more diverse pool of applicants for our upcoming May 15, 2013 fellowship deadline.

- 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 mentioned above, the new NASA Nebraska Education Space Ambassador program will partner pre-service and in-service teachers together for training at NASA Kennedy Space Center. These teachers will then serve as our ambassadors to conduct teacher training in NASA content across the state.

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

  Several new relationships have been made with community college faculty, while others have been strengthened. At Western Nebraska Community College, a college on the far west side of the state, Dr. Bill Spurgeon, our Campus Coordinator, continues to mentor students in fellowships and has at least one disabled student who will be traveling to Boulder, Colorado for a competition in June. He also brought two students to present at the annual conference. Dr. Spurgeon facilitated a campus visit for NASA Nebraska Space Grant where we met with additional faculty members and students interested in Space Grant. Four new faculty members showed interest in the program and we are working with them on proposals for the next funding cycle.

Dr. Kendra Sibbernsen, our Campus Coordinator at Metropolitan Community College (MCC), delivered a High Altitude Ballooning course, and has a new research project in development which would expand more research opportunities to community college students. Dr. Dave Wooten is also a new contact at MCC. He teaches Physics and is helping promote NASA opportunities in his courses.

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

  Michaela Lucas serves as the Co-Chair of the Aeronautics Working Group of the National Council of Space Grant Directors. She will host the first Nebraska Unmanned Aerial Systems Summit in May 2013. This summit will bring academia, government, and industry together to discuss current directions in UAS with a goal to establish a Nebraska UAS Working Group.

  One researcher conducting Aeronautics research is Lily Wang from UNL. She received a Research mini-grant for her project entitled, "Human Reactions to Noise with Varying Degrees of Rattle or Vibration as Produced by Low-Boom Supersonic Aircraft." NASA is interested in developing low-boom supersonic aircraft for commercial use. However, one main concern with deploying such aircraft over land is the detrimental effect that such noise could have on human communities.

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

  Dr. Jing Zen, UNL Department of Earth and Atmospheric Sciences, received a Higher Education mini-grant to develop a course titled Satellite Remote Sensing of the Atmosphere. The course material is based on utilizing NASA's satellite data to study weather patterns like precipitation, air quality, visibility, and climate. The funding will also help Dr. Zen develop another course titled Numerical Modeling of Weather and Climate.

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

  Dr. Sara Myers, University of Nebraska at Omaha (UNO), received NASA Nebraska Space Grant funding in the past. She was recently named one of the first two Research-only faculty members at UNO. Her NASA Space Grant funding played a significant role in her obtaining this position, as well as a lead researcher on a nationally competitive NASA EPSCoR grant.

IMPROVEMENTS MADE IN THE PAST YEAR

Several changes took place this year. In March, our Grants Specialist resigned to take another position and we did not fill the open line. The goal is to streamline the operations where possible, and spread the workload among the current staff to reduce administrative costs. The mini-grant program has been restructured to reflect changes discussed by NASA program management at the spring 2013 meeting. For example, stronger emphasis is now placed on projects being unique to NASA, even stronger language has been incorporated about diversity targets, and the funding levels have been reduced as we do not anticipate any augmentation funding. The focus of our Precollege program has shifted to decentralize teacher training through the NESA program discussed above. Our goal is to have the cadre of ambassadors deliver the teacher training across the state. Finally, UNO is pursuing a potential opportunity to have recently retired NASA Astronaut Clay Anderson play a larger role in STEM education outreach across several departments on campus and with community partners such as the Strategic Air and Space Museum. The Nebraska Space Grant will play a key role if the opportunity comes to fruition.

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