

North Dakota Space Grant Consortium
Lead Institution: University of North Dakota
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Consortium URL: ndspacegrant.und.edu
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Lines of Business (LOBs): NASA Internships, Fellowships, and Scholarships;
Stem Engagement; Institutional Engagement; Educator Professional Development

A. 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 Dakota Space Grant Consortium is a Capability Enhancement Consortium funded at a base level of \$300,000 and augmentation level of \$270,000, totaling \$570,000 for fiscal year 2016.

B. PROGRAM GOALS

The North Dakota Space Grant Consortium (NDSGC) stated the following overarching goals in its 2016 base and augmentation proposal:

1. Support undergraduate/graduate student STEM experiences that will lead to enhancement of the NASA and technical workforce
2. Nurture and grow specific Research Focus Areas (RFAs) that will develop multi-institutional, collaborative research to develop expertise in several NASA-relevant research disciplines
3. Expand K-12 educator competence in space sciences and provide them the necessary tools to conduct investigations in the classroom
4. Distribute scholarships and research fellowships to North Dakota undergraduate and graduate students in STEM fields with an emphasis on female and American Indian student support
5. Conduct public service projects that engage and educate the North Dakota citizenry of NASA's mission and activities.

C. PROGRAM/PROJECT BENEFITS TO PROGRAM AREAS

Aligning with NASA Education Outcome 1, the North Dakota State University (NDSU) Bison Robotics team and the University of North Dakota (UND) RAPTOR (Robot Automated for the Procurement and Transport of Regolith) team competed in the 7th Annual Robotic Mining Competition in May 2016 at the Kennedy Space Center. This was NDSU's first year competing in the competition and

placed 30th out of 45 teams. UND's RAPTOR team placed 5th and also won 1st place for the Outreach Project Award and 2nd place for the Slide Presentation and Demonstration Award. Both teams conducted hands-on activities with K-12 students throughout North Dakota. Team members also served as mentors for the local First Lego League Tournament and the Nurturing American Tribal Undergraduate Research and Education (NATURE) program, which serves students at Tribal schools and colleges across the state.

Aligning with NASA Education Outcome 2, one of the three high school teams supported by the NDSGC qualified to compete in the *For Inspiration and Recognition of Science and Technology* (FIRST) Robotics World Championships through exemplary work at regional competitions. This team was the Hatton-Northwood Thunder Robotics Team 876. They finished 48th out of 650 teams in the St. Louis World Championships! The other teams included North Star Robotics Team 877, who made it to the semi-finals in Duluth, MN, and the West Fargo FIRST Robotics Team 4818, *The Herd*, who made it to two regional competitions in Duluth, MN and Cedar Falls, IA. The Herd was also selected as "Team Captain" in IA and made it to the semi-finals! All of the robotics students worked diligently on STEM outreach initiatives throughout the entire school year.

Aligning with NASA Education Outcome 3, the NDSGC conducted its first Amateur Radio on the International Space Station (ARISS) call with astronaut Commander Tim Kopra. Over 400 students from nearby K12 schools, UND college students, and the public attended this event. The NDSGC prepared for this historic 1,000th ISS call by visiting classrooms from around the state and advertising to the public. The NDSGC also prepared a day full of hands-on STEM demonstrations, inflatable GeoDome lessons, and college-level NASA-competition rockets, rovers, and FSAE racecars.

D. PROGRAM ACCOMPLISHMENTS

- NASA Internships, Fellowships, and Scholarships (NIFS):

The NDSGC SMART goals in NIFS includes a minimum of 51% of awards will be awarded to females and 10.5% of awards will be awarded to underrepresented minorities in STEM. Out of the 139 NIFS awarded, 73 recipients were female (53%), and 34 were underrepresented minorities in STEM (24%).

- Higher Education projects:

The NDSGC funded six quarter-time or half-time Graduate Research Assistantships in FY16. The NDSGC SMART goal in this area is four students annually. These students completed research in areas including high altitude ballooning, human spaceflight, exoplanet research, and extraterrestrial oxygen production.

In FY16, NDSGC supported six college teams. Students from the University of North Dakota participated in the NASA Student Launch, Robotics Mining Competition, and the High Altitude Student Platform (HASP). Students from the North Dakota State University participated in the NASA Rover Challenge, Robotics Mining Competition, and AIAA Design Build Fly competition.

NDSGC awarded six Summer Faculty Fellowships to faculty from four different affiliate institutions in FY16. The original SMART goal was to provide four faculty members summer fellowships. These institutions included Dickinson State University, United Tribes Technical College, Nueta Hidatsa Sahnish College, and the University of North Dakota.

In FY16, the NDSGC reached a total of 240 pre-service teachers through workshops across the state. The SMART goal in this area is to reach 200 pre-service teachers annually. The NDSGC also attended an in-service teacher conference at the North Dakota Math and Science Teachers Association at the Red River High School in Grand Forks, ND. The NDSGC conducted their own ballooning workshop and discussed funding opportunities with a booth display, reaching a total of 62 educators. The SMART goal in this area is to reach 15 teachers. The NDSGC is also planning the annual in-service workshop for May of 2017. Presence at this conference resulted in a record 11 teams participating in the Near-Space Balloon Competition (NSBC), held in the fall semester.

Four students from the University of North Dakota received travel grants to present their STEM research at conferences around the United States. The SMART goal was to provide five students with travel grants.

Six college students from UND, Mayville State University, and Sitting Bull College joined the STEM Ambassador program. There were five female and one male undergraduate and graduate students. All six participated in STEM outreach events throughout the entire FY16, compared to the SMART goal of ten students (five per semester).

- Research Infrastructure projects:

Three RFAs were funded in FY16, each with PIs or Co-PIs at non-research institutions, and two with a Co-PI at a Tribal college. The SMART goal in this area is to fund a total of two projects over the course of the performance period.

The Human Space Flight Laboratory housed at UND provides research for faculty and students in multiple departments at the university. In FY16, the NDSGC supported activities conducted by student researchers at UND, including a 10-day analogue study in a confined habitat with an all-female crew. The SMART goal in this area includes expansion of the project to include at least two investigations to be carried out by faculty and students at a non-research affiliate institutions over the course of the performance period. Additional focus will be placed on this SMART goal in FY17.

- Precollege projects:

The FY16 Megalaunch ballooning initiative was replaced with efforts focused on the 2017 Space Grant Total Solar Eclipse campaign. This also involves a collaboration with a third grade Tribal elementary school, ultimately launching their students' payload during the eclipse launch. The SMART goal in this area is to expand the project to include at least three launches over the course of the performance period, with a focus on rural and Tribal community K-12 schools.

In FY16, the NDSGC visited six schools reaching 815 students. This was in preparation for these schools' involvement with the call to the ISS. One of these schools was a very small elementary school with five classes in the entire school, near Emerado, ND. The SMART goal in this area is to conduct at least two classroom visits at either rural or Tribal community schools.

In FY16, the NDSGC funded three teams to compete in the K-12 FIRST Robotics Competition (highlighted in the program/project benefits to program areas section of this report). The SMART goal in this area is to fund or partially fund three high school teams annually, with a focus on rural and Tribal community schools.

Eleven middle and high school teams from Kindred, Hebron, Bismarck, Tower City, Fargo, and Grand Forks participated in the 2016 Near-Space Balloon Competition (NSBC). Our SMART goal was to fund six schools with a focus on rural and Tribal community K-12 schools.

One of the NDSGC SMART goals is to recruit 15 Space Camp attendees for FY16. This was NDSGC's first iteration of the NDSGC-run "Space Camp", which instructed 32 students and was held at Bismarck's tribal college, United Tribes Technical College.

- Informal Education projects:

In FY16, the NDSGC reached a total of ~1152 members of the public through various informal education programs. The SMART goal in this area is to reach 1000 members of the public annually, with a focus on rural and Tribal communities. Some of the highlights in these areas include the partnership with the North Dakota School for the Blind, a radio call to the ISS, a space-themed Family Night at Grafton Elementary School, and visits to rural communities like Bottineau, ND to participate in hands-on activities with 5th and 6th grade students in their annual "Water Festival."

E. PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE GOALS

- **Diversity:**

The NDSGC has five Tribal College affiliate institutions: Turtle Mountain Community College, Cankdeska Cikana Community College, Nueta Hidatsa Sahnish College, United Tribes Technical College, and Sitting Bull College.

Faculty: Two of the three current RFAs have a Co-PI at a Tribal College, Nueta Hidatsa Sahnish College. One of these projects has one female PI. Of the six Summer Faculty Fellowships, three were awarded to females and four to Tribal Colleges.

Students: Of the 139 scholarships awarded, 60 recipients were female, and 32 were underrepresented minorities. Five of these awards were both significant (meeting the \$2500 threshold) and for American Indian students. Four of the five American Indian recipients were female. Of the 17 research fellowships, six were awarded to females. Of the four NASA internships, one was awarded to a female student.

- **Minority Serving Institution Collaborations:**

Affiliates at Tribal Colleges are of great assistance in recruiting applicants for NDSGC NIFS, specifically in scholarship recipient selection for the American Indian Scholarship. These affiliates are in regular attendance at our annual meetings. The NDSGC also visited the United Tribes Technical College in FY16 to conduct a Space Camp for area middle school students. Registration for this two-day camp filled up in one day! NDSGC has maintained connection with the National Coalition of Native American Students, which was made through affiliate faculty at Nueta Hidatsa Sahnish College (NHSC). Two collaborative RFA projects between UND and NDSU with NHSC continued in FY16, increasing research opportunities for both faculty and students in STEM fields at Tribal Colleges in ND.

- **Office of Education Annual Performance Indicators:**

○ API 2.4.1: ED-16-1	<u>73</u>
○ API 2.4.2: ED-16-2	<u>312</u>
○ API 2.4.4: ED-16-4	<u>20</u>
○ API 2.4.5: ED-16-5	<u>1215</u>

F. IMPROVEMENTS MADE IN THE PAST YEAR

FY16 was the first full year with Caitlin Nolby as Deputy Director and Marissa Saad as Coordinator. The NDSGC focused on reaching the western side of North Dakota, including rural and Tribal communities. The NDSGC has been able to significantly expand its reach throughout the state, especially in the areas of educator workshops, public outreach, Space Camps, and student recruitment into STEM programs and NDSGC-sponsored opportunities through career fairs (e.g. research fellowships and NASA competition teams). The NDSGC high altitude ballooning team has expanded to over 15 team members, a record number of participants.

The NDSGC has also raised expectations and selectiveness for all funding solicitations, due to the number of applications each semester. This increases the competitiveness between all affiliate institutions and programs. For example, the college-level team projects and fellowships have more demanding eligibility criteria. The STEM Ambassador program, also augmented in FY16, had its first Training Workshop, where students from multiple affiliate institutions met at UND participated in the same hands-on activities that they will teach around the state. They also learned pedagogical and andragogical teaching techniques from a Teaching and Learning professor, Dr. Mark Guy (UND). These students are inspiring the next generation of students in STEM through multiple avenues, not possible through the NDSGC in previous years. The NDSGC's reach across the state continues to expand, with help from these STEM Ambassadors.

G. CURRENT AND PROJECTED CHALLENGES

Some of the largest challenges facing the NDSGC include student recruitment and awareness of various research opportunities in STEM. This challenge is currently being addressed through participation in more public events, especially in rural and Tribal communities. With affiliate institutions spread out geographically due to the layout of North Dakota, this also makes collaborations in projects more difficult. By implementing the STEM Ambassador program and participating in affiliate-organized events, NDSGC now has assistance reaching out to western and rural K-12 schools.

An additional challenge facing the NDSGC is the involvement of community college and Tribal college students and faculty in NASA research projects. Many of these faculty members have such a large teaching load compared to faculty members at research universities that they do not always have the time to participate in another project. Also, many students at these colleges are non-traditional students and may have full-time employment outside of school, so also do not have time to participate in another project. The NDSGC is currently examining strategies to address levels of involvement.

One strategy to overcome this challenge is to implement the Community College and Tribal College Fellowship Bridge Program. Although there were no applicants in FY16, NDSGC has made modifications to the program and will continue to promote this opportunity to affiliate institutions. This program will provide research funding for students who are transferring from a two-year college to UND or NDSU (both research university affiliates of the NDSGC). These students will complete a research project the summer before enrolling in classes at the research university, under the mentorship of a faculty member at that institution. The goal of this program is to "bridge" the gap between the two campus cultures, and to encourage retention in STEM fields, especially among female and underrepresented minority students.

H. PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

The following table reflects only FY16 affiliate involvement projects.

NDSGC Affiliate Institution	Institution Type	Involvements
Bismarck State College	Two-year Community College	NIFS; High Altitude Ballooning
Cankdeska Cikana Community College	Tribal College at Spirit Lake Indian Reservation	NIFS
Dakota College at Bottineau	Two Year Community College	NIFS; Educator Workshops; K12 Education
Dickinson State University	Public Four Year College	NIFS; Hosted 2016 Annual Affiliates Meeting; Educator Workshops; RFAs
Gateway to Science Center	Children’s Museum in Bismarck	Community Outreach
Lake Region State College	Two Year Community College	NIFS; Community Outreach
Mayville State University	Public Four Year College	NIFS; STEM Ambassador Program; RFAs; Educator Workshops
Minot State University	Public Four Year College	NIFS; Educator Workshops
North Dakota Heritage Center	State History Museum in Bismarck	Community Outreach
North Dakota State College of Science	Two Year Technical College in Wahpeton	NIFS; RFAs; Career Fairs
North Dakota State University	Doctoral Research University in Fargo	NIFS, with a focus on research fellowships and internships, NASA student competition teams; Educator Workshops
Nueta Hidatsa Sahnish College	Tribal College at Fort Berthold Indian Reservation	NIFS; RFAs; Summer Faculty Fellowships
Sitting Bull College	Tribal College at Standing Rock Indian Reservation	NIFS; STEM Ambassador Program
Turtle Mountain Community College	Tribal College at Turtle Mountain Indian Reservation	NIFS; Educator Workshops
United Tribes Technical College	Tribal College in Bismarck supported by all four Indian Reservations in the state	NIFS; RFAs; Space Camp; Summer Faculty Fellowships
University of North Dakota	Doctoral Research University in Grand Forks	NIFS, with a focus on research fellowships and internships; NASA student competition teams; STEM Ambassador Program; Space Camps, Community Outreach Events; NSBC; K12 Programs; Human Spaceflight Laboratory; Travel Grants; Educator Workshops; Career Fairs
Valley City State University	Public Four Year College	NIFS; Educator Workshops
Williston State College	Two Year Community College	NIFS; College Fairs