

**The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD – this document) 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.**

North Dakota Space Grant Consortium  
Lead Institution: University of North Dakota  
Director: Dr. Santhosh Seelan  
Telephone Number: 701-777-2355  
Consortium URL: [ndspacegrant.und.edu](http://ndspacegrant.und.edu)  
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## PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The North Dakota Space Grant Consortium is a Capability Enhancement Consortium funded at a level of \$430,000 for fiscal year 2014.

## PROGRAM GOALS

The North Dakota Space Grant Consortium (NDSGC) stated the following goals in its 2010 base proposal and budget:

1. Fund five research proposals worth up to a total of \$50,000 from non-research affiliate institutions. Five Research Focus Areas (RFAs) have been defined (astronomy/planetary science research, planetary space suit research, Earth science research, materials science research and small satellite design and development) but meritorious, NASA-relevant projects in other areas may also be approved;
2. Fund six Summer Faculty Fellowships, each worth \$5,000, that allow faculty to revise or create a NASA-relevant STEM course;

3. Provide partial or full funding for up to four North Dakota students to attend NASA Space Centers for summer internships for a total of \$25,000 plus travel;
4. Provide travel funding of \$10,000 to support North Dakota BalloonSat and HASP participants;
5. Provide funding for up to six FIRST Robotics teams to attend regional or national competitions for a total of \$25,000;
6. Provide \$2,000 in funding for travel to present pre-service workshops at affiliate colleges around the state.
7. Base funding for scholarships/fellowships will provide \$130,000 to undergraduate and graduate students from across North Dakota. All applications will be submitted through the Consortium website and evaluated for eligibility. Fellowships per semester are now \$3,500 for undergraduate students, \$4,500 for masters students and \$6,000 for Ph.D. students and can be awarded to the same student up to two semesters. Students must submit a NASA-relevant research proposal that includes collaboration and oversight with a faculty mentor. Scholarship amounts will be determined based on recommendations of each affiliate college but it is expected that all amounts will be less than \$5,000 per student.

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

Aligning with NASA education Outcome 1, American Indian Scholarships of \$2,500 each were awarded at each of the five tribal colleges in the state. These scholarships are given to exceptional students who plan to complete a four year degree or graduate school program in North Dakota after receiving their degrees at their respective tribal colleges. Student Maurianna Loretto was the recipient at Sitting Bull College this past year, and she will graduate in May of 2015 with a B.S. in Environmental Science, with plans to enroll in a master's program in the field upon graduation.

Aligning with NASA education Outcome 2, the NDSGC supported K-12 students from West Fargo public schools to participate in the Student Spaceflight Experiments Program in 2014. This engaging hands-on experience excited the students about science and space exploration. With a wide range of ages involved, mentorship between grade levels was a large part of the project as well. The winning project, focused on rust and oxidation processes in microgravity, will be launched to the International Space Station in 2015.

Aligning with NASA education Outcome 3, the NDSGC participated in Dickinson State University's (DSU) space-themed *Family Science Day* in December 2014. Activities for students and their families centered on the Exploration Flight Test of NASA's Orion Space Capsule, in collaboration with Johnson Space Center's Outreach Office. Through planetarium showings and hands-on investigations, the event increased public awareness of NASA programs and space exploration.

### PROGRAM ACCOMPLISHMENTS

#### **Outcome 1:**

Scholarships/fellowships: The NDSGC provided 181 undergraduate scholarships to our affiliate institutions in 2014. This includes the American Indian Scholarship given to a student at each of the five Tribal Colleges, the Pearl Young Scholarship (given to a female at the University of North Dakota), and the Lillian Goettler Scholarship (given to a female student at North Dakota State University) as well as the general undergraduate scholarships at the non-research institutions. The NDSGC scholarship program provides a crucial connection to financial aid officers and faculty in STEM departments at each affiliate institution, and has allowed for expansion in affiliate participation in other NDSGC programs as well.

Eleven (11) research fellowships were given to students at both research institutions and affiliate colleges and universities as part of a new effort to encourage STEM research at the undergraduate level across the state. Two (2) of the students were enrolled at the graduate level and nine (9) were undergraduates. The NDSGC scholarship/fellowship programs are in direct alignment with Program Goal 7.

*“The NDSGC funding provided me with a valuable opportunity to produce an undergraduate research project, which has an important role in my preparation for graduate school and my future career in mathematics. I am honored to have been selected for the award and am proud to recognize the support of NASA when I present and share my work.” (Submitted by Chloe Ondracek, fellowship recipient, Minot State University)*

NASA Center Internships: The NDSGC supported five (5) students for internships at NASA centers. Student participation as interns not only gives the students unique opportunities, but provides the NDSGC with connections for future collaborations with NASA centers in research and programming. Support for student internships is in direct alignment with NDSGC Program Goal 3.

*“The opportunity I had being able to work with NASA’s Robotics Academy has made me a more technically skilled engineer. In addition, I gained valuable experience in robotics, the field in which I intend to pursue, while working on a NASA prototype project with a team of engineers.” (Submitted by Jordan Senff, internship recipient, University of North Dakota)*

Research Infrastructure: The following Research Focus Area (RFA) awards give students and faculty the opportunity to engage in field or lab research in a STEM field that also furthers the goals of NASA. Each project is in direct alignment with NDSGC Program Goal 1.

Joseph Martinetti of United Tribes Technical College (UTTC) received RFA funding continuing in 2014 for a project titled, “Watershed Impact Analysis Using AVIRIS and Field Data.” This research is working to create a procedure to monitor the environmental impacts that the recently expanding oilfield in Western North Dakota may have on the wetlands over the long term and on a large scale.

Corinne Brevik of Dickinson State University received RFA funding beginning in the summer of 2014 for a project titled, “Light Pollution in Western North Dakota due to Regional Oil Development.” This work involves collaboration from faculty at the University of North Dakota and engages undergraduate students in field research.

Katie Lyman of North Dakota State University received RFA funding beginning in the fall of 2014 for a project titled, “Kinesio Taping as a Low-Cost Intervention to Assist with Quadriceps Recruitment During Exercise Countermeasures.” This work involves collaboration from faculty and students at Mayville State University as well.

Dilpreet Bajwa of North Dakota State University received RFA funding beginning in the fall of 2014 for a project titled, “Novel Nanocellulose based Fire Retardants for Polymer Composites.” This work involves collaboration from faculty and students at Fort Berthold Community College and NASA Glenn Research Center as well.

Summer Faculty Fellowships: Five (5) summer faculty fellowships were given in FY14 for faculty at affiliate institutions to create or improve an existing higher education course in STEM fields or complete a NASA-relevant research project. Faculty were from Dickinson State University, North Dakota State College of Science, Lake Region State College, and the University of North Dakota. Students at these affiliate institutions are now enrolled in improved courses with new hands-on experiences in: biology, zoology, geology, and unmanned aerial vehicle uses in agriculture, and completing research on the characterization of engineering management in small new space firms. These awards are in direct alignment with NDSGC Program Goal 2.

Graduate Research Assistantships/Tuition Waivers: Space Grant funded six (6) M.S. students in Space Studies with Graduate Research Assistantships for FY14. Research projects included UND observatory operations, high altitude ballooning (aligning with NDSGC Program Goal 4), Near-Earth Object (NEO) characterization, human spaceflight, and extraterrestrial oxygen production. Six (6) M.S. Space Studies students received tuition waivers in 2014, for a total of 35 credits.

*“The unique experience I have had working in the human spaceflight lab at UND and collaborating with NASA researchers as a GRA has been challenging but rewarding, one that I hope will lead to unique opportunities after I graduate.” (Submitted by Lindsay Anderson, Graduate Research Assistant, University of North Dakota)*

Space Grant Sponsored Travel and Research: Space grant provided travel stipends for seven (7) students to present research at conferences or to complete research projects at NASA centers. These meetings included the National Council of Space Grant Directors’ Spring 2014 Meeting, Fall 2014 Western Region Space Grant Meeting, Lunar and Planetary Science Conference, International Mars Society Convention, and a trip for research to NASA Ames Research Center.

National Competitions: The NDSGC supported college-level teams in STEM-relevant and NASA competitions. These included HASP (High-Altitude Student Platform) in

collaboration with the University of North Florida (in direct alignment with NDSGC Program Goal 4), Student Launch, Robotics Mining, Rover Challenge, and the AIAA Design/Build/Fly competitions. Some North Dakota teams are rookies in these competitions, yet still perform exceedingly well at the national competitions.

**Outcome 2:**

Teacher Workshops: The NDSGC conducted pre-service workshops for two hundred (200) education students at the University of North Dakota, Valley City State University, North Dakota State University, and Dickinson State University in 2014. In-service workshops for forty (40) teachers were conducted at the ND Science Teachers Meeting and at Minot State University. The NDSGC Coordinator also gave the keynote address at the ND Council of Teachers of Mathematics Meeting, attended by 250 teachers. These efforts have greatly increased K-12 participation in NDSGC programs. These workshops are in direct alignment with NDSGC Program Goal 6.

FIRST Robotics: Three (3) teams from North Dakota high schools were supported for regional competitions in FY14. Those teams were from Cando, Northwood/Hatton, and West Fargo. All of these teams performed very well at the regional competitions, and West Fargo took the 1<sup>st</sup> place title in Duluth, MN. Northwood received the Engineering Inspiration Award at a second regional competition in Peoria, IL and qualified with West Fargo to compete at the World Championship later in 2015. These teams continue to improve each year, and receive the support of their local communities as well. Support for these teams is in direct alignment with NDSGC Program Goal 5.

Near-Space Balloon Competition (NSBC): In 2014, the NDSGC sponsored the 4<sup>th</sup> consecutive NSBC for students in grades 6-12. Six teams competed (twice that of the previous year!), developing scientific payloads at their respective schools which were included in a double high-altitude balloon launch in November 2014. The more intense timeframe for the competition in comparison to previous years was put in place to familiarize students with the NASA Project Life Cycle. The winning team embraced mentoring between high school seniors and 6<sup>th</sup> graders, and studied the effects of the near-space environment on plants and marshmallows. Support for this competition is in direct alignment with NDSGC Program Goal 4.

High Altitude Ballooning Middle School Initiative: In the spring of 2014, the entire 8<sup>th</sup> grade class at Schroeder Middle School in Grand Forks participated in a high altitude balloon launch. Students worked in teams to develop and build payloads. The goal of this program is to increase opportunities for hands-on STEM investigations at the K-12 level. The 2014 NSBC is the first evidence of the HAB Middle School Initiative inspiring participation in the statewide competition the following year. This initiative is in direct alignment with NDSGC Program Goal 4.

**Outcome 3:**

Space Science Outreach: The NDSGC and NDSGC-supported college students conducted numerous visits to K-12 schools throughout 2014, giving presentations and conducting hands-on activities with students related to space sciences and STEM.

Activities also included space camps and school field trips and public tours of the UND Human Spaceflight Laboratory. The increased presence of the NDSGC in K-12 outreach is a result of teacher workshops conducted throughout the state and connections made as members of the ND STEM Network (a community of partners working together to provide high quality experiences in STEM fields).

Community Events: In partnership with organizations like the Dakota Science Center in Grand Forks, the NDSGC participated in educational events like *Super Science Day*, public libraries' summer programming across the state, *Dickinson Family Science Day*, and other public events throughout 2014 that promote STEM education and awareness of NASA's missions and goals.

## PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Diversity:** The NDSGC has five Tribal College affiliate institutions: Turtle Mountain Community College, Cankdeska Cikana Community College, Fort Berthold Community College, United Tribes Technical College, and Sitting Bull College.  
*Faculty:* Of the 4 RFA awards, 2 of these projects have a PI or Co-PI at a Tribal College. Two of these projects have at least 1 female PI or Co-PI. Of the 5 Summer Faculty Fellowships, 2 were awarded to females.  
*Students:* Of the 181 scholarships, 97 were female, and 51 were underrepresented minorities. 10 of these awards were significant (meeting the \$2500 threshold) with 6 of those awards going to American Indian students, and 5 going to females. Of the 11 research fellowships, 3 were awarded to females. Of the 5 NASA internships, 2 were awarded to females. Of the 7 travel funding awards, 3 were given to female students.
- **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. Visits to United Tribes Technical College (UTTC) and Fort Berthold Community College (FBCC) took place during the summer of 2014 to not only tour facilities, but to strengthen relationships in NDSGC programming as well. RFA funding continued for a faculty member at UTTC in 2014, and a new collaborative RFA project between NDSU and FBCC began in 2014 as well, increasing research opportunities for both faculty and students in STEM fields at Tribal Colleges in ND.
- **NASA Education Priorities:**
  - Students participated in hands-on experiences and real-life problem solving in multiple NDSGC programs in 2014. This included NASA and national STEM competitions at the college level, research fellowships, activities conducted at community events, FIRST Robotics, high altitude ballooning and the Near-Space Balloon Competition, GRAs in many fields including work in the UND Human Spaceflight Laboratory, and NASA center internships.

- Middle school teachers are engaged through in-service workshops throughout the state and through the Near-Space Balloon Competition (grades 6-12) and the high altitude ballooning initiative focused on 8<sup>th</sup> grade classes.
- NDSGC student research fellowships are awarded each semester, but the summer is an excellent time for an undergraduate or graduate student to work with a faculty mentor on a STEM research project with the aim of retaining them in their STEM major through to graduation and toward a STEM career.
- Strong relationships exist with faculty at Dakota College at Bottineau, Lake Region State College (LRSC), and Bismarck State College through pre-service teaching, high altitude ballooning program expansion, and research fellowships. LRSC also has an Integration Scholarship for students completing research as a lab assistant in a STEM field while exceling academically, and this program is being used as a model for expansion to other community colleges.
- Two RFAs currently ongoing are directly related to environmental science and climate change, aimed at better understanding the regions in Western North Dakota due to the recent “oil boom.” Faculty and students at United Tribes Technical College are studying the long-term effects on local wetlands and faculty and students at Dickinson State University are examining the impact of the population increase and increase in services on light pollution due to activities related to oil drilling.
- Summer faculty fellowships and RFA awards are directly aimed at enabling early career faculty to complete NASA-relevant research and to improve infrastructure at non-research institution affiliates for both students and faculty in STEM fields to complete hands-on research. For example, faculty and students at Fort Berthold Community College are participating as collaborative partners with North Dakota State University as a direct result of experience gained through a RFA project in 2012.

## IMPROVEMENTS MADE IN THE PAST YEAR

In 2014, the Human Spaceflight Laboratory made a significant leap in the research opportunities available to faculty and students in North Dakota, in collaboration with multiple NASA centers. Three graduate students lived inside the integrated system of habitat, rover, and space suits for a total of thirty days. Research projects conducted during the mission included microbial sampling in partnership with NASA’s Jet Propulsion Laboratory, horticulture studies and waste production, geological surveys, and psychological and physiological studies. The key objective of the mission was to confirm that the facility was capable of supporting a month-long mission. Much of the research conducted also provided data for master’s theses at UND. The NDSGC supported the design of space suits starting in 2004, and the program continues to expand each year. The students recorded their 30-day experience at: <http://spacesuitlab.blogspot.com/>

The Near-Space Balloon Competition has increased the prevalence of the NDSGC and NASA initiatives at the K-12 level throughout the state. Participation in the 2014 competition *doubled* in comparison with the previous year. This program not only gives

middle and high school students the opportunity to conduct hands-on research up to the stratosphere, but engages science and math teachers in NASA content as well.

There was a significant increase in the number of research fellowships awarded to students at non-research affiliates of the NDSGC in 2014. In past years, this program has focused only on students at the University of North Dakota and North Dakota State University, but in an effort to increase hands-on opportunities in STEM for students at two- and four-year colleges, applications have been encouraged from students throughout the state. For this program, the willingness of affiliate faculty to mentor students and their persistence in encouraging undergraduate research have been crucial to this effort's success.

The NDSGC Newsletter, *The Aurora*, highlights each of these activities:  
<http://goo.gl/mtZk4U>

## PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

The NDSGC affiliate members each helped develop our strategic plan. An annual meeting of the NDSG is held each spring; with consistent attendance by representatives from each affiliate institution. The meeting location rotates each year with a new affiliate host, encouraging involvement of all affiliates throughout the state.

The roles of NDSGC affiliates vary depending on institution-type, but generally include: involvement in pre-service and in-service teacher workshops, encouragement of student, faculty, and local community participation in NDSGC programming (research fellowships, RFA projects, summer faculty fellowships, high altitude ballooning, public outreach and K-12 events), and the scholarship recipient selection and awards process.

Bismarck State College—two year community college  
Cankdeska Cikana Community College—tribal college at Spirit Lake Indian Reservation  
Dakota College at Bottineau—two year community college  
Dickinson State University—public four year college  
Fort Berthold Community College—tribal college at Fort Berthold Indian Reservation  
Gateway to Science Center—children's science museum in Bismarck  
Lake Region State College—two year community college  
Mayville State University—public four year college  
Minot State University—public four year college  
North Dakota Heritage Center—state history museum in Bismarck  
North Dakota State College of Science—two year technical college in Wahpeton  
North Dakota State University—doctoral research university in Fargo  
Sitting Bull College—tribal college at Standing Rock Indian Reservation  
Turtle Mountain Community College—tribal college at Turtle Mountain Indian Reservation  
United Tribes Technical College—tribal college in Bismarck supported by all four Indian Reservations in the state

University of North Dakota—doctoral research institution in Grand Forks  
Valley City State University—public four year college  
Williston State College—two year community college