NDSGC

North Dakota
Space Grant Consortium

Aurora

2019 Edition

NORTH DAKOTA
SPACE GRANT CONSORTIUM

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Cover Photo:
Participants in Space Center University for students who are visually impaired, work together on hands-on challenges to complete a NASA mission. (See full story on page 21).

Notes From the Director

Nurturing Space and STEM education throughout North Dakota

Greetings to each of our North Dakota Space Grant Affiliates.

I've procrastinated long enough but with Caitlin and Marissa urging me more forcefully each day to get at writing this letter, I find myself looking out my office window with the ground covered with snow and wind chills below -30. What could be better than being in North Dakota at this time of year?! OK – maybe a few of you have some ideas – but I ask where else but in North Dakota could you find the individual and collective enthusiasm for STEM and all things related to space? In the next few pages, you'll see that enthusiasm expressed in many different ways and all across the state. You're all working in this arena because you're genuinely excited in your own right about helping lead the way for our students as they learn about the nature of the world about themselves. You show your enthusiasm and you light the fires that will drive our students to great things! In that regard, be sure to check out the success stories that some of our students have offered – see what they've done with the enthusiasm that you've brought.

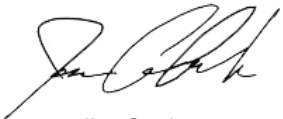
I'll briefly note here for those who assiduously keep track of such things that we've realigned the Aurora to better match the dates that cover our annual report to NASA, so that what appears here in the future will better match those data. This Aurora coverage includes a partial overlap of last year to catch our previously reported coverage of hosting the National Space Grant meeting in September of 2017.

Our success is marked in part by the number of people we reach. And this year, as in the past, our STEM Ambassadors have led the way. Six Ambassadors served during this period – reaching over 6,800 K-12 students, teachers, and members of the public. These students came from Mayville State University, North Dakota State University, and the University of North Dakota. Among these, Emma Twedt (NDSU), and Connie Nelson (Mayville) have now been STEM Ambassadors for two years, and Shae Skager (UND) has served as an Ambassador for three years – that's a lot of bristlebots! This is a key aspect of NDSCG – and we'd encourage any college student from our affiliates to contact us about how they might be able to serve.

Reaching K-12 students involves giving teachers more tools. Caitlin and Marissa have presented three in-service and six pre-service workshops for 322 educators across the state. Activities vary from fun stomp rocket competitions to working through a simulation of an Apollo 13 scenario to show how effective communication is needed to solve complex problems.

I'm particularly proud of our team's activities with the North Dakota Vision Services/School for the Blind in Grand Forks. Caitlin and Marissa received some training themselves and then teamed with Dr. Cass Runyon of South Carolina Space Grant to work with the students at NDVS/SB. Here the tools are different but the enthusiasm is the same. Among other aids, Cass brought special tactile maps to help the students better appreciate the organization of the solar system and the surface of the Moon.

Finally, through student internships at NASA and in industry, research fellowships for students and professors, travel grants, and support for team competitions, NDSCG has had a busy and exciting year. I'm glad you could be part of it.



Jim Casler

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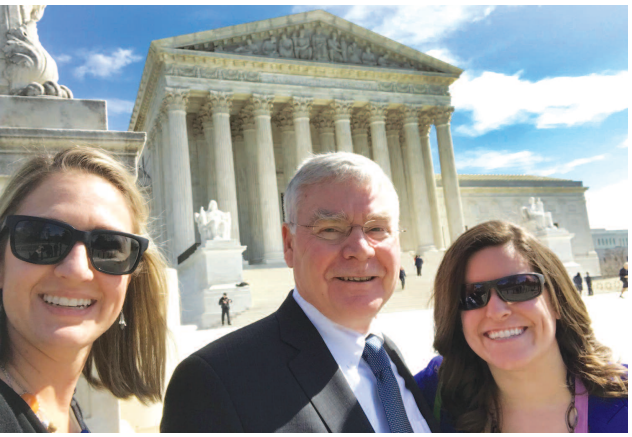
NASA initiated the National Space Grant College and Fellowship Program, also known as Space Grant, in 1989. Space Grant is a national network of colleges and universities. These institutions are working to expand opportunities for Americans to understand and participate in NASA's aeronautics and space projects by supporting and enhancing science and engineering education, research, and public outreach efforts. The Space Grant national network includes over 950 affiliates from universities, colleges, industry, museums, science centers, and state and local agencies. These affiliates belong to one of 52 consortia in all 50 states, the District of Columbia, and the Commonwealth of Puerto Rico. The 52 consortia fund fellowships and scholarships for students pursuing careers in science, technology, engineering, and mathematics, or STEM, as well as curriculum enhancement and faculty development. Member colleges and universities also administer pre-college and public service education projects in their states.

Space Grant Meetings

From March 1st to the 4th, the NDSGC Director, Deputy Director, and Coordinator attended the 2018 National Council of NASA Space Grant Directors' Annual Spring Meeting in Washington, D.C. and visited with United States legislators from North Dakota. They shared the successes of the North Dakota programs and projects funded by Space Grant over the past year. Senator John Hoeven, Senator Heidi Heitkamp, and U.S. Representative Kevin Cramer were all receptive to the North Dakota Space Grant program. At the Directors' Meeting, the NDSGC met with keynote speaker John Holdren, the Science Advisor to President Obama.



Affiliate Involvement

On April 13-14th, the 2018 NDSGC Affiliates Meeting was held at North Dakota State University in Fargo, ND. Presentations included Space Grant funded student research, team projects, faculty research, and funded STEM education projects from across North Dakota. Some interactive presentations included FIRST Robotics technology demonstrations and hands-on challenges team in engineering. The meeting schedule and research presentation downloads can be found here: https://bit.ly/2R6XDtH

National Meeting

The NDSGC hosted the National Space Grant Directors' Meeting from September 14-16, 2017, where over 200 delegates from across the nation visited Grand Forks, ND.

The meeting included an interactive session on diversity, video footage and project highlights of the Eclipse Ballooning Project, a student poster session & Eclipse Fair, and round table discussions with Mike Kincaid, NASA's Associate Administrator for Education. Attendees also participated in tours of the Ronald Reagan Minuteman Missile Site, kayaked down the Red River, got a behind-the-scenes look at the Ralph Engelstad Arena, and experienced the UND Human Spaceflight Laboratory.

The NDSGC would like to thank the Space Grant Foundation, the Space Grant Executive Committee, UND student volunteers, meeting presenters, and a generous grant from the Greater Grand Forks Convention and Visitors Bureau for their help in making this meeting a success!

You may read an article about the National Meeting in UND Today, here: https://goo.gl/YwNycJ.

NDSGC team and UND Space Sudies graduate student volunteers.

NDSGC affiliates and NDSGC team (From L to R): Saad (NDSGC), Shannon King (NDSCS), Angie Bartholomay (DCB), Erik Holland (Heritage Center), Nolby (NDSGC).

Meeting attendees explore student research projects related to the Total Solar Eclipse on August 21, 2017 while walking along the "path of totality."

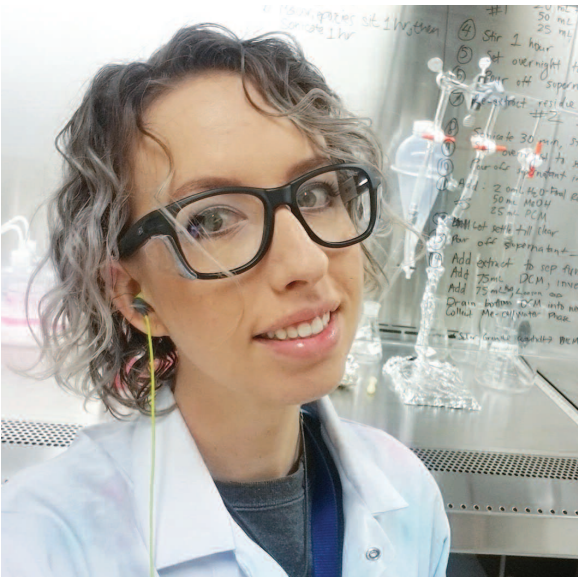
NASA Internships

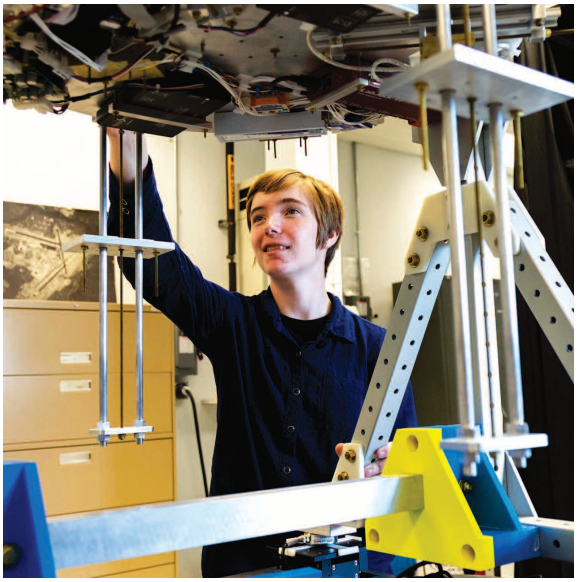
Kayla Daniels

Space Studies,
University of North Dakota

ILC Dover:
Design Engineer Intern

"Interning at ILC Dover has allowed me to participate in the processes that go into building spacesuits and orbital habitats. Through the knowledge I have gained from the projects I worked on, I am better equipped to complete my thesis and excited to continue a career in the space industry."





Kim Whaley

Mechanical Engineering,
North Dakota State University

Wallops Flight Facility
Small Satellite Test Engineering

"Thanks to NDSGC, I've been able to work in my dream job for a summer and really jump start my career as a future aerospace professional."

Denise Buckner

Space Studies,
University of North Dakota

Ames Research Center
Astrobiology Research Assistant, Planetary Systems Branch

"Don't be afraid to ask questions and meet with as many scientists and engineers as you can. Their knowledge and expertise is a valuable resource and they love to help interns. Plus, you might teach them something!"

Evan Gjesvold

Electrical Engineering,
North Dakota State University

Goddard Space Flight Center
Precision Eddy-Current Displacement Sensor

"Working at NASA Goddard Space Flight Center this summer gave me invaluable insight into what the industry is like. Having this knowledge at the beginning of my career will help me confidently make decisions about future job applications."

Zane Ducheneaux

Business Administration, Sitting Bull College

Goddard Space Flight Center
MAIANSE (Minority University Research and Education Program (MUREP) for American Indian and Alaska Native STEM Engagement) Intern Collaboration

"This internship allowed me the opportunity to work with great people. I truly could not have asked for a more efficient team to be a part of. This experience was an odyssey that I will never forget."

Aaron Knudtson

Mechanical Engineering,
North Dakota State University

Goddard Space Flight Center
Thermal Engineering Intern: Experimental Testing of a Heat Pipe Operating Under a Reflux Mode

"Space Grant funding allowed me to have the life changing summer that I did. My NASA experience even convinced me to pursue a Masters in Aerospace Engineering."

Porter Dixon

Mechanical Engineering,
North Dakota State University

Johnson Space Center
Avionics System Division: Human Interface Branch

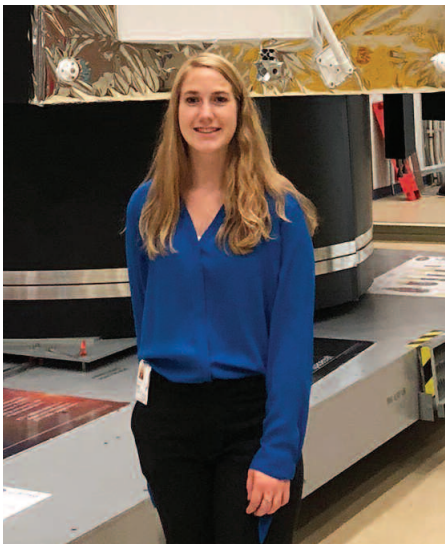
"This internship at JSC allowed me to experience the work culture of NASA while also affording me the opportunity to gain job experience, make new friends, and network with people who are in fields that I'm interested in. I now know that I want to work at NASA full time as a career."

Annie Miles

Mechanical Engineering,
University of North Dakota

Goddard Space Flight Center
Two-Phase MicrofluidicCooling of Emerging Electronic Devices

"NASA Goddard was able to truly help me discover my passion of research while giving me the opportunity to use and enhance the skills I learned at the University of North Dakota."



Nathaniel Boisjolie-Gair

Mechanical Engineering, North Dakota State University

Armstrong Flight Research Center
PReliminary AerodyNamic Design To Lower Drag (PRANDTL-D)

"My mentor Albion Bowers said, 'Engineers are terrible communicators. Just say it. Put the idea out there and go from there.' These words stuck with me to remind me that sometimes you can't find the perfect way to present an idea but more progress will be made if you throw it out there and try to explain it rather than think about it alone."

National Student Competitions

NDSU MATE ROV Team

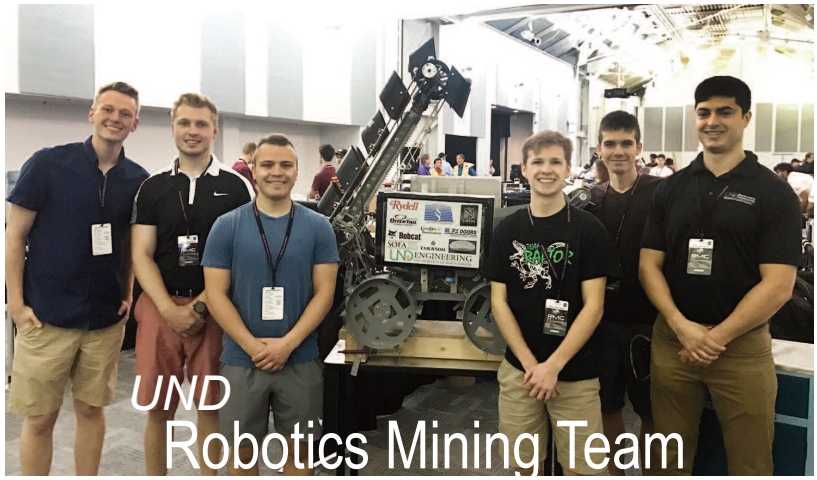
The NDSU designed a robot for the 2018 Marine Advanced Technology Education (MATE) ROV Competition. The MATE competition challenges students from all over the world to design and build ROVs to tackle missions modeled after scenarios from the ocean workplace. This year, the tasks were modeled to simu- late the recovery of vintage aircraft engines, recovering a seismometer, and in- stalling a tidal turbine and instrumentation to monitor the environment. The team built a ROV made out of PVC, aluminum, and acrylic. It had a total of six thrusters and was controlled via a 75-ft tether.

NDSU Drone Team

2018 marked the first year that NDSU participated in the Association for Unmanned Vehicle Systems International Student Unmanned Aerial Systems (AUVSI SUAS) Competition. They focused heavily on design, research, and development of a 3D printed unmanned aerial system. They did so by dividing into two teams, to focus on electrical and mechanical aspects of the project. The mechanical team studied the principals of flight, such as the flight physics, aerodynamics, and structural integrity to aid in the development of 3D printed prototypes. The electrical team focused on designing the communication, flight control, and power systems and interfaced these embedded systems in the design. They also performed tests on the power system to ensure safe flights.

NDSU AIAA Design Build Fly

The AIAA Design Build Fly (DBF) team constructed a tube-launched UAV for the 2017-2018 competition season. The objective of this project was to design, manufacture, assemble, and test a radio controlled, unmanned airplane to compete in April of 2018. The 8-person team competed with students from around the world as they traveled to Fort Collins, Colorado and Wichita, KS for launches. The project served as the team's Senior Capstone project for students in NDSU's Mechanical Engineering program.

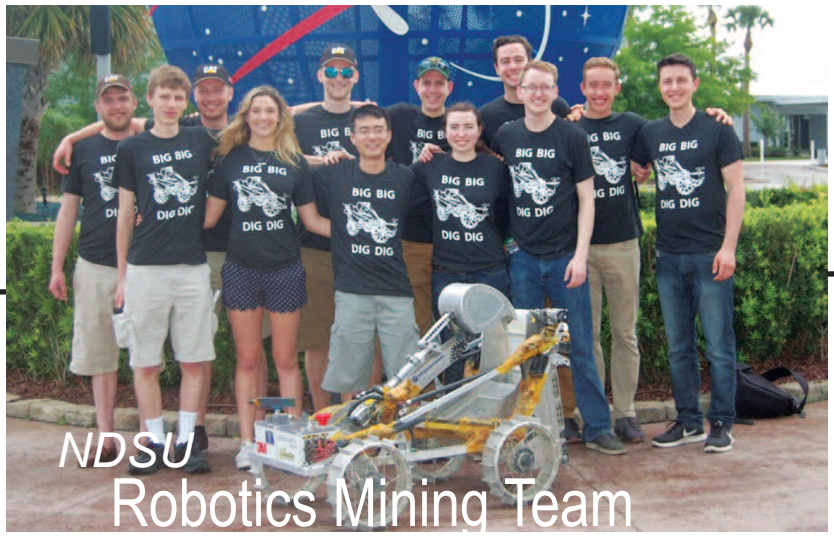


UND Robotics Mining Team

The UND Robotics Team performed well in the 2018 mining competition, collecting more of the important icy regolith than any other team during a single run. In addition to the development of a competitive robot, the team performed a variety of outreach activities throughout the competition season, reaching an impressive 2,000 K-12 students. One such event where the team volunteered their time was a FIRST Robotics Competition for high school teams. The UND team showcased their robot at the challenge and talked with area high school students about the possibilities of continued hands-on involvement in robotics in college. 2018 marked the first year that a regional competition was held in Grand Forks.

UND FSAE Racecar Team

In June, the University of North Dakota Formula SAE team competed at the Lincoln, Nebraska Formula SAE event held by SAE International, a professional engineering association that emphasizes transportation solutions. The team competes with a whole new car every year, one that is completely designed and built by the students. The competition has several dynamic events that test the handling, speed, and reliability of the racecar. In addition, there are presentations in which the students are challenged to validate the engineering decisions made for the racecar as well as the cost of the final product.



NDSU Robotics Mining Team

The NASA Robotic Mining Competition Bison Robotics earned the following accolades in May 2018: the IEEE Judges' Innovation Award, first place in the slide demonstration category, second place in the on-site mining category, second place in the autonomy category, and second place overall in the competition. The team was comprised of eleven NDSU students and one James Madison University student. In the 2017 - 2018 competition year, their complex and fully autonomous robot was completely redesigned with over 3,000 components! Their robot was capable of mining large amounts of icy regolith with a lower overall weight than many other competitors.

NDSU Rover Team

The NDSU NASA Rover Challenge Team competed in NASA's 2018 Human Powered Rover Competition held in Huntsville, Alabama. In September 2017, the team started the work on the design of the rover and got familiar with the competition rules and prior rover designs. They formulated the project plan, gantt chart, and required budget to design and manufacture the rover. After much design and redesign, the team started to manufacture their rover which was structurally made of aluminum. They separately designed and built the wheels according to the competition rules. In the processes of manufacturing and assemblage of the rover they utilized practical manufacturing jobs, such as welding techniques (using aluminum tungsten inert gas), threads making using lathe, installing control instruments of the rover, and other related issues. The team spent many hours testing the rover to ensure it would perform as planned in the competition. Despite the many successful practice runs in Fargo, the rover suffered a failure in the competition. Overall, the team learned a great deal about the importance of design, manufacturing, testing, assemblage, reliability, mechanical failure, teamwork, and perseverance.

UND Frozen Fury Rocketry Team

The University of North Dakota Frozen Fury Rocket Team participated in a demanding eight-month engineering design process for the 2017-2018 NASA Student Launch Initiative. During this grueling project, a team of UND students learned how to design, develop, fabricate and launch a high-powered rocket with an engineering payload. The launch vehicle was constructed out of carbon fiber tubing with exception of the fins, which were fabricated with fiberglass. The rocket was designated “Some Assembly Required” and stands at 10 feet tall and has a 6-inch diameter. Inside the launch vehicle, near the nose cone there is a custom payload bay for a deployable rover. The deployable rover was the teams engineering payload for the competition. It was a tank style rover that would extract itself from the internal airframe of the launch vehicle once it landed and proceed to drive eight feet and deploy an array of solar panels. Along with the engineering challenges the students also organized outreach events for K-12 students to teach the next generation of rocketeers the fundamentals of rocketry and the physics principles behind these magnificent machines.

At the competition *Some Assembly Required* flew to an apogee of 4,078 feet, however the payload malfunctioned and was unable to complete its mission. The team received a 2nd place award in the website design out of the 50 university teams that participate in the competition. The competition takes place at NASA’s Marshall Space Flight Center located near Huntsville Alabama, which is also known as The Rocket City.

Kimberly

Whaley

North Dakota
State University

Lillian Goettler
Scholarship

Kim is a sophomore in Mechanical Engineering at North Dakota State University. Outside of the classroom, she loves to participate in all aspects of college life; she is currently a teaching assistant for a NDSU's Visual Communications for Engineers class, is assisting faculty with material science based research, and has gotten involved with several different engineering clubs such as the American Institute of Aeronautics and Astronautics (AIAA) and the American Society of Mechanical Engineers (ASME). Last summer she also had the chance to intern with NASA as a small satellite test engineer. After earning her bachelors, Kim hopes to either work towards a masters in space studies or get a job in the space industry.

Cristin

Finnigan

University of North Dakota

Pearl I. Young
Scholarship

Cristin turned her love of research into a career as a paralegal and contracts manager. In 2018, she was a student in the University of North Dakota's Space Studies Master of Science program focusing in space law and policy. She was also the Region V Deputy Director – Public Policy, Twin Cities Section Public Policy Officer, and newly-named Secretary of the Legal Aspect of Aeronautics and Astronautics Technical Committee for the American Institute of Aeronautics and Astronautics. Additionally, she volunteers for the Jet Propulsion Laboratory's Solar System Ambassadors Program, and participates in several outreach and education activities, especially focusing on supporting girls and women and other underrepresented communities in STEM. Cristin also collaborates as a co-founder of a robotics fabrication shop in the Minneapolis area.

NDSGC Scholarships

Every academic year, the NDSGC provides each of the affilaite two-year, four-year, and Tribal colleges with scholarship funding. Students are slected by faculty at their home institution and must have an excellent academic record and be majoring in a STEM field.

Bismarck State College
Brandi Cain
Dani Douri
Jenna Duttenhefner
Whitney Geletich
Alexis Glass
Jackson Nagel
Jerame Novak

Cankdeska Cikana Community College
Isnala Roan Eagle*
Arlete Lohnes
Leah Demarce
Danacia Greywater
Samantha Azure
Nicole Demarce
Trista Dauphinais
Alexis Lehnes

Dakota College at Bottineau
Alex Abrahamson
Spencer Dorsey
Georgina Eidmann
Victoria Gullett

Dickinson State University
Kevin Pineda
Aleesa Joslyn
Marissa Schatz
Zachary Miller
Brittany Decker
Allison Buckman
Cassidy Tormaschy

Lake Region State College
Adrianna Bibeau
Mason Hanson
Kyle Henningsgard
Eric Johnston
Erin Nelson
Landyn Swenson

Mayville State University
Lexi Carpenter
Summer Dearinger
Shayla Fossum
Jacob Leier
Brady Nygaard

Minot State University
Hayley Hanna
Matthew Winburn
Morgen Amato
Mark Fulbright
Donald Forche
Michael Heck
Darice Burdick

North Dakota State College of Science
Aaron Oslowski
Brandon Joos
Alex R. Johnson
Cody Danielson
Drew Biffert
Faith Goettle
Mitchel Johannsen
Jordyn Hjeldness
Adam Nelson
Brian Van Nostrand

Nueta Hidatsa Sahnish College
Lizette Alvarez*
Caley Fox
Ashly Hall
Shayla Gayton
Lee Voigt

Sitting Bull College
Jcamille Buckley
Anitra Hill*
Melanie Howard
Jacqueline Mitchell
Moriah Thompson
Floris White Bull

Turtle Mountain Community College
Samantha Bercier*
Denver Larocque
Annadine Rendon
Memphis Belgarde
Farrah Gourneau
Jesse James Rodriguez

United Tribes Technical College
Danielle Peltier*
Bonita Claymore
Trustin Two Moons

Valley City State University
Ellen Anderson
Tory Anderson
Rachel Blomquist
Jean Brown
Kelly Cahoy
Morgan Gentzkow
Sean Glaholt
Benjamin Kietzman
Clarissa Olson
Dylan Olson
Jake Peterson
Dillon Praus
Ryan Schneider
Renee Snyder

Williston State College
Jacob Bird
Ben Olson

*American Indian Scholarship Recipients, see below.

American Indian Scholarships

United Tribes Technical College

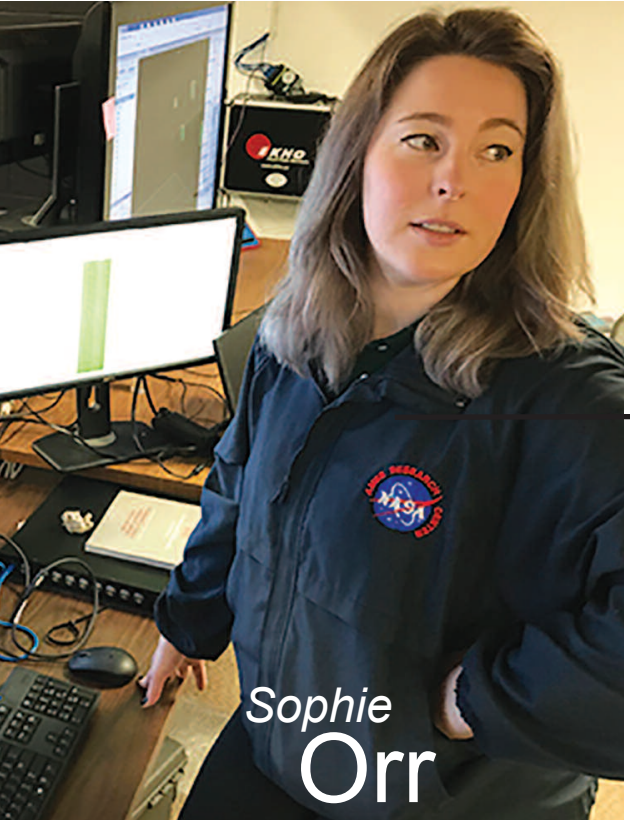
Cankdeska Cikana Community College

Turtle Mountain Community College

Nueta Hidatsa Sahnish College

Sitting Bull College

Student Travel Grants



Space Studies, University of North Dakota

Effects of Suited and Unsuited Locomotor Gaits in Reduced Gravity Environments on Muscles of the Leg

NASA Johnson Space Center | Houston, TX

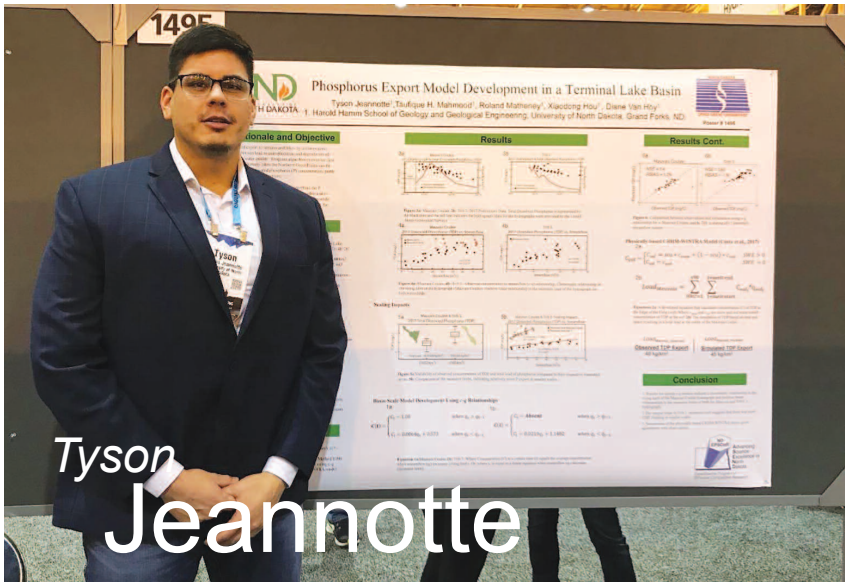
"Without this funding I would not have been able to complete my thesis research at a NASA facility. This opportunity has opened so many doors for me, allowed me to create professional connections and will play a role in my ability to create quality science for the space life science community."

Space Studies, University of North Dakota

NASA S.U.I.T.S (Space User Interface Technologies for Students) Challenge

NASA Johnson Space Center | Houston, TX

"This experience allowed me to take this research a step further, when I had my experiment fly a microgravity flight aboard a Falcon 20 and had one of my Scientist-Astronaut Candidate mates test it out. I was in a spacesuit so I couldn't test it myself, but having another subject test it gave me a different insight into how it would work and be useful in microgravity, in space."



Geological Engineering, University of North Dakota

Phosphorus Export Model Development in a Terminal Lake Basin

American Geophysical Union Meeting | New Orleans, LA

"I would like to express my gratitude for the travel funding that made it possible for me to experience my first AGU Meeting. It was diverse and educational, and it presented several professional opportunities. Being a young Native American scholar that hasn't had the opportunity to travel much, the first thing I noticed was the diversity that was present. It was an amazing feeling to meet researchers that experience the same struggles and achievements as me. My experience at the meeting was like no other."

The NDSGC provides travel grants to North Dakota students to present papers or posters at conferences throughout the U.S. The students have the ability to not only share their research with others in the STEM community but also to network with others in their field. This allows them to eventually become employed in a STEM field as a result of their travel to the conference.

Space Studies, University of North Dakota

Effects of Total Solar Eclipse on Stratospheric Ozone Production

Academic High Altitude Conference | Minneapolis, MN

"Attending AHAC was an awesome opportunity that greatly enriched my grad school experience. Not only did I get to present the research I completed during my Space Grant summer fellowship, I also got the chance to see research from other high altitude ballooning groups and network with scientists from across the country. The research presented has already inspired me to initiate other projects, and has helped provide solutions to problems faced during past balloon operations."

Space Studies, University of North Dakota

NASA S.U.I.T.S (Space User Interface Technologies for Students) Challenge

NASA Johnson Space Center | Houston, TX

"Participating in this unique engineering and outreach opportunity gave me access to a real-world design challenge and invaluable feedback from experts in the field. Following this graduate opportunity, I was hired on at NASA's Jet Propulsion Laboratory working in science communications."

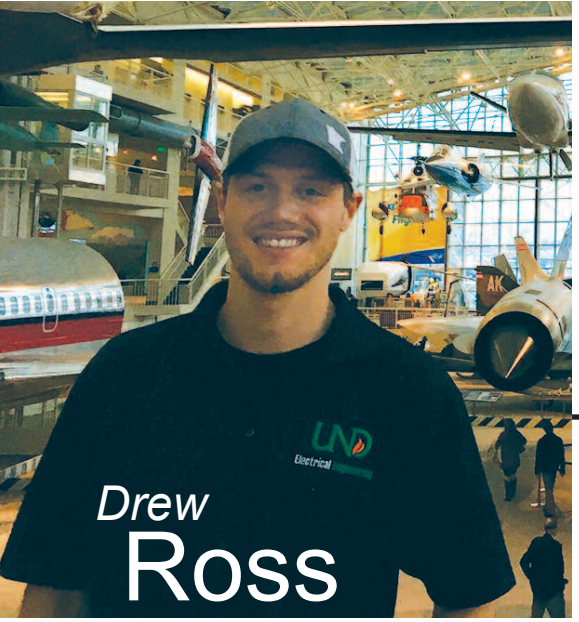
Space Studies, University of North Dakota

Eclipse Ballooning STEM Outreach for Elementary, Middle, and High School Education

Academic High Altitude Conference | Minneapolis, MN

"AHAC helped me build stronger interpersonal skills in the scientific community and showed me technology I hadn't been exposed to before!"

Research Fellowships



Fall 2017 Recipient
Electrical Engineering,
University of North Dakota

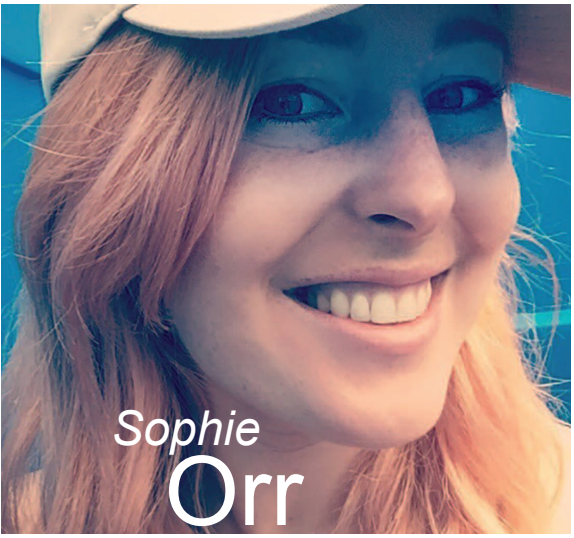
Robotic Vehicle Wireless Communications

"North Dakota Space Grant allowed me to work on an intriguing project and interact with brilliant students that share a passion for aerospace. The experience I gained through UND Aerospace was a critical factor in achieving my primary career goal of becoming an engineer with The Boeing Company."

Fall 2017 Recipient
Space Studies and Biomedical Engineering,
University of North Dakota

Embedding Biomimetic Silk Fibers and Thin Films with Carbon Nanoparticles for Electro-Mechanical Shape Responsive Nanocomposites

"The North Dakota Space Grant Consortium has allowed me to work with hands on space research in line with my curiosity and interests. My fellowship strengthened my graduate studies of biomaterial research during my M.S. in Mechanical Engineering at North Dakota State University. This experience has led me to the pursuit of my M.S. in Space Studies in tandem with a PhD in Biomedical Engineering at UND working with human and robotic integration for space technology."



Fall 2017 Recipient
Space Studies,
University of North Dakota

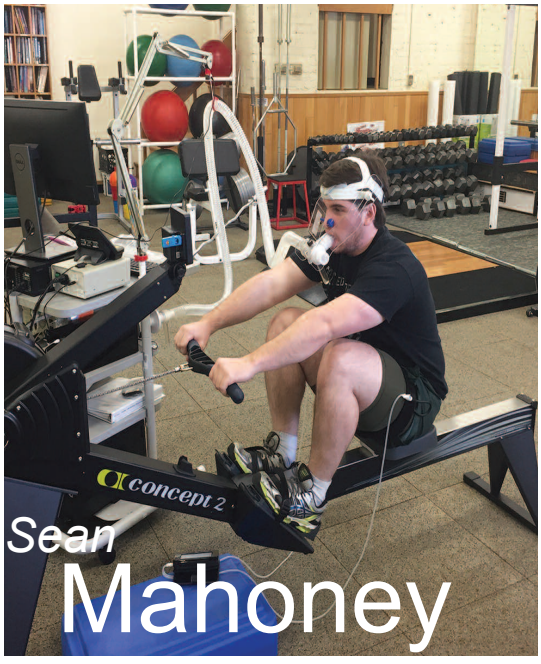
Effects of Locomotor Gaits under Simulated Reduced Gravity Conditions on Muscles of the Leg

"NDSGC Fellowship funding has given me a chance to do real science with real space exploration, and NDSGC support was instrumental in the cultivation of skills and experiences that have allowed me to thrive in my graduate program and beyond. Working with NDSGC inspired me so much that I now work for the Colorado Space Grant Consortium and aim to provide the same level of support, encouragement and empowerment for a new generation of college students."

Fall 2017 Recipient
Health, Nutrition, and Exercise Science
North Dakota State University

Leg Blood Flow Restriction during Rowing Exercise as a Countermeasure for Microgravity Induced Deconditioning

"This amazing fellowship has given me the unique opportunity to develop advanced exercise protocols for future spaceflight missions. Moving forward, I hope to expand these protocols into earth-based research analogs."



The NDSGC research fellowships are given on a competitive basis to undergraduate and graduate students at all affiliate colleges.

Spring 2018 Recipient
Mechanical Engineering,
North Dakota State University

Rocket Propulsion Design Team: Supersonic Nozzle Design for a Paraffin/GOx Hybrid Rocket Engine

"Starting the Rocket Propulsion Design Team at my university would not have been possible without the help of the North Dakota Space Grant Consortium. I have been inspired by the propulsion work I have done and I am excited to continue onto a full-time career involving further testing of rocket engines!"

Spring 2018 Recipient
Mechanical Engineering,
North Dakota State University

Optical Nozzle Design and Diagnostics for Supersonic Flow Studies

"I am now a better student, coworker, and researcher because of the North Dakota Space Grant Consortium. This research taught me how to collaborate to work towards a common goal as well as set me up for my future in the world of academia, and I am extremely grateful to have been given this opportunity."

Spring 2018 Recipient
Space Studies, University of North Dakota

Design and Preliminary Fabrication of a Lifting Body Vehicle for High Altitude Research

"Without the NDSGC graduate fellowship, I would not have been able to work at Kennedy Space Center for the spring semester and fabricate the high altitude lifting body glider for my thesis research. I have an opportunity to design and build a small-scale space plane which will deepen my understanding of reentry and descent flight dynamics and provide a platform for other students to conduct atmospheric experiments, and I cannot wait to fly it."

Research Fellowships

Summer 2018 Bridge Fellowship Recipient
Pre-Physical Therapy, Bismarck State College

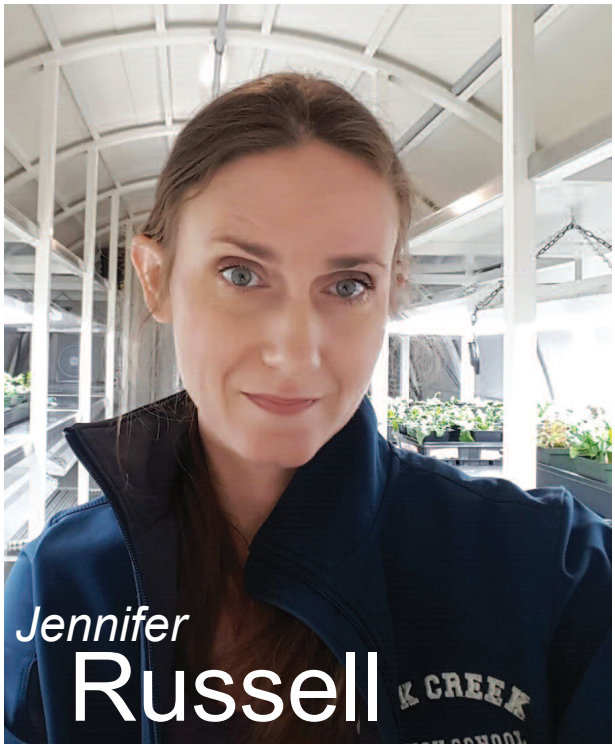
Apollo 11 - Historical Research on North Dakota's Involvement in the Apollo Program

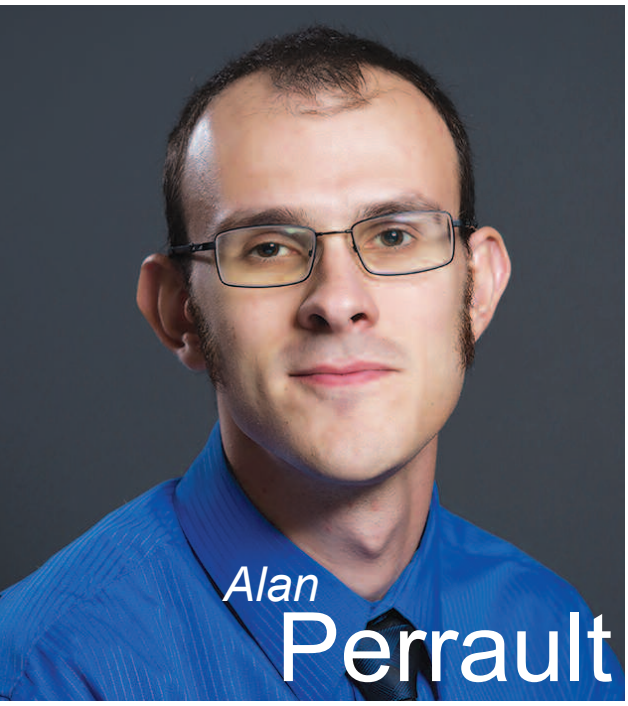
"The North Dakota Space Grant Consortium's funding for the Historic Apollo 11 Project has furthered my academic goals by providing a new way to compose historic research. Using information from the past in varying forms of documentation, this project provided a hands-on type of research different from those that one learns in a standard English Literature class."

Summer 2018 Recipient
Space Studies, University of North Dakota

Enriching Simulated Martian Regolith using Eisenia Fetida (Red Wiggler) and Inedible Plant Biomass Sccumulated during Mission V in the Inflatable Lunar Mars Analog Habitat (ILMAH)

"The NDSGC summer fellowship provided me with the opportunity to introduce biological life into the Plant Production module and solve a long standing problem with inedible biomass left over from ILMAH's analog missions. Using small earthworms to recycle waste generated in the PPM and convert it into rich fertilizer that was then used to amend simulated Martian regolith, simulating the use of in situ resources by creating an organic growth medium for the plants used during Mission VI in October 2018. This research continues to provide exciting research opportunities in plant growth applications inside a closed ecological system."





Spring 2018 Recipient
Mechanical Engineering,
North Dakota State University

Turbulence Model Benchmarking

"The North Dakota Space Grant Consortium has helped me explore new things and further my graduate research."

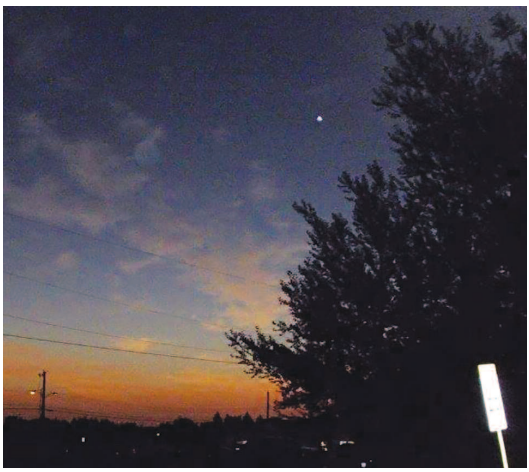
Meet an Affiliate

Dane Schaffer

Minot State University

Dane Schaffer is an Assistant Professor of Science at Minot State University and became a Space Grant Affiliate in the spring of 2017. Dane grew up in Mt. Vernon, IN and attended Purdue University where she earned a BPE in Physical Education with a minor in General Science and endorsements in athletic training and coaching. However, Dane's true love was science, especially the Earth Sciences. After graduating from Purdue, she came back home to teach and coach. Soon after, Dane started her Masters in Secondary Education with an emphasis in Science Education at Indiana State University. While starting her Masters, Dane taught science for grades 5-8 as well as the seventh grade at a local parochial school in Evansville. After finishing her Masters at ISU, Dane left Indiana to teach as the Lead Teacher for Physical Science in Kansas City, MO. After five years, Dane went across the state to teach College Prep Earth Sciences in the Ferguson-Florissant School District in St. Louis County, MO. In all, Dane taught nearly 25 years before returning to the University of Missouri, Columbia, to complete her Ph.D. in Learning, Teaching, and Curriculum with an emphasis in Science Education.

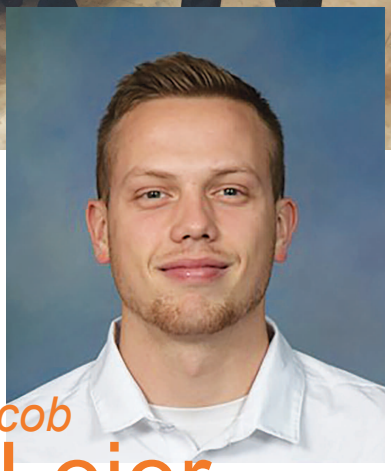
As a four-year faculty member at Minot State, she is implementing more professional workshops for her practicum (Elementary and Secondary) students to attend as a way to get to know what is available to them as North Dakota classroom teachers as well as chances to present at state conferences. Dane's research on teachers' conceptual understanding of the water cycle and plate tectonics and the development of tiered assessments have been presented and published on the international level. In her spare time, Dane likes to sit with her telescope observing the skies and celestial events. See the pictures below.



STEM Ambassador Program

The STEM Ambassador program is designed for North Dakota college students to conduct NASA-relevant STEM outreach across the state with K-12 students, teachers, and the general public. Ambassadors participate in a hands-on training at the start of the academic year to become familiar with best practices for engagement and to build relationships with other students participating in the program.

In the 2017-2018 academic year, these students significantly contributed to the number of North Dakotans reached through informal and pre-college education initiatives. STEM Ambassadors worked with nearly 2,000 K-12 students, over 100 K-12 teachers, and more than 1,100 members of the public, in ***addition*** to regularly scheduled NDSGC outreach events.



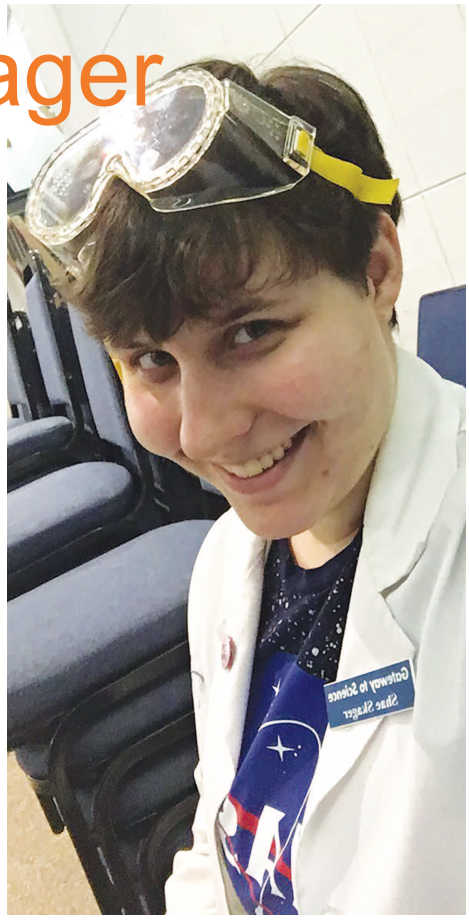
Jacob Leier

Chemistry and Secondary Math Education, Minor in Sport Management, Mayville State University

"Being a STEM Ambassador has given me opportunities to connect with and learn from professionals in the field of STEM education that I otherwise would never have been able to meet! I also really enjoyed working with kids who are excited about science and math!"

Jacob is pictured here at the North Dakota Association of Colleges for Teacher Education (NDCTE) in April 2018, where his presentation included advocacy for technology use in the math and science classrooms.

Shae Skager



Communications, Minors: Nonprofit Leadership & Space Studies, University of North Dakota

"My ultimate goal is to do informal education and outreach for NASA, and being a STEM Ambassador puts me in the perfect place to work on achieving that goal. It gives me opportunities to network and hone my skills so I can have my dream job someday!"

Shae has also completed STEM Ambassador work through her positions at the Gateway to Science Center in Bismarck, ND as a center guide, summer staff, and administrative intern. Through these roles, Shae designs curriculum, teaches summer camps, and helps at various outreach events.

Matthew Kurtti

Physics, North Dakota State University

Connie Nelson

Elementary Education,
Mayville State University

"Working as a STEM Ambassador helped me gain confidence in my abilities to teach STEM concepts to elementary students. I love working with younger students and watching them collaborate to solve problems. There is nothing more rewarding than seeing 23 1st-4th graders build their own bristle bots!"

While completing her degree, Connie also holds a position at Mt. Pleasant School in Rolla, ND as a Special Education Paraeducator.

Emma Twedt

Biological Sciences Education,
North Dakota State University

"Being a STEM Ambassador has challenged me to look for creative ways to teach science concepts, and has given me so much hands-on experience teaching STEM. I've loved the opportunity to see the range of STEM experiences available to people in North Dakota!"

In the spring of 2019, Emma will be student teaching at Park Christian School in 8th grade Earth Science, 9th grade Physical Science, 11th grade Chemistry, and 12th grade Physics classes.

Levi Lemer

History, Science, and Composite in Chemistry Education, Minor in Coaching,

Mayville State University

NDSGC Activities with NDVS School for the Blind

Throughout 2018, the NDSGC team visited the North Dakota Vision Services/School for the Blind (NDVS/SB), which is located in Grand Forks, ND. They conducted multiple hands-on STEM activities with students who are visually impaired or blind. The NDSGC team continues to strengthen their collaborative relationship with this school, bringing STEM to students of all ages.

Space Center Houston
Visual Impairment Program

NASA Mathematician and Engineer, Bob Shelton, who is completely blind, shared his story and accessible mathematics software that he created with the campers.

In August, the Deputy Director, Coordinator, and Emily Stenberg, an educator from Grand Forks' North Dakota Vision Services/School for the Blind (NDVS/SB), traveled to Houston, TX where they assisted in the first annual Space Camp for students with vision impairments. Collaborating with South Carolina Space Grant Consortium's Director, Dr. Cass Runyon, and staff from the Space Center, they led a three-day camp. Students worked with tactile space resources and hands-on activities, toured the space center, visited the Saturn V rocket, and networked with other students with vision impairments. This memorable experience will benefit future local workshops between the NDSGC and students from the NDVS/SB.

A special thank you goes to Stephanie McMahon, Accessibility and Inclusion Specialist at Space Center Houston, for establishing the camp and including us in the inaugural year of the program. The NDSGC team also learned from the invaluable experiences of Gail Henrich, Teacher for Students with Visual Impairments/Orientiation & Mobility Specialist (TVI/O&M) for Norfolk Public Schools in Virginia. The Viriginia Space Grant Consortium sponsored a student and chaperone from VA to attend the camp as well.

Students calculate the apogee of rockets that they constructed.

Students had the opportunity to ask questions during a presentation by retired NASA astronaut, Brian Duffy.

Undergraduate Student Instrument Project
USIP

The NDSGC continued to work on their Undergraduate Student Instrument Project (USIP). USIP is a competitive project that promotes hands-on flight research for 47 higher education teams across the nation. In 2018, the NDSGC team launched a high altitude balloon with the goal of capturing a temperature profile of the atmosphere. UND Engineering students constructed the sensitive thermosonde to gather data for the UND atmospheric science team. Due to project requirements, the ballooning team conducted their first night launch on May 4th. The team recovered the payload one day later, near Maple Lake in Minnesota. Future steps include introducing a UND marketing student to the team, as well one more launch in 2019.

Inflatable Lunar/Martian Analog
Habitat

The University of North Dakota (UND) conducted its sixth mission in the Inflatable Lunar/Martian Analog Habitat (ILMAH), in May 2018, housing three crewmembers for 14 days. UND is the only university in the United States to conduct this type of space exploration research, which helps prepare for long-duration Martian missions. The crewmembers live in this confined environment, studying psychological factors, biomedical research, and mission operations.

Crewmembers lived in three modules; the living quarters, a botany/greenhouse module, and an EVA module. Docked to the ILMAH via a tunnel is the Pressurized Electric Rover (PER), which students use to conduct Extravehicular Activities (EVAs), or spacewalks outside of the habitat. During the sixth EVA, these three crewmembers launched a high altitude balloon with the help of the Atmospheric and Educational Student Initiated Research (AESIR) Ballooning Team, led by NDSGC student, Denise Buckner. The ILHMAH crewmembers tested flight systems, simulating a Martian launch. New ballooning equipment was designed, space suit flexibility was examined, and GPS systems were utilized. The mission was a success, and the crew members received great flight data.

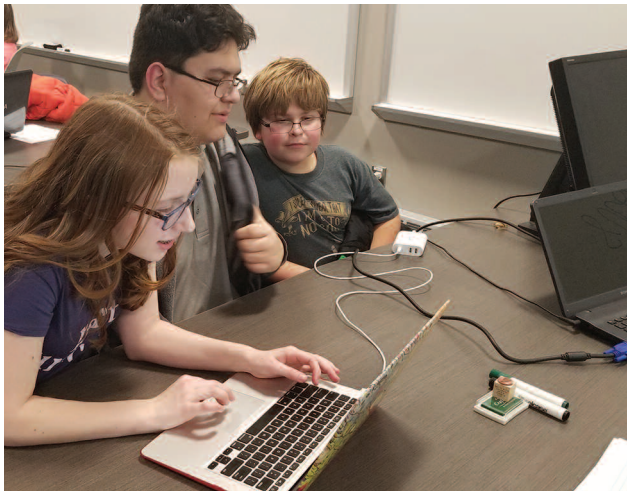
To learn more about the Human Space Flight Program at UND, visit: https://goo.gl/9ZK9M3

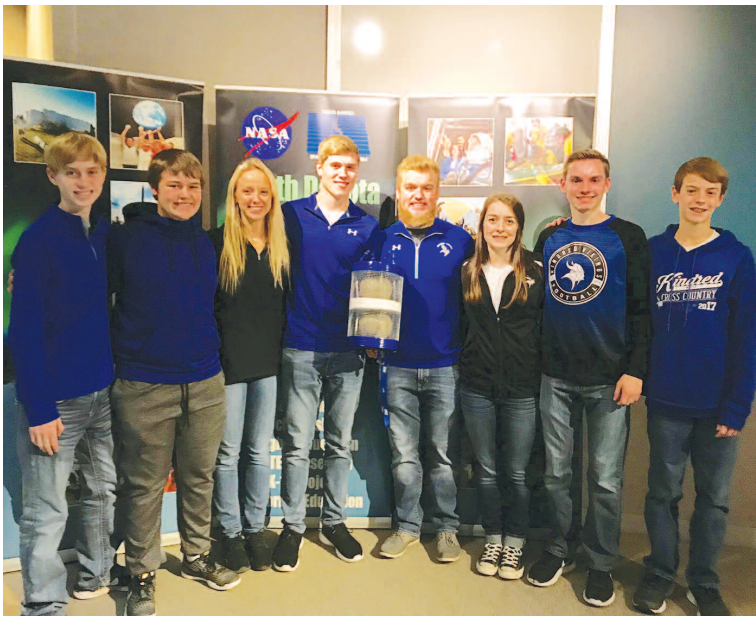
Near Space Balloon Competition

From October 2017 to January 2018, the NDSGC engaged six towns in a hands-on STEM project, called the Near-Space Balloon Competition (NSBC). All North Dakota students in grades 6 – 12 are eligible to form a team, propose an experiment, and become a NASA scientist! At the start of the school year, teams designed their experiments, visited UND to integrate the payloads together, and ventured to Northern Cass School in Hunter, ND to launch a giant helium-filled high altitude balloon. Students then boarded buses and tracked the balloon as it ascended 19 miles high into the atmosphere! Students quickly located the experiments in Tamarac National Wildlife Refuge in Minnesota.

In 2018, the teams analyzed their data and submitted final reports, presenting their findings and lessons learned. Congratulations to the Kindred high school seniors on their first place accomplishments. In addition, one of the Kindred students, Brianna Maddock, was named a 2018 US Presidential Scholar!

Many thanks to the North Dakota teachers who volunteered their time to engage their students with this STEM program!





Community Outreach
Events

In the 2017-2018 academic year, the NDSGC team worked with K-12 students and their families at various outreach events across the state. With the help of the STEM Ambassador program, the NDSGC reached a total of more than 4,200 North Dakotans in informal education initiatives. Through K-12 specific programs, the NDSGC impacted nearly 2,100 K-12 students and more than 130 teachers. These events include Marketplace for Kids events, visits to public libraries, STEM Days, STEAM Days, and a STREAM Camp, public presentations, Super Science Day, the Water Festival, Science Olympiad, STEM Adventure Camp, STEMtastic, K-12 classroom visits, and Aerospace Community Day. These outreach events took place in Grand Forks, Fargo, Minot, Bottineau, Bismarck, Jamestown, Mandan, Rugby, Mayville, and New Town.

These outreach events are a joint effort of all affiliate institutions. A special thank you is extended to the North Central Education Cooperative, Dakota College at Bottineau, Nueta Hidatsa Sahnish College, United Tribes Technical College, and the Gateway to Science Center for their coordination and participation in these initiatives in the past year.

Students designed payload containers and launched stomp rockets at the Earth Lodges near Nueta Hidatsa Sahnish College during STREAM camp.

Students test radiation protection of various materials for spacesuit development using UV beads.

The Human Spaceflight Laboratory (HSFL), housed within the Space Studies Department at the University of North Dakota, includes the space suit laboratory, spacecraft simulators, electric rover, and inflatable habitat. In-person and virtual tours of the Human Spaceflight Laboratory at UND included groups from Girl Scouts, Boy Scouts, preschool groups, K-12 field trips, the Nurturing American Tribal Undergraduate Research and Education (NATURE) program, the Research Experience for Undergraduates (REU) program, Aviation Camps, NASA personnel, ROTC cadets, and various summer camps.

Aerospace Community Day

On February 3, 2018, the John D. Odegard School of Aerospace Sciences at the University of North Dakota opened their doors to approximately 2,500 visitors in a celebration of their 50th anniversary. Guests of all ages – including families, UND students, staff, and faculty, and industry members – immersed themselves in aviation, space studies, atmospheric science, sustainability, and flight operation experiences. Guests stamped their “UND Aerospace Passports” at various stations throughout the day. They explored static displays of helicopters and airplanes, operated aircraft and spacecraft simulators, heard research talks from aerospace students and faculty, flew small UAS, toured the space suit laboratory, experienced virtual reality, controlled the 360° air traffic control tower simulator, and participated in many other aerospace demonstrations and activities.

The NDSGC served on the organizing committee for this event, and was actively engaged with other UND Aerospace faculty, staff, and students to inspire the next generation of explorers. Space Studies graduate students and STEM Ambassadors also assisted with the event, leading hands-on activities and tours of the human spaceflight laboratory. Families could hold real meteorites, test their communication skills in an Apollo 13-based simulation, and launch their own stomp rockets with the goal of landing on Mars.


AEROSPACE
UNIVERSITY OF NORTH DAKOTA


Master of Science
Space Studies
Doctor of Philosophy
Aerospace Sciences
www.space.edu
University of North Dakota
Department of Space Studies
Online and Campus
Military Friendly
SPACE

Educator Professional Development

Pre-Service Teacher Workshops

The NDSGC conducted educator workshops for 171 pre-service teachers in the past year. These education students were enrolled at United Tribes Technical College, Minot State University, the University of North Dakota, and Valley City State University. Workshop participants worked in teams on hands-on activities such as the design of Mars Rover Landers, development of "Bristle Bots," and launching of stomp rockets. The NDSGC also shared NASA and STEM resources and engaged students with innovative teaching strategies.

Space Exploration Educators Conference (SEEC)

The NDSGC supported three North Dakota teachers to attend the Space Exploration for Educators Conference, held at NASA's Johnson Space enter and Space Center Houston, in February 2018. We asked each of them to reflect on their experiences and offer advice to future ND educators.

Williston High School
9-12 Robotics, Programming, Physics

"It's one thing to be aware of NASA's accomplishments through TV and the internet, but SEEC is a grand experience that makes NASA real to educators. The connections I met at SEEC presented an opportunity to send a student to intern at NASA last summer; I would recommend that ND teachers follow NASA on social media to become aware of these amazing opportunities."

Steele Elementary – Kidder County
5th Grade, 6th Grade Science

"Through this awesome experience, I learned more about the history of the United States space program while also learning science concepts that have enhanced learning in my classroom. North Dakota educators should not miss this opportunity to network and collaborate with educators from all around the country and world!"

Washington School
Valley City Public Schools, 5th Grade

"After four exciting days, I came back to my classroom with renewed energy and enthusiasm for Space education and STEM activities. I now incorporate a STEM Minute into my daily routine. First thing every morning my students engage in a STEM challenge to get their brains focused and engaged. If you're looking for inspiration and tons of innovative ideas, attend SEEC!"

In-Service

Educator Workshops

The NDSGC conducted educator workshops for 151 in-service teachers in the past year. Participating affiliate institutions included Valley City State University, United Tribes Technical College, and the University of North Dakota. Teachers got hands-on with NASA activities at workshops throughout the year, the largest event being the North Dakota STEAM Conference for Math and Science teachers. A special thank you goes to the North Central Education Cooperative (NCEC) for organizing professional development opportunities as well!

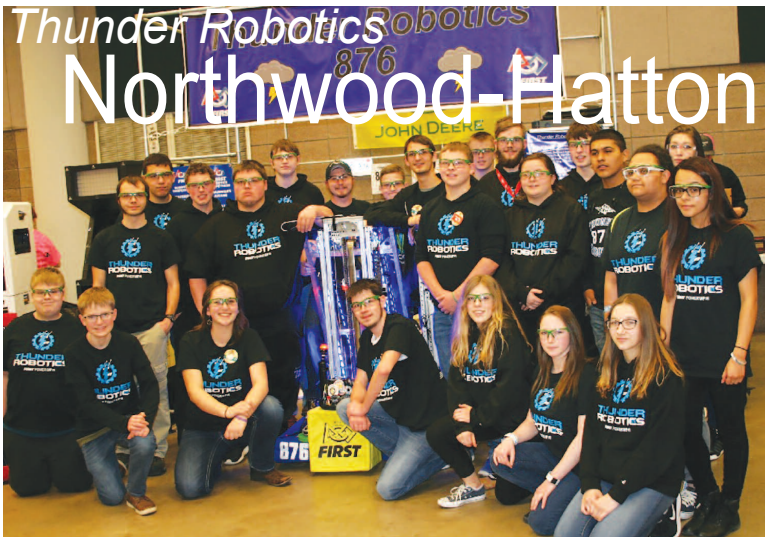
The NDSGC partners with a different affiliate college each year for an in-service summer training for North Dakota educators to earn professional development credit. In July 2018, the NDSGC worked with United Tribes Technical College in Bismarck, ND and 6 educators on a “Mission to Mars” themed workshop, where participants worked in teams to complete a crewed journey to Mars, while learning about NASA resources and integrating new teaching strategies into existing STEM lesson plans.

Teachers designed rovers to clear Martian regolith from solar panels on Mars.

FIRST Robotics

Team 877 met throughout the fall and winter to work on driving skills, CAD activities, and programming. Their robotics team conducted a demonstration at a local nursing home and was featured at school pep rallies. They competed in a regional tournament in Grand Forks, North Dakota. Their robot passed inspection with no mechanical or electrical problems and was able to get onto the field for ALL practice and qualification rounds. This was the third year they coded in Java. There is a saying that a good team never loses, either they win or they learn.

This year, team 877 learned! They designed and built a very ambitious robot and created very complex autonomous code; code that didn't work as reliably at the event as it did in the shop. The team did an outstanding job troubleshooting and upgrading the robot during competition, and worked with field staff to isolate the programming bugs, but were unable to advance beyond the qualification matches this year. They received quite a lot of attention from the design judges! Their robot was the only one at the competition to utilize a vacuum-based pickup mechanism.



Thunder Robotics built their robot "Ed" and competed in two regional tournaments. At Grand Forks, they won 9 straight matches, were the 4th seeded alliance and won the Spirit Award. At Duluth, they again were the 4th seeded alliance but lost in the semifinals. The team is active in their communities and helped to host a prime rib "Hoof and Wheels" supper, ran a summer golf tournament and competed in two fall competitions. At the Minnesota Robotics Invitational in Minneapolis, team 876 took 2nd place and at the NMRC tourney in Bemidji, the team won the championship.

The 2018 season was a season of growth for The Herd. Their team expanded into two separate teams, one for West Fargo schools and one for Fargo schools. The two teams, along with the Moorhead team, worked alongside each other in the STEM Alliance Robotics Center of Fargo Moorhead that was donated by a local businessman and funded through a coalition of local and corporate businesses. At the Great Northern regional in Grand Forks, they won the Imagery Award and made it to quarter finals. They helped the Fargo team win the Rookie Inspiration Award, allowing them to compete in the world competition in Detroit! At the Iowa regional in Cedar Falls, their team became third alliance captains, made it to the semifinals, and won another Imagery Award.

During the preseason, students worked together to perfect their skills. Team members continued to volunteer at various events and assist more FIRST teams than in previous years. During the season, their team strived to push the boundaries of what can be done. They designed a robot that could compete in every aspect of the 2018 game. This proved to be a great challenge, but was very rewording. They were recognized by their peers and competition judges for their work. Students grew their skills and went beyond every expectation that was placed on them. They are looking forward to future seasons!

The NDSGC awards fellowships to ND faculty each summer to develop new courses or revise existing courses in STEM fields, of relevance to NASA. Faculty are encouraged to incorporate engaging educational techniques focused on improving student learning.

Summer Faculty Fellowships

Andre
DeLorme
Science | Valley City State University
BIOL 470: Limnology

David
DeMuth
Science | Valley City State University
Supernova Neutrino Masterclass

Michael
Dodge
Space Studies | University of North Dakota
SpSt 575:
Remote Sensing Law & Policy

Julie
Robinson
Teaching, Learning, and Professional Practices | University of North Dakota
TLPP 518: Science in the Elementary School

Sherry
Fieber-Beyer
Space Studies | University of North Dakota
SpSt 570:
Scientific Writing: Proposals

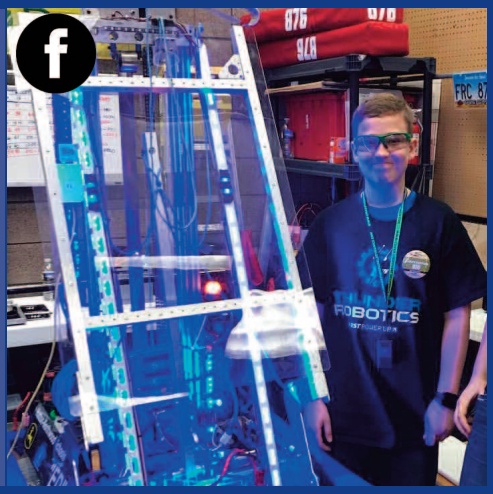
David
Wibe
Science and Education | Turtle Mountain Community College
ASTR 300: Astro-Imaging

We Are #NASAinND

North Dakota students work hard, have fun, and love to share their passion! Take a look at their 2018.

nd_space_grant
We had a BLAST showing teachers some fun hands-on activities for their classrooms! They expertly designed tools for the Neutral Buoyancy Lab, saved Mark Watney on Mars, and landed theri own rovers safely on the Martian surface. #rugbynorthdakota #professionaldevelopment

nd_space_grant
The Hatton/Northwood FIRST robotics team, #876, was amazing at regionals! They're true professionals and great team players!



nd_space_grant
We're at the @uofnorthdakota career fair today! Stop by our booth at the wellness center to learn about #NASA internships and more #STEM opportunities. #UNDProud

nd_space_grant
His experience from the Shuttle, looking down on Earth? "Spaceship Earth has no borders. Madagascar was all deforested, the Aurora was breathtaking. #Undproud #NASAinND @undaerospace

nd_space_grant
Super sleuths! Matching meteorite samples to parent body asteroids, glitter-style! #STEM #NASAspacegrant #UNDproud

Where Are They Now?

Space Grant Alumni Success Stories

Drew Ross

Dakota College at Bottineau and
University of North Dakota
Electrical Engineering
Fall 2017 NDSGC Research
Fellowship Recipient

Nominated by: DCB's Angela Bartholomay

Where am I now?
The Boeing Company as an
Avionics/Electrical Service Engineer

My advice to students: It is important to find your passion and try to surround yourself with others who have similar interests. Join clubs around campus to meet like-minded people and create personal projects outside of the classroom to improve your skill set.

Stephanie Sundhagen

Minot State University
BS in Chemistry Education
2017 NDSGC Scholarship Recipient

Nominated by: MSU's Dannah Schafer

Where am I now?
Velva Public School as a
Physical Science teacher

My advice to students:
Never stop learning! Every day there is something new and exciting being discovered or invented, it's your responsibility to inform yourself as an earthly citizen! No matter what science career you go into you can use NASA research to grow and be a better scientist.

Sophie Orr

University of North Dakota M.S. in Space Studies
Fellowship, Internship, Scholarship, and Travel Grant Recipient

Nominated by: UND's Jim Casler

Where am I now? The Colorado Space Grant Consortium as a Student Project Coordinator

My advice to students: Put your all into your school work, but also into contributing to the communities you are a part of in your academic and work settings. It's not easy to remember every student, but it's easy to remember students who make an effort to brighten your day.

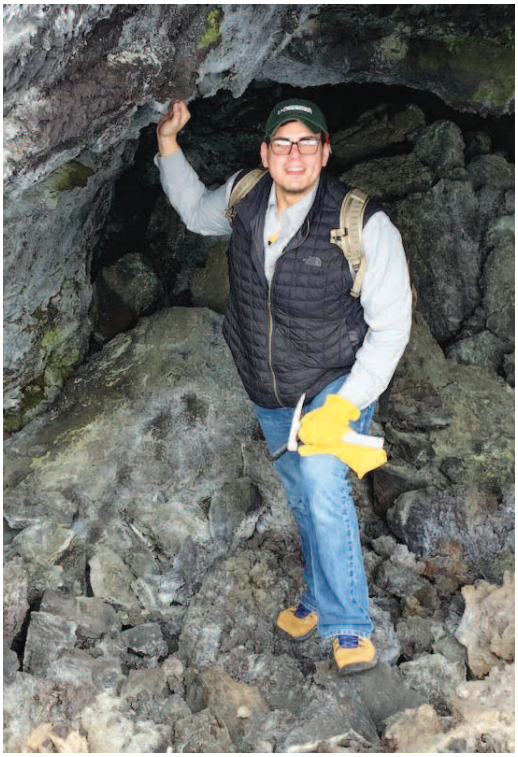
Tyson Jeannotte

University of North Dakota
M.S. in Geological Engineering,
BS Environmental Geoscience
Turtle Mountain Community College (AS)
Travel Grant Recipient

Nominated by: TMCC's Stacie Blue

Where am I now? ND EPSCoR as a Native American Success in Science and Engineering Mentor (NASSE)

My advice to students: Education has made all the difference in my life and has given me the ability to make a difference in yours. Your education is going to be your greatest investment. Invest and enjoy the ride.



We Want You!

The NDSGC is also looking to expand its reach in various programs with students and educators across North Dakota. If you are interested in any of the opportunities described in this newsletter, or if you would like to arrange a visit from the NDSGC at your institution (e.g. STEM Ambassador outreach events, teacher workshops, informational presentations, etc.) please reach out to any member of the NDSGC team. Contact information is listed on the inside of the front cover.

Social Media

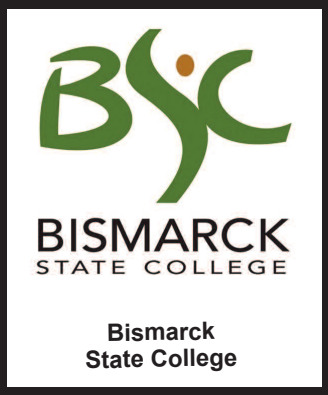
Connect with the NDSGC via social media platforms. Tag us in your posts with #NASAinND. Follow us on the following platforms to stay up to date on events, funding opportunities, deadlines, exciting projects, and much more!

- NorthDakotaSpaceGrant
- @NDSGC
- @ND_Space_Grant
- North Dakota Space Grant
- @ndspacegrant
- ndspacegrant.und.edu

Thank You!

None of these events would be possible without the amazing work of representatives at the NDSGC affiliate institutions (listed on the back cover). Their efforts allow the NDSGC to expand its reach statewide and ensure that students across North Dakota are able to participate in a number of programs. The NDSGC would like to thank each of them for their dedication to NDSGC programming, promotion of opportunities, and continued involvement.

Thank you also to Kathy Borgen (Graphic Artist in the Department of Space Studies at the University of North Dakota) for designing the Aurora Newsletter each year. Her creativity allows the NDSGC to share successes of the past year and highlight opportunities for more North Dakotans to get involved in the future.



Bismarck
State College

Cankdeska Cikana
Community College

Dakota College
at Bottineau

Dickinson
State University

Gateway to
Science Center

Lake Region
State College

Mayville
State University

Minot
State University

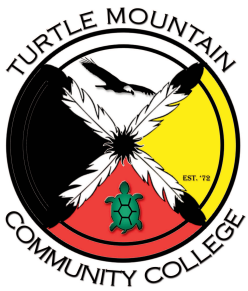
North Dakota State
College of Science

North Dakota
State University

Nueta Hidatsa
Sahnish College

Sitting Bull
College

State Historical Society
of North Dakota



Turtle Mountain Commu-
nity College

United Tribes
Technical College

University of
North Dakota

Valley City
State University

Williston
State College