



THE

# AURORA

NORTH DAKOTA SPACE GRANT CONSORTIUM

2016/2017





- Bismarck State College
- Cankdeska Cikana Community College
- Dakota College at Bottineau
- Dickinson State College
- 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 Community College
- United Tribes Technical College
- University of North Dakota
- Valley City State University
- Williston State College

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**Cover Photo:** On March 10, 2016, the NDSGC called Astronaut Tim Kopra while he orbited overhead on the International Space Station. Over 400 students from across the state attended NASA's historic 1,000th Amateur Radio Call.

# Notes from the Director

Greetings to our Space Grant Colleagues.

In August, after six years as Director of the North Dakota Space Grant Consortium, Santhosh Seelan passed the role on to me. He worked hard to build up a well-functioning team and network throughout North Dakota. His efforts are much appreciated. The energy and enthusiasm of Caitlin and Marissa have kept Space Grant flying along and they inspire me daily. I enjoyed meeting affiliates and students at our annual meeting in Dickinson and I am still planning on visiting with each affiliate before the end of the academic year. If we haven't had a chance to visit yet, I look forward to seeing you soon.

Last year, Santhosh's message was the expansion of Space Grant outreach in North Dakota. This effort continues and was exemplified by the Amateur Radio Call to the International Space Station (ARISS) made from the UND campus to astronaut Tim Kopra as the ISS passed overhead. This was NASA's 1000th amateur radio call to the ISS! This was a fun milestone but it was the participation and excitement of the 400 K-12 students from the greater Grand Forks area that made the event memorable.

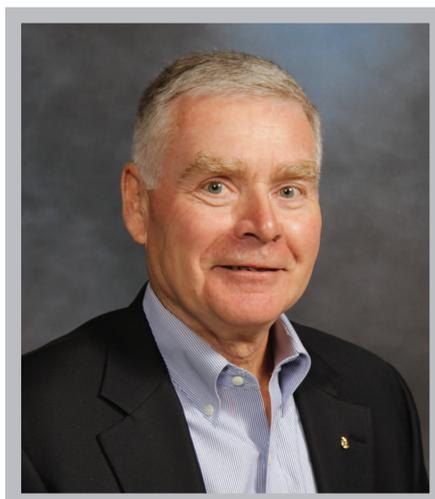
This edition of the Aurora highlights this and other activities that brought increased awareness of space and STEM to students around the state. The Near-Space Balloon Competition (NSBC) continues to expand and involve more schools, more student teams, more students, and more teachers. Our Space Grant team has been on the road supporting career fairs, conducting workshops, and a Space Camp at United Tribes Technical College – engaging students in STEM. They are available and eager to meet with your students also. Their stomp rocket competition is the best! And, more student fellowships and faculty support have been awarded. Last summer, four North Dakota students were funded for NASA internships.

Many, many thanks go to the STEM Ambassadors whose activities helped our Space Grant team during visits to many elementary and secondary classrooms around the state. Throughout the year, these undergraduate and graduate students conducted or participated in events on their own and took the initiative to inspire future generations in STEM. Our STEM Ambassadors were paramount to the success of Space Grant's outreach in ND this year. Our goal is to increase our STEM outreach, particularly in western ND!

Two major events are in store for this summer. First, a student team will be participating in the tracking of the solar eclipse in its sweep across the nation on August 21st. Our team will be traveling to Rexburg, Idaho, where they will launch a high altitude balloon that broadcasts photos and video of the sun from the stratosphere. We are proud to work alongside other states' consortia and represent North Dakota in this historic ballooning campaign.

Second, we look forward to hosting the National Space Grant Meeting in Grand Forks, on September 14-16. You are all invited to be part of the meeting which will be an opportunity to meet Space Grant colleagues from across the nation.

I hope to see you in 2017 while we visit affiliates around the state, or at the National Meeting in September.



Jim Casler

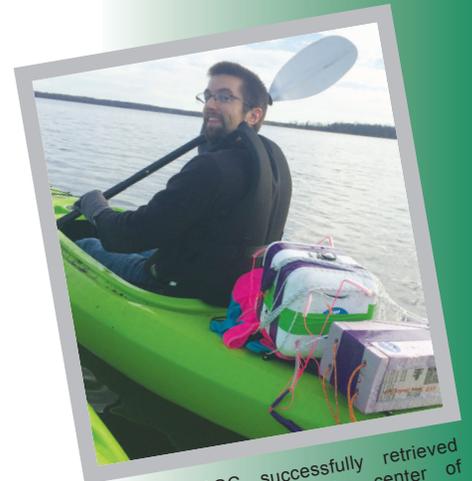
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Space Studies master's students practiced launching high altitude balloons.



NDSGC successfully retrieved payloads from the center of Puposky Lake, MN.

# Space Grant Meetings



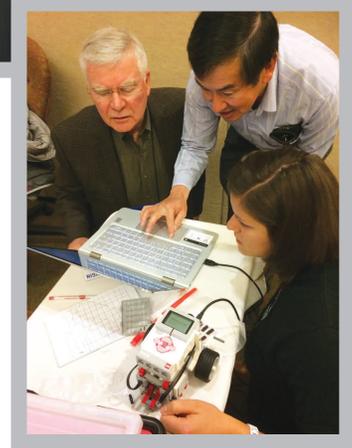
## National Space Grant Meeting - Washington, D.C.

From March 1st to the 5th, Dr. Santhosh Seelan, Caitlin Nolby, and Marissa Saad attended the 2016 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. While in D.C., the Deputy Director and Coordinator met up with NDSGC's alumnus Katrina Jackson and received a behind-the-scenes tour of Goddard Space Flight Center.



## Regional Space Grant Meeting - Bend, Oregon

The Fall 2016 Regional Space Grant Meeting was hosted by the Oregon Space Grant Consortium (OSGC) from September 29th to October 1st. Dr. Jim Casler, Caitlin Nolby, and Marissa Saad attended this meeting and participated in OSGC's hands-on workshop, constructing a LEGO Mindstorm rover, which successfully navigated simulated Martian terrain. Caitlin and Marissa also joined other Space Grant members on a white water rafting team-building experience on the Deschutes River. Thank you OSGC for hosting!



The NDSGC builds their LEGO Mindstorm rover with Washington Space Grant's Director, Robert Winglee.

## Background of the National Space Grant College and Fellowship Program



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.

# NASA Center Internships

Every year, NDSGC funds North Dakota students to complete an internship at a NASA Center. Those eligible include any on-campus undergraduate or graduate student attending a two year college, four year college, or research university in the state of North Dakota. In 2016, NDSGC funded four North Dakota students' experiences at Goddard Space Flight Center, Ames Research Center, and Marshall Space Flight Center.



**Eric Kramer**

Mechanical Engineering,  
University of North Dakota

**Ames Research Center: Graphene for Use in Energy Storage Applications in the Nanotechnology Branch**

"Thanks to the NDSGC, I have furthered both my knowledge and curiosity of the behavior of materials at the nano-scale. I plan to further explore these subjects upon graduation."

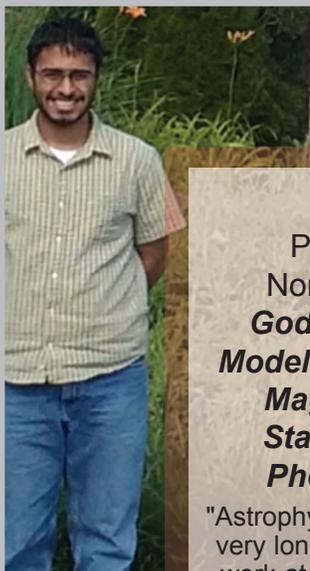


**Sophie Orr**

Space Studies,  
University of North Dakota

**Ames Research Center:  
Advanced Modifications in the Rodent Habitat System to Improve Rodent Health During Space Flight**

"Experiencing NASA culture first hand showed me how my passion for space and science can be directly applied to a variety of research areas. Working with Space Grant opened the door for my future in the space industry."



**Vijay Shah**

Physics and Mathematics,  
North Dakota State University  
**Goddard Space Flight Center:  
Modeling of Relativistic Plasma in Magnetospheres of Neutron Stars - Pair Production from Photon-Photon Interactions**

"Astrophysics has been of interest to me for a very long time, and I have always wanted to work at NASA. My internship taught me so much about what research in astrophysics is like, and I am grateful that I got to have this wonderful opportunity."



**Colton Mosser**

Mechanical Engineering,  
North Dakota State University  
**Marshall Space Flight Center:  
Office of Advanced Concepts Intern**

"My internship at MSFC exposed me to the processes required for a successful space satellite mission and has inspired me to look forward to more opportunities to involving myself in scientific exploration."

# National Student Competitions



## NASA Student Launch

The University of North Dakota's Rocketry team, Frozen Fury, competed in NASA's Student Launch Competition in April 2016 in Huntsville, AL. The team designed and constructed a high powered rocket that met NASA's criteria for the competition. Along with designing the rocket, the team also developed scientific payloads to meet certain challenges set by NASA. This

year's payloads were a landing hazard detection payload and a particle counter. The first payload constantly took pictures of the ground as the rocket flew up and as it floated down and used hazard detecting algorithms to locate the best possible landing area. The particle counter gathered data based on particle size on the particulates in the atmosphere after the rocket was launched to detect the amount of pollution in the air. The UND rocket, at nine feet tall, was one of the biggest in the competition. The rocket and the payloads performed spectacularly during the launch, yet missed the target altitude of 5280 ft due to the mass of the rocket.

Frozen Fury also participated in several outreach events throughout the year. The Frozen Fury faculty lead was Dr. Tim Young with Student participants: Xuchu Xu, Brittany Zimmerman, Ning Li (Scott), James Sutton, Prabhu Victor, Poonam Josan, Ashish Kotwal, Lance DiAngelis, Gregory Foote.



## Robotics Mining Competition

In May of 2016, two North Dakota teams competed in the 7th annual Robotics Mining Competition, held at the Kennedy Space Center. These teams were from North Dakota State University (NDSU) and the University of North Dakota (UND). NDSU placed 30th out of 45 teams and UND placed 5th. This was NDSU's first year competing. The UND team also won first place in the Outreach Project Award and second place in the Slide Presentation and Demonstration Award. The UND faculty members were Drs. Jeremiah Neubert and Naima Kaabouch. The NDSU faculty mentor was Dr. Majura Selekw. Congratulations to all the robotics mining students who represented North Dakota!



# National Student Competitions



## NASA Rover Challenge

A team of North Dakota State University Mechanical Engineering students competed in NASA's Human Exploration Rover Challenge, organized by NASA's Marshall Space Flight Center in Huntsville, Alabama in April 2016. The challenge requires students from 70 different teams to race human-powered rovers through a Lunar/Martian themed obstacle course at the U.S. Space and Rocket Center, with goals of furthering knowledge for future NASA missions. This NDSU Rover Team participated in a new wheel technology

challenge, which prohibited the use of commercial products for the wheel, except for the hub. The team completed the course in 5:28, had an assembly time of 0:32, and had a one-touch penalty that added 1:00, totaling a final time of 7:00 minutes. NDSU won the Most Improved Award for the University division, after they improved last year's time by 85.39%. They also won the Wheel Technology Challenge Award! The faculty lead was Dr. Ghodrat Karami with student participants: Alexis Barton, Chris Benson, Rupert Cooper, and Austin Karst.

## AIAA Design Build Fly

The North Dakota State University (NDSU) American Institution of Aeronautics and Astronautics (AIAA) student team competed in the 20th annual Design, Build, Fly Competition in Wichita, Kansas in April 2016. This year, there was a new requirement for writing the proposal for review. 137 proposals were submitted and 93 teams passed to the next phase. Then, 80 teams submitted reports to the judges, and 69 teams passed to make it to the fly-off. There were over 625 stu-



## HASP

The High Altitude Student Platform (HASP) is a student competition organized by NASA and the Louisiana Space Grant Consortium. Every year, 12 student-built instruments are launched from Fort Sumner, NM on a zero-pressure balloon. The University of North Dakota and the University of North Florida have collaborated together since 2008 and fly a nano-crystalline sensor payload. This measures the ozone profile in the troposphere and stratosphere. Dr. Ron Fevig, faculty from the Space Studies department, and two UND graduate students, Sean McCloat and Christopher Follette, contributed to its success this year. HASP launched September 1st, floated for over 15 hours, and reached over 122,000 feet in altitude.

# Lillian Goettler Scholarship



**Rachel  
Simon**  
Zoology  
North Dakota  
State University

*Ever since I was young, I was intrigued by the study of genetics. Something about how something so small can be so complicated and have such a large impact on our lives, really caught my attention. It wasn't until I was sitting in my introductory genetics course, freshman year at NDSU, that I realized I could really pursue a career in this field. My professor talked so*

*highly about genetic counselors and what they do that I had to research more. When I found out that I could combine my love of genetics with helping educate people that are living with the consequences of even the slightest changes in their DNA, I knew this was the career for me. This change of heart led me to changing my major to Zoology: Physiology, Cell Biology, and Health Science with a minor in Psychology. Academics have always been an important part of my life, but beyond that I have always had a love for volunteering. I volunteered at an animal shelter in Fargo as a dog socializer and now volunteer as an on-call advocate at the Rape and Abuse Crisis Center in Fargo. When not at school I spend my free time involved in the NDSU Lion's Club, a volunteer based organization, or working for a research wheat geneticist at the USDA in Fargo. I have always loved hunting and fishing, trying to learn to snowboard, and also spending time with family and friends.*

# Pearl I. Young Scholarship

*I am majoring in Petroleum Engineering and minoring in both Mathematics and Geology. I volunteer my time at the CSI after school program which is aimed at tutoring young students of low income families. At the University of North Dakota, I am actively involved in the Society of Petroleum Engineers in which I serve as the Committee Chair of Public Relations and with the Society of Women Engineers where I serve as the Outreach Coordinator and received the Distinguished Member Award for substantial involvement in my first semester. I am also a member of the Dean's Advisory Board. Along with serving as Secretary of the Engineer's Council, I am also the Treasurer of The Society of Exploration Geophysicists.*

**Jen  
Grinsteiner**  
Petroleum Engineering  
University of  
North Dakota



# NDSGC Scholarships

Every academic year, Space Grant provides each of the affiliate two year, tribal, and four year colleges with scholarship funding. Students are selected by faculty at their home institution and must have an excellent academic record and be majoring in a STEM field.

## Bismarck State College

Mitchell Quist  
Matthew Kurti  
Tyler Weigel  
Levi Kinn  
Candi Yates

## Cankdeska Cikana Community College

Danacia Greywater\*  
Alexis Lohnes  
Traci Owlboy  
Bridget Baker  
Bailee Longie  
Nicole Demarce  
Colton LaRoque  
Mary Cavanaugh  
David Mattson  
Duane Mudgett  
Ava Robertson  
Moriah Thompson

## Dakota College at Bottineau

Spencer Dorsey  
Taylor Hewson  
Jesse Mendel  
Braden Pewe

## Dickinson State University

Rachel Kovash  
Zachary Miller  
Braeton Erhardt  
Parker Egli  
Joshua Hatch  
Tatia Hibbs  
Erin Bertelsen  
Christopher Zumwait  
Shanta Zietz  
Aleesa Joslyn  
Travis Huff  
Seth Ehleng  
Brittany Decker

## Lake Region State College

Tailor Rudoph  
Mariah Foote  
Nicholas Hammons  
Landyn Swenson

## Mayville State University

Bennie Bradner  
Alicia Gibson  
Karissa Hanson  
Elizabeth Hoglo  
Bradley Nygaard  
Katelyn Ogburn  
Summer Dearingier  
Jacob Eaton  
Shayla Fossum  
Maren Johnson  
Jacob Leier  
Brooklyn Miller  
Brady Nygaard  
Leah Olson  
Taylor Plautz  
Morgan Porter  
Adrian Sevigny  
Jeannette Sevigny  
Hannah Torgerson

## Minot State University

Caitlyn Bachmeier  
Inga Dudley  
Donald Forche  
Mark Fulbright  
Michael Heck  
Rachel Holmes  
Annika Kraft  
Stephanie Sundhagen  
Dennis Uhrmacher  
Matthew Winburn

## North Dakota State College of Science

Trinity Dahl  
Taylor Heinz  
Kayla Karels

Ryan Iverson  
Matthew Schuster  
Evan Smith  
Matt Glen  
Faith Goettle  
Brandon Joos  
Logan Kisgen  
Cody Danielson  
Hope Krumm  
Nathan Schmit  
Jolene Kerr  
Brandon Eckholm  
Dalton VonRuden  
Braeden Neiber  
Mitchel Johannsen  
Emily Sjoquist  
Caleb Bellig

## Nueta Hidatsa Sahnish College

Caley Fox  
Sonya Abe  
Lee Voigt  
Alexis Archambault  
Flo L. Garrett

## Sitting Bull College

Luke Black Elk  
Sheena Gladue\*  
Anitra Hill  
Melanie Howard  
Jacquelyn Mitchell

## Turtle Mountain Community College

Memphis Belgarde\*  
Crystal Azure  
Trevor Thomas  
Kevin Brien  
Joshua Lackey  
Nefer Villalobos Sanchez Jr.

Zoe St. Claire  
Winter Monette  
Brooke DeCoteau  
Samantha Herman  
Molly Allery  
Justin Thomas  
Kara Azure  
Kayana Trottier  
RaeAnn Morin  
Kiana Brunelle  
Chelsi DeCoteau  
Clarence Davis  
Michael Selburg  
Rhea Nadeau  
Tiray Azure  
Brittany DeCoteau

## United Tribes Technical College

Kimberly Blevins  
Bonita Claymore  
Marlee Finley\*  
David Shillingstad

## Valley City State University

Alex Askerooth  
Machenzie Bruce  
Haley Christofferson  
Max Kollar  
Nick Kramer  
Lindsey McMaster  
Brady Smith  
Marielle Villarin  
Madelyn Zahnow

\* Recipient of the American Indian Scholarship

## Career Fairs

To increase awareness of Space Grant opportunities, the NDSGC participates in career fairs at affiliate institutions throughout the state. The NDSGC attended college fairs at the University of North Dakota and North Dakota State College of Science in 2016. At these fairs, students receive information on available scholarships, fellowships, NASA internships, and graduate level STEM-programs.



# Research Fellowships

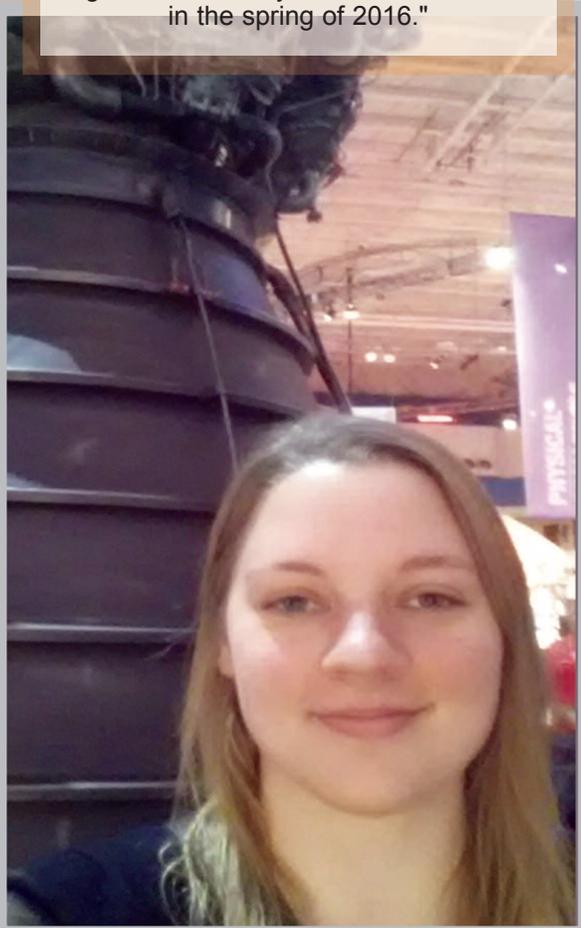
The NDSGC research fellowships are given on a competitive basis to undergraduate and graduate students at affiliate colleges who are completing projects that are of particular interest to NASA.

## Lindsay Anderson

Space Studies,  
University of North Dakota

### ***A Comparative Analysis of the Geology Tools Used During the Apollo Lunar Program and Their Suitability for Future Missions to the Moon***

"The fellowship awarded by the NDSGC allowed me to spend a semester focused on finishing my thesis data reduction and write-up. Thanks to this research opportunity, I was able to graduate with my Master of Science in the spring of 2016."



## Meyer Bohn

Soil Science,  
North Dakota State University

### ***Evaluating Soil Health Using Remotely Sensed Evapotranspiration on the Benchmark Barnes Soils of North Dakota***

"I am exceedingly grateful for the funding and support provided by the NDSGC Summer Fellowship. This research opportunity has given me insight to the complex dynamics of soils, survey methods, and broad scale resource assessment via remote sensing. The experience I gained from field work, GIS, and laboratory analyses has been instrumental in my development as a soil scientist and further prepared me to address the challenges of the future."



## Lawrence Burkett

Earth System Science and Policy,  
University of North Dakota

### ***A Sustainable Tuvalu***

"The support of Space Grant allowed me to focus on both research and my family. I was able to study Tuvalu, a remote island nation in the South Pacific, with the goal of helping to characterize environmental stability."

# Research Fellowships

## Jason Burns

Mechanical Engineering, University of North Dakota  
***Quantifying Cure in Industrial Composites Using  
Fourier Transform Infrared Spectroscopy***

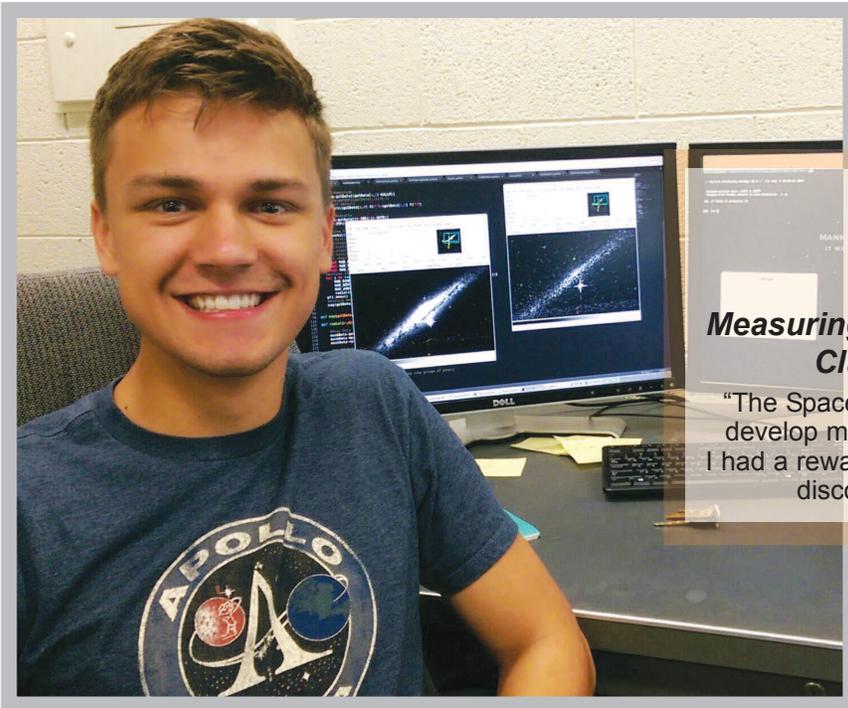
"The Space Grant fellowship has afforded me the opportunity to dive deeper into my graduate research as I work towards graduating with a Master's of Science in Mechanical Engineering."



## Nathan Carlson

Physics and Astrophysics,  
University of North Dakota  
***Measuring the Specific Frequency of Globular  
Clusters around Spiral Galaxies***

"The Space Grant Fellowship allowed me to explore and develop my skills and abilities as a scientific researcher. I had a rewarding experience of overcoming challenges and discovering my strengths and weaknesses."



## Mitch Campion

Electrical Engineering, University of North Dakota  
***Predicting West Nile Virus Occurrences in  
North Dakota Using Data Mining Techniques***

"This project has challenged me to come up with novel solutions to complex problems, for which, there is no known protocol or example to follow in meeting the desired objective. More specifically, this project has exposed me to the skills required by a career in the field of data science and has given me tangible experience by applying these skills to a meaningful problem, the mitigation of West Nile Virus."



# Research Fellowships

## Peter Henson

Civil Engineering, University of North Dakota  
**Structural Health Monitoring (SHM)  
of Spacecraft Structures**

“The NASA research fellowship I took part in has helped me obtain a more developed understanding of SHM systems used today and for deep space exploration in the future. With Space Grant’s helpful contribution, I was given the opportunity to work problems scientifically and to continue pursuing my interests in an education and a career path I am truly passionate about in the aerospace industry!”



## Tyler Lane

Electrical Engineering, North Dakota State University  
**Energy Harvesting of Prosthetics**

“This experience has helped me to further explore my interest in the field of control systems. I am very excited to finish my graduate degree and I look forward to a potential career with NASA.”



## Sean McCloat

Space Studies, University of North Dakota  
**Photometry and Transit Timing Variation  
Analysis of Recently Discovered  
Hot Jupiter Exoplanets**

“The support I have received from the NDSGC (from this fellowship and in the past) has been the single most enabling factor of my college and graduate school career. Absolutely, the NDSGC has been indispensable in helping me achieve the level of success I currently experience and continues to enable me to fulfill my dreams of participating in the future of space exploration.”

# Research Fellowships



## Lucky Mulenga

Chemical Engineering, North Dakota State University  
***A Study of Continuously Rotating Detonation Engines***

“This fellowship allowed me to add another pertinent section to my dissertation, furthering my research in Chemical Engineering.”



## Madison Olson

Mechanical Engineering, University of North Dakota  
***UND Habitat Modeling and Additions***

“This fellowship has taught me that many environmental conditions must be considered in design for space exploration. It is also important to keep in mind the simulation conditions in the local area and how to note the contrast between the environments when making a simulation as accurate as possible. These are critical factors to consider for future projects for space in my career and I am grateful for the opportunity.”



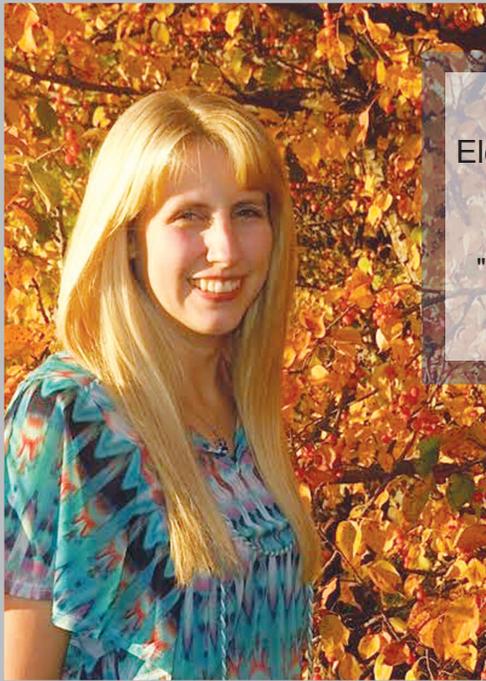
## Sophie Orr

Space Studies, University of North Dakota  
***Analysis of Human Exploration Research Analog (HERA) Crew Audio/Visual Journals***

“Working alongside an industry expert with ties to many facets of NASA has prepared me to engage in space related research and connect what we are doing in the Space Studies department at UND with government level projects.”

Sophie is pictured with mentor Dr. Jack Stuster.

# Research Fellowships



## Mary Pearson

Electrical Engineering, North Dakota State University  
***The Interaction of Radio Frequency  
and Lambda DNA***

"Receiving this Space Grant fellowship has motivated me to pursue my academic goals of continuing my education to obtain my PhD in Biomedical Engineering."

## Billi Jean Peterman

Environmental Science, Dickinson State University  
***Investigating Changes in  
Soil Microbiological Communities***

"If Drs. Brevik and Steffan had not persuaded me to participate in this soils research project, I would still be wandering aimlessly on an academic path that was not suited for me. This project has revealed to me a career I will enjoy daily and not necessarily see as a just job I must report to."



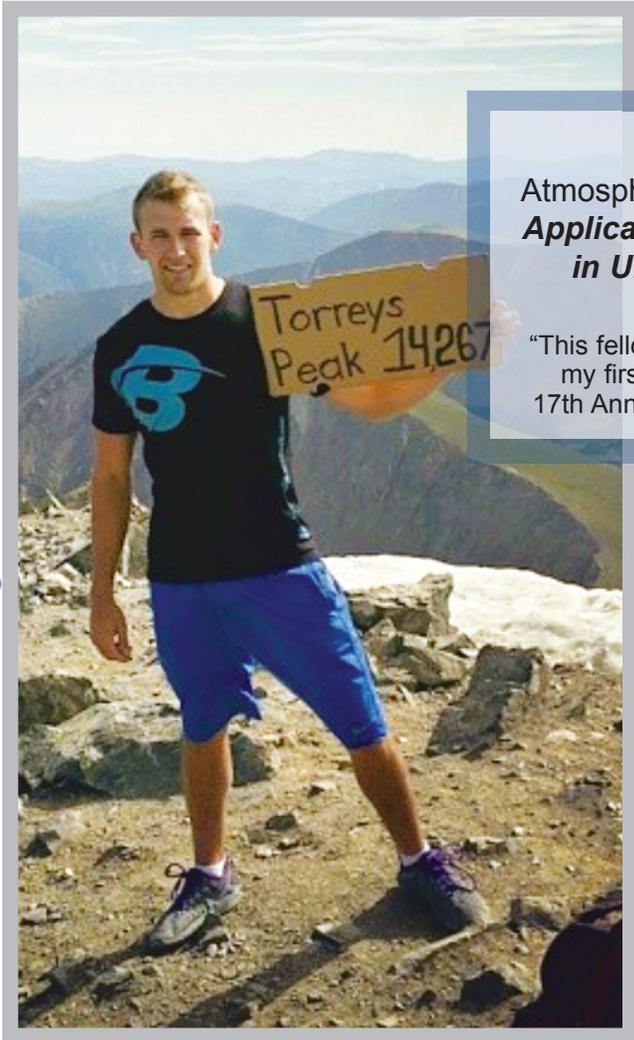
## Charles Schneider

Electrical Engineering, University of North Dakota  
***Pilot Headset Augmentation -  
Navigation and Physiological Feedback Device***

"The NASA Space Grant has been a gift that allowed me to pursue my research and further my career in the field of aerospace and bio-electrical engineering, while reducing my student debt!"



# Research Fellowships



## Tim See

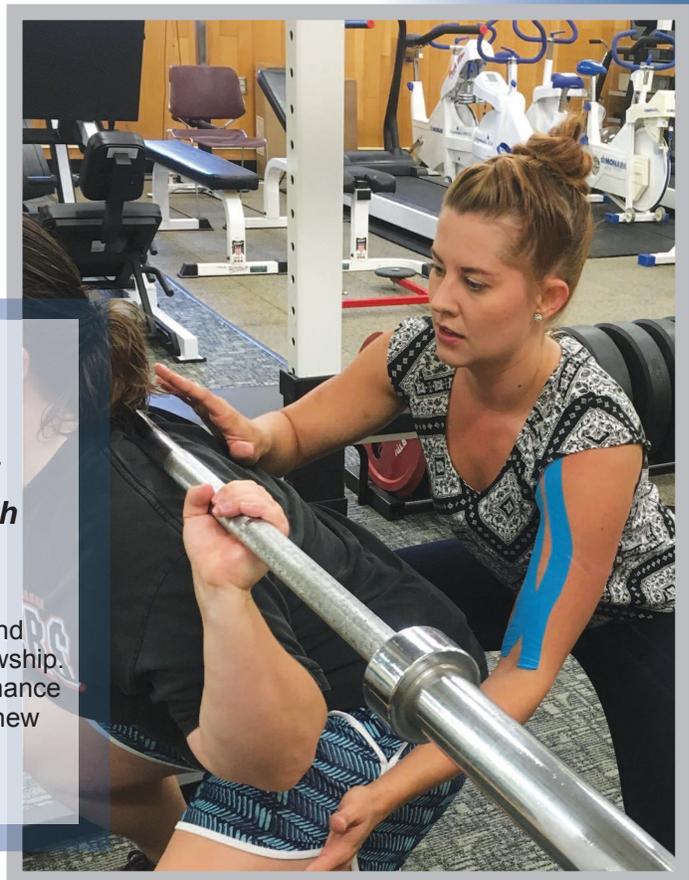
Atmospheric Sciences, University of North Dakota  
***Application of Docker Containerizing Software  
in Undergraduate Education to Increase  
Model Understanding***

"This fellowship made it possible to work toward presenting my first scientific poster in the summer of 2016 at the 17th Annual WRF Users' Workshop in Boulder, Colorado."

## Kara Stone

Exercise Science and Nutrition,  
North Dakota State University  
***Surface Electromyography Analysis of  
Paraspinal Muscles when Facilitated with  
Kinesio® Tape During Exercise  
Countermeasures***

"I am very grateful for the experience, knowledge, and growth provided by the NDSGC summer research fellowship. I was able to combine my knowledge of human performance with a plethora of technologies (many of which were new to me) causing me to grow not only as a student, but also as a researcher."



# STEM Ambassador Program

This year, NDSGC selected six students to be STEM Ambassadors - students from across North Dakota who visit K-12 schools, conduct public outreach events, or other STEM projects - to represent Space Grant's outreach program. On September 17th, these STEM Ambassadors attended our first training session. They conducted the hands-on activities that they would be teaching North Dakota students and received advice from guest speaker, Dr. Mark Guy, professor from the Teaching and Learning Department, on how to improve their teaching pedagogies. This year's STEM Ambassadors attend Mayville State University, Sitting Bull College, and the University of North Dakota. Some of the past events STEM Ambassadors have assisted NDSGC with include: the 1000th ARISS Call to Astronaut Tim Kopra, K-12 school visits, the Near-Space Balloon Competition (NSBC), and our Summer Space Camp in Bismarck. This year's STEM Ambassadors are: Tiana Delzer (University of North Dakota), Hope Gutschmidt (Mayville State University), Madison Olson (University of North Dakota), Shae Skager (University of North Dakota), Nathan Walsh (Mayville State University), and Floris White Bull (Sitting Bull College).



Training  
with  
Dr. Mark Guy



Maddy and Floris examine glitter meteorite samples in SciGirls™ Super Sleuths activity.



Hope, Shae, and Maddy design robot arms, an activity used with K-12 students.



Hope, Tiana, Maddy, Shae, and Floris. Not pictured: Nathan.

# Student Travel Grants

The NDSGC provides travel grants to North Dakota students to present papers or posters at conferences throughout the U.S. Many of the research projects presented have been funded by Space Grant. 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.



## Christopher Buelke

University of North Dakota

*Moon Rocks into Spacecraft LOX:  
Modernizing a study and  
Comparing Reactions*

**Space Resources Roundtable and  
the Planetary and Terrestrial Mining  
Sciences Symposium**

Golden, CO

## Nathan Carlson

University of North Dakota

*Globular Cluster Population of the  
HST Frontier Field Galaxy  
J07173724+3744224*

**American Astronomical  
Society Meeting**

Kissimmee, FL



## Sean McCloat

University of North Dakota

*Constraining Exoplanet Transit  
Timing Variations (TTVs)*

**2016 Sagan Exoplanet  
Summer Workshop**

Pasadena, CA

## Mike Cook

University of North Dakota

*Extreme Poynting Flux over the Polar Cap Region*

**Space Weather Workshop**

Denver, CO



# Space Camp

The NDSGC's Deputy Director, Coordinator, and STEM Ambassador, Hope Gutschmidt, traveled to United Tribes Technical College (UTTC) in Bismarck and conducted a Space Camp on June 15th and 16th with UTTC faculty member, Jeremy Guinn. Thirty middle school students were led through a Mars mission, where they worked in teams to solve their own science and engineering design problems. Students had to form a crew, launch their own rockets, think critically and work as a team during "emergency Apollo-13-esque" situations, design robotic CanadArms, construct robotic rovers to remove Martian dust from solar panels, and land a crew safely on Mars.



# First Robotics

## Team 876 Thunder Robotics

Team 876 Thunder Robotics from Hatton/Northwood was a semi-finalist at the Northern Lights Regional in Duluth, MN. They were the Regional Champions at the Central Illinois Regional in Peoria, IL. At the World Championships in St. Louis, MO Team 876 finished 2nd in their division of 75 teams, one of the top 48 teams out of 650 teams at the competition!

The team also ran a summer golf tournament, helped serve a prime rib supper and demonstration, assisted in a coyote tournament, demonstrated at parades, nursing homes, and school activities. They had 24 members from four communities: Hatton, Northwood, Aneta, and Emerado. The faculty mentor for Team 876 is Mike Voglewede.



## Team 877 North Star Robotics

North Star Robotics FRC 877 made it to the semi-final rounds in our 2016 competition in Duluth, Minnesota and we hope to “freeze out the competition” in this year’s challenge, FIRST Steamworks. We were selected to present at the 2017 Technology Showcase and are looking forward to showing our state senators and representatives what we CAN-Do with technology! We would like to wish all competitor’s the best of luck this season and would like to thank the UND/NASA Space Grant Consortium and all of our sponsors for their support. The faculty mentor for Team 877 is Lisa Ramey.

## Team 4818 The Herd

The First Robotics team from West Fargo, ND competed in two regional events in 2016 located in Duluth MN, and Cedar Falls, IA. In the Duluth competition, Team 4818 finished in 58th place, so they fundraised to be eligible for participation in a second regional competition. They were selected as *Team Captain* at the Cedar Falls competition, and made it to the Semifinals. This was the first time Team 4818 had earned this honor in their five years of competing.

For preparation, during the off-season, the students became familiar with 3D-modeling software to increase their efficiency in mechanical design of the robot. Team 4818 also developed and built three new drive trains (Mecanum, Tank, and Swerve) in the fall of 2016 to improve the design, build, and programming skills to prepare them for the 2017 season. The faculty mentor for Team 4818 is Brad Mackowick.

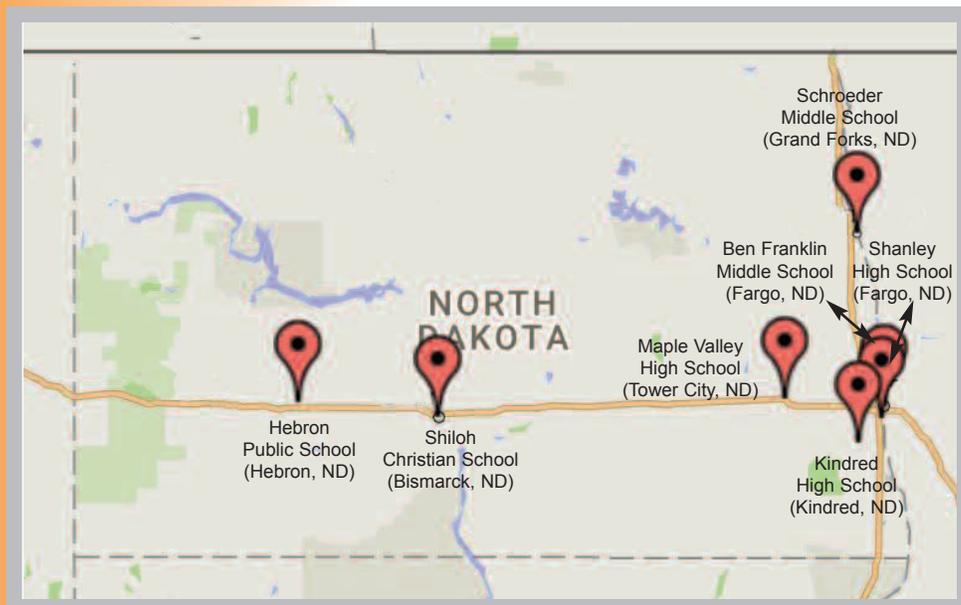


# 2016 NSBC

The sixth annual Near-Space Balloon Competition (NSBC) was held in Grand Forks, ND, at the University of North Dakota. The NSBC is a state-wide middle and high school student launch competition, where students gain hands-on experience with the scientific and engineering design process. Students define a hypothesis, design, construct, and launch a payload to the near-space environment. After the payloads ascend to 100,000 feet and return back to Earth, the students analyze their data and produce a final report. This year's NSBC objective was to design a payload that would study heliophysics, in preparation for the August 21, 2017 total solar eclipse.

Even though the primary and secondary launch dates were postponed due to weather, the students visited UND to participate in Integration Night. Each team presented their payload to their fellow peers and the graduate student team of judges. The following morning, they participated in various hands-on sessions which included a tour of the Human Space Flight Laboratory at UND, ballooning tracking equipment, and eclipse ground station operations.

Their payloads are ready for the next available launch date, which will occur in the spring semester of 2017. All of the NSBC students were mature and patient, understanding how real life space missions may be delayed for weather. They are very excited to complete this year's competition!



This year, we had over 60 students from 11 different teams representing 6 towns! This was a record year for the NDSGC's competition!

# Community Outreach Events

The NDSGC team was invited to participate in and support many outreach events throughout 2016. In the spring, Space Grant visited the Alerus Center and conducted an interactive lunar activity at ArtWise, a community night for families and schools. In May, Space Grant visited Dakota College at Bottineau during their annual Water Festival, where students conducted a problem-based learning activity as Neutral Buoyancy Laboratory engineers. The annual Marketplace for Kids, held in Grafton, was also a great success, where Space Grant conducted the Strange New Planet activity with middle school students. The NDSGC supported a star party family event at Lake Region State College in September to celebrate the college's 75th anniversary. The NDSGC team also visited the North Dakota Vision Services/School for the Blind (NDVS/SB) throughout the year. The team taught interactive lessons on seasons, meteorites, and space suits. Students who participate in these NDVS/SB week-long programs travel from around the state and Northern Minnesota.



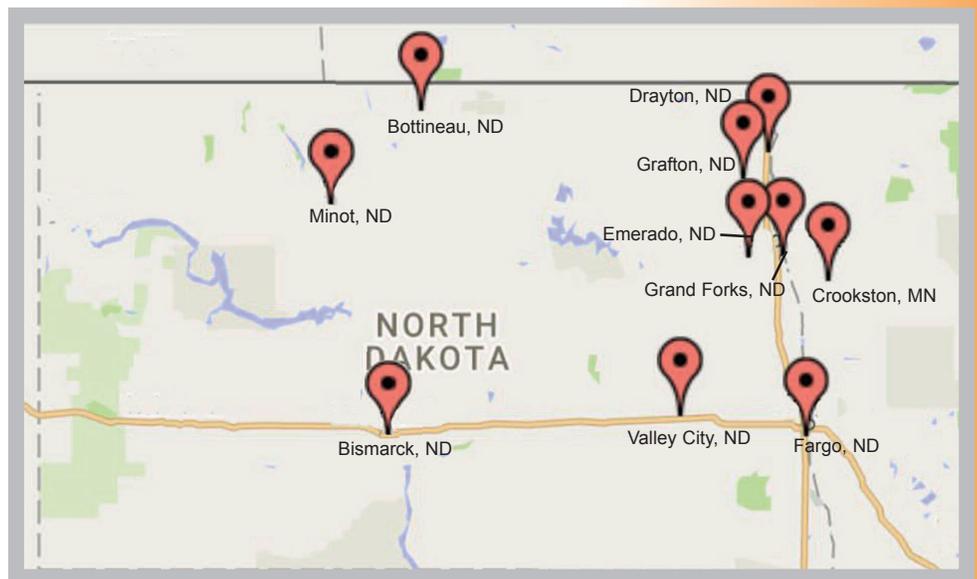
## Tours:

The Human Space Flight Laboratory (HSFL), located at UND and supported by the NDSGC, offers tours to the North Dakota community, prospective students, local legislative staff, summer camps, and K-12 field trips. The HSFL is comprised of Spacecraft Simulators, Inflatable Habitat, Space Suits, and Electric Rover. To prepare students for the radio call to Astronaut Tim Kopra on the ISS (see page 24), numerous schools toured the HSFL. Other special tours included homeschool groups, undergraduate Space Policy classes, other Space Grant affiliates.

## Classroom Visits

Throughout the school year, the NDSGC team makes visits to classrooms statewide and conduct hands-on activities with students grades K-12. In 2016, the NDSGC visited the school districts that would be attending the ARISS call to Astronaut Tim Kopra, conducting NASA-related activities to increase their excitement and help them prepare their interview questions. In the second year of the STEM Ambassador program, students traveled across the state and led hands-on activities.

The Deputy Director and Coordinator also led a school-wide assembly presentation at Century Elementary School in Grafton, ND. They presented the young students with potential STEM careers, encouraging them to stay in school and pursue college. They examined possible NASA career paths, discussing real NASA missions and programs and relating them to TV-robots and space movies.



# Eclipse Workshop

In order to prepare for the upcoming August 21, 2017 total solar eclipse, the NDSGC Deputy Director, Coordinator, and two students traveled to Bozeman, Montana for an eclipse workshop. Teams from over 30 states met at Montana State University (MSU) and constructed a balloon-tracking ground station. This ground station will receive high resolution images and live video from the balloon and transmit these to the NASA website. Never have high altitude balloons streamed a total eclipse live before and NDSGC is grateful to be a part of this multi-space grant collaboration and once-in-a-lifetime opportunity. Preparations for this eclipse are ongoing throughout the year, culminating in the summer of 2017!

Preparation  
for the  
upcoming  
Total Solar  
Eclipse -  
August 21,  
2017

Students Mike Cook and Maddy Olson test the ground station at the July 2016 workshop.



# Affiliate Involvement



## Annual NDSGC Affiliates Meeting – Dickinson, ND

In April, the 2016 NDSGC Affiliates Meeting was held at Dickinson State University in Dickinson, ND. Presentations included Space Grant funded student research, team projects, faculty research, and funded STEM education projects from across North Dakota. Attendees also participated in a hands-on competition of designing, constructing, and launching a rocket to safely deliver food to an astronaut stranded on Mars. The schedule for the meeting, along with research presentation downloads, can be found here: <https://goo.gl/vHYlvG>.



The first team to successfully land "on Mars" and rescue Mark Watney.



# Amateur Radio on the International Space Station (ARISS)

# ISS Call

At 1:07 pm on March 10, 2016, 400 K-12 students, teachers, University of North Dakota (UND) students, and community members sat quietly in the Memorial Union's ballroom at UND and stared straight ahead, listening attentively. The HAM radio, broadcasting silence, suddenly burst out with static. The voice of astronaut Tim Kopra, Commander of the International Space Station (ISS), confirmed he could hear us "loud and clear". The excitement in the room was palpable – we had established the complex link from North Dakota all the way to an orbiting research center flying 200 miles above us, traveling at nearly 18,000 miles per hour. This was NASA's historic 1,000th ARISS call – and first ISS radio call to North Dakota.

This long-distance connection was made possible by the collaboration between the North Dakota Space Grant Consortium (NDSGC), the Student Amateur Radio Association (SARA), and the Amateur Radio on the International Space Station (ARISS). The ARISS mentor, Charlie Sufana AJ9N, worked with the NDSGC and SARA for an entire year, helping to make this event a success. With help from the UND Aerospace Network, colleagues, friends, and family from across the nation were able to view the contact through a live video stream.

Sixteen students, ages ranging from second grade to graduate school, asked CDR Kopra their own questions, within a 9-minute contact window. The attentive audience heard responses such as how he became an astronaut, his exercise routine on the Space Station, and advice to work hard in school. "My advice to some of you who might want to work for NASA or any place that requires a high level of academic achievement is to study very hard and work hard in school. When you do well in school and learn a lot, it's like money in the bank. You can always use that for future opportunities," CDR Kopra stated. He also admitted how he has a new personal photography goal – imaging North Dakota from space!



# ISS Call

After receiving classroom visits from the NDSGC team in preparation for this day, students traveled to the event at UND from all across the ND region – Kindred, Grafton, Grand Forks, and even Crookston, MN. They participated in twelve different hands-on activities throughout the morning, such as constructing and launching paper rockets, constructing a robotic CanadArm, and releasing their own Orion Capsules with parachutes. There were four college-level demonstrations: the Student Amateur Radio Association, Formula One Car organization, and two NASA competition teams, Rocketry and Robotics. The UND Space Studies Department provided their interplanetary rover and analog space suits (part of the NASA EPSCoR program), demonstrating their functionality to all of the students. Additionally, the UND Physics and Teaching and Learning Departments provided the GeoDome – an inflatable planetarium – one of the students' favorite stations.

This historic 1,000<sup>th</sup> ISS call was successful due to the collaboration between organizations, the gracious volunteers, and the teachers' flexibility with scheduling. The NDSGS's involvement in this event would not have been possible without the motivation of UND students Joey Castiglione and Jason Burns. Commander Kopra may have spoken to only 16 students that day, but in fact, he impacted the lives of the entire North Dakota community.

Astronaut  
Tim Kopra as he  
speaks to students,  
teachers, and  
community members  
at the University  
of North Dakota



Check out  
our featured  
article on  
NASA's website!  
<https://goo.gl/xpV9e1>



**SEEC  
2016**  
Houston, Texas

# Educator Professional Development

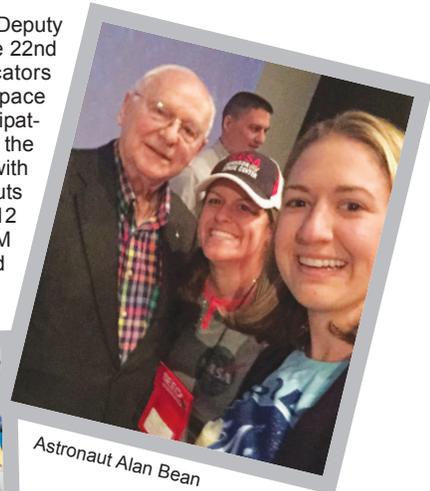


Astronaut Clayton Anderson



In February 2016, the NDSGC Deputy Director and Coordinator attended the 22nd Annual Space Exploration Educators Conference (SEEC) at Johnson Space Center in Houston, Texas. They participated in hands-on STEM sessions, toured the Neutral Buoyancy Lab, flew planes with the Civil Air Patrol, and met astronauts Clayton Anderson, Eric Boe, and Apollo 12 astronaut, Alan Bean. These new STEM activities were brought back and adapted

for pre- and in-service teacher workshops in North Dakota.



Astronaut Alan Bean



Astronaut Eric Boe



The NDSGC supported two North Dakota teachers to attend Space Academy for Educators at the U.S. Space and Rocket Center in the summer of 2016. As a result of their participation in "space camp," they are now more equipped to include hands-on, NASA-relevant investigations in their classrooms and encourage their students to pursue careers in STEM fields.



## Teacher Space Camp

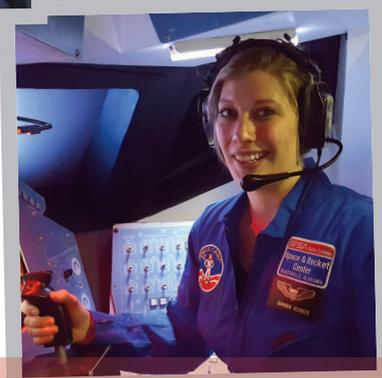


### Barry Olson

8th Grade Earth Science  
Ben Franklin Middle School, Fargo, ND

*"I would like to thank you for the opportunity to attend 'Space Camp for Educators.' The camp was filled with great activities, presentations, and lessons. I will be using many of the things learned at the camp in my classroom during the rest of my teaching career."*

Check out his webpage on his time at NASA Space Camp!  
<https://sites.google.com/a/fargoschools.org/olson-science/nasa-space-camp-2016>



### Shannon Blomker

STEM Program Director for Charism  
Fargo, ND

*"I will never forget the experience I had at Space Camp in Huntsville, Alabama; it has made such an impact on my life that I'll never take for granted. The missions were real-life and incredible. My team was amazing and it was great to collaborate with them during challenges throughout the week. It's been wonderful to use the resources and curriculum I received while at Space Camp—students have learned a lot more about space exploration and absolutely love it. It's so cool to see kids get excited and inspired about STEM education and 21st century competencies. Also, it was such an honor to meet Ed Buckbee, Homer Hickam, and Luke Talley (one of the computer scientists that worked on the Saturn V!)"*

## In-Service Teaching

The NDSGC Deputy Director and Coordinator attended the 2016 Spring ND Collaborative STEM Conference for Science and Math Teachers in North Dakota. They presented the teachers with handouts, lesson plans, and NASA-related STEM resources at their NDSGC booth. In addition to the booth, they conducted a workshop on the annual Near-Space Balloon Competition (NSBC) and provided hands-on demonstrations, such as investigating heliophysics experiment ideas, methods to construct a payload, and how the NDSGC uses HAM radios to track in real-time. Discussing how middle and high school teachers can benefit from ballooning education resulted in a record year for 2016 NSBC participation!

# Educator Professional Development

## Pre-Service Teaching

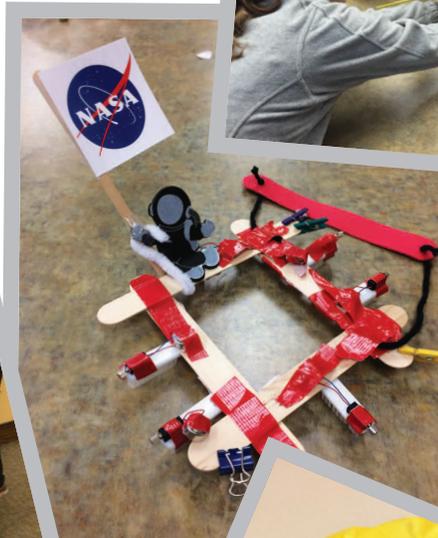
The NDSGC Deputy Director and Coordinator conducted various pre-service teacher workshops throughout 2016. These took place at the University of North Dakota, Valley City State University, Minot State University, and North Dakota State University. Education students learned about NASA classroom resources and opportunities for them as teachers, studied human space exploration, and launched their own rockets, rovers, and rescue missions. These workshops allow future teachers to bring space sciences into their North Dakota classroom with web resources and hands-on activities.

*"Thank you for taking time to work with the Minot State University Elementary Education teachers.*

*I had a great time November 4th and really enjoyed the afternoon. I can see how fun it would be to incorporate those activities into the classroom. Not only are they engaging, but the students are learning as well!*  
*From Johnson Space Center ;)"*

Hannah Alto, Minot State University

Students at UND work on Stomp Rockets activity.



Mars Rover powered by "Bristle Bots."



UND students pose with rovers.



MSU students use the engineering design process to build landers.



NDSU students test out their Mars Rover Lander designs.

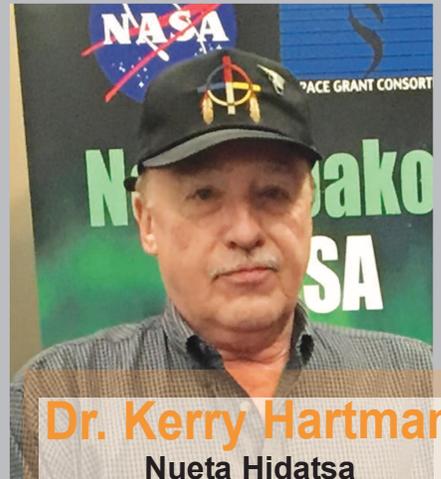
# Summer Faculty Fellowships

Every summer, the NDSGC provides funding to faculty to create or revise a college-level course that is in a science, technology, engineering, math (STEM) field and is NASA-relevant. This program directly supports one of the goals of NASA Education. The overall goal of this program is to increase the exposure of college students to NASA research.



**Ms. Alexa Azure**

**United Tribes  
Technical College**  
Engineering with CAD,  
3D Printing Lab,  
Trigonometry,  
Organic Chemistry/Lab, and  
College Physics/Lab



**Dr. Kerry Hartman**

**Nueta Hidatsa  
Sahnish College**  
Entomology

**Michael Dodge, JD, LL.M.**

**University of North Dakota**  
Space Politics & Policy



**Dr. Mandy Guinn**

**United Tribes  
Technical College**  
Genetics and restructured six-one  
credit courses in Undergraduate  
Research



**Dr. Julie  
Stock-Porter**

**United Tribes  
Technical College**  
Advanced Cell Biology



**Dr. Joshua  
Steffan**

**Dickinson  
State University**  
Pathophysiology

# NASA Research Focus Areas

The NDSGC provides funding to STEM faculty at all affiliate institutions who have an interest in NASA-relevant research in North Dakota. This is the sixth year of Research Focus Area (RFA) funding, which is designed to promote, develop, and expand NASA research in North Dakota in astronomical/planetary research, small satellite development, earth sciences, materials science, planetary space suit research, and other NASA-relevant research areas.

## Dr. Alena Kubátová

UND - Chemistry

### *Proof of Concept of Drone (UAS) Sample Collection to Investigate Occurrence of Atmospheric Carbonaceous Particulate Matter*

with Nueta Hidatsa Sahnish College

In order to understand a full scope of atmospheric processes, a comprehensive picture on occurrence of carbonaceous species in air particles is essential. Within the project we will design and install a particulate matter sampler on the UASs allowing for investigation of the atmospheric carbonaceous particles. Such systems may then be employed for assessment of specific sources or plumes including impacts of harvest, ditch burning, etc. The benefits of the UAS sample collection are in ability of both vertical and horizontal spatial sampling and low costs, thus making feasible screening studies using several UASs at the same time over a large area. Aside from scientific impact, the project will provide training of several graduate and undergraduate students including students from Nueta Hidatsa Sahnish College.



## Dr. Dilpreet Bajwa

NDSU - Mechanical Engineering

### *Improvement in the Performance of Novel Nanocellulose based Fire Retardants for Polymer Composites*

with Nueta Hidatsa Sahnish College



## Dr. Yeo Howe Lim

UND - Civil Engineering

### *Water Yield Characteristics of Tile Drained fields in Eastern North Dakota: Use of Hydrologic Models Based on Field and Remote Sensing Data at Various Scales*

with Mayville State University

Dr. Howe Lim, an Associate Professor at UND, is collaborating with Dr. Aaron Kingsbury, an Assistant Professor in Geography and Political Science at Mayville State University (MSU). Hydrologic models will be utilized to project the water yield characteristics of a number of sites in the local area.

Graduate students from UND and undergraduate students from MaSU will collaborate on carrying out field measurements of parameters, including soil moisture, surface flow and tile-drain flow from the selected areas starting in the spring of 2017. MaSU has acquired a soil moisture probe equipped with a logger under the grant. Representative watersheds in Grand Forks County are currently being selected and the detailed infrastructures are being mapped out by UND graduate student Daniel Fife. Daniel is pursuing his MS research under the supervision of Dr. Lim.



# Meet an Affiliate



**Dr. Jeremy Guinn**  
Environmental Science  
United Tribes  
Technical College

Jeremy Guinn serves as Chair of the Tribal Environmental Science Department at United Tribes Technical College. The department houses the Pre-Engineering program and the Environmental Science & Research program. He has a doctorate in Zoology from NDSU, is a Certified Wildlife Biologist, and uses advanced technology to study wildlife.

He received a BS in Biology from Bridgewater College (VA), a MS in Biology from Western Illinois University, and an AA in Native American Studies from Sitting Bull College. He has served as a science faculty member at tribal colleges since 2004 and has been Department Chair since 2015. In 2009, his high standards of student engagement were acknowledged by receiving the Diversity Award from The Wildlife Society. His participation with the ND NASA Space Grant Consortium began just this past year.

For summer 2016, Jeremy was searching for more meaningful and exciting science outreach opportunities for K-12 students near United Tribes Technical College. A collaborative team, including Jeremy (UTTC), Marissa Saad (NDSGC), Caitlin Nolby (NDSGC), and Hope Gutschmidt (Student, Mayville State University - Elementary Education), designed and delivered a week-long "Space Camp for Kids" program. The program was held at the Science & Technology Center at United Tribes Technical College in June and targeted 5th-8th graders, recruited primarily through the Department's Facebook page.

Registration was overbooked on the first day! The program included plenty of competition-style group "make" activities representing NASA science and math concepts. The first few days began with a Mission to Mars theme as students learned about space travel and built mock space-suits and robots to keep their rover's solar panel clear of dust. Later, the students took a trip in the Star Lab, an inflatable domed planetarium, to learn about stars and constellations to help guide them on their way. Finally, the students built and tested balloon rockets to see which team could reach the destination (i.e. Mars; i.e. to other side of the classroom) carrying a payload of four astronauts.



# Student Success Story

Science! It has always been my passion. Whether it was star-gazing, storm chasing, or hiking nature trails in the Badlands, if it involved science and nature, I was onboard. As a freshman enrolling at Dickinson State University, I wasn't sure exactly what I wanted to do, but it was a no-brainer that it would involve science. I initially took math, chemistry, and biology classes, but still not quite having decided on a definite career, I took a break from school for a few years. I returned to DSU in the spring of 2008 with a little more focus of what I wanted to do, and declared Chemistry as my major and Earth Science as my minor.

During my time as an undergraduate, I was fortunate enough to be the recipient of NASA Space Grant funding and had the opportunity to visit the Goddard Space Flight Center in Greenbelt, MD. As a student researcher, I was involved in a project that utilized Landsat satellite images for cover crop analysis of Dunn County, ND. I worked on that project for a semester and a half until I graduated in 2011.

Immediately following graduation, I was hired as a well-site mudlogger/geosteering consultant in the Bakken and Three Forks oilfields. I started initially as a paid intern with Neset Consulting Service, but eventually I was promoted to a full-time lead hand. My job was to analyze and log (hence the name) the drill cuttings that are removed from the wellbore during the drilling process, and along with interpreting gamma radiation signatures, we determined where the drill bit was underground in relation to the desired payzone. The hours and days out on a given job could get long, and although it was sometimes stressful, it was a lot of fun and a very rewarding experience. I never would have thought of myself as part of the rough-and-tumble oilfield crowd, but it was a blast! And I never got bored with looking at rocks millions of years old that came from two miles below the surface.

The biggest down side is that the oil industry is, of course, very market-driven. So in late 2015 with the downturn in the price of crude oil, employment in the oilfield became more uncertain and I had to start to consider other options. I was fortunate enough to be hired on as a chemistry laboratory technician in the fall of 2015 at what is now the Tesoro Dickinson Refinery. Here I test the process samples—from the Bakken crude that comes in off of the pipeline and trucks all the way to the finished diesel product that gets sold at the fuel pumps. I think that it is so cool that not only did I have a hand in getting the oil out of the ground, but also a hand in processing it!

While working in the oil and refining industries has been an incredible experience, my real passion is nature and the environment. I do think that at some point I will continue on with my formal science education. In fact, I am currently considering finding a program that would allow me to utilize my oilfield experience and also my enthusiasm for the environment—perhaps something along the lines of oilfield remediation or reclamation. In the meantime, I'm grateful for the experiences that I've had that have shaped my career into what it is today and I'm simply enjoying that I get paid to "play" science!



Meredith Andrus





**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**



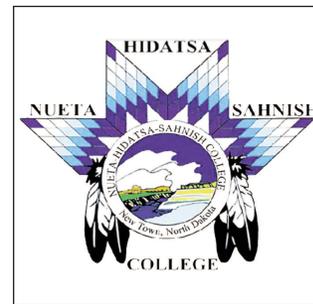
**Minot State University**



**North Dakota State College of Science**



**North Dakota State University**



**Nueta Hidatsa Sahnish College**



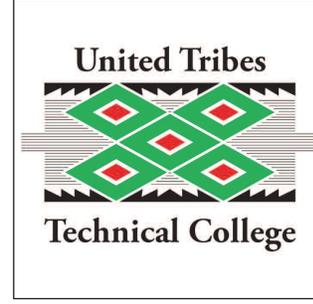
**Sitting Bull College**



**State Historical Society of North Dakota**



**Turtle Mountain Community College**



**United Tribes Technical College**



**University of North Dakota**



**Valley City State University**



**Williston State College**