



The Aurora

2014/2015





Notes from the Director

North Dakota Space Grant Consortium

University of North Dakota
North Dakota State University
Dickinson State University
Mayville State University
Minot State University
Valley City State University
Cankdeska Cikana Community College
Fort Berthold Community College
Sitting Bull College
Turtle Mountain Community College
United Tribes Technical College
Bismarck State College
Lake Region State College
Dakota College at Bottineau
North Dakota State College of Science
Williston State College
North Dakota Heritage Center
Gateway to Science Center

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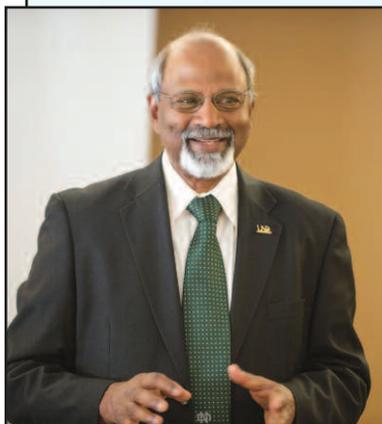
Cover Photo: K-12 educators complete *Sorting the Solar System* investigation as part of the two-day in-service teacher workshop held at UND in March 2014.

Aurora photo in the page banners courtesy of Jonathan Schiralli.

“Making a Difference”

Dear NDSGC Colleagues,

Thanks to all of you, we had another great year for the space grant program in North Dakota! As you can see from the highlights presented in this issue of *Aurora*, our activities are expanding and we continue to make a difference in the lives of our students we serve. Yet the number of students we are able to reach out to is still very small compared to the several thousands who are out there - there is potential to do more.



As I was thinking about how space grant can help bring more students into STEM fields in North Dakota, I was reminded of the well-known starfish story. A young man, walking along a beach, notices thousands of starfish washed ashore. He also notices an old man picking up one starfish after another and tossing it gently back to the sea. The young man asks the old man, “What difference do you make? There are thousands of them.” The old man picks up

another starfish, tosses it into the water and says, “There, it made a difference to that one.” The story generally ends there, but if it were to conclude on an even more positive note, I guess the young man, inspired by the old man’s actions, also starts picking up starfish and tossing them back to the sea. He also encourages others on the beach to do so. I guess the second half of the story is relevant to us if we wish to bring more students into STEM fields.

We are fortunate to have fantastic STEM mentors in our affiliate institutions who make the “difference” to our students through classroom instruction, student competitions, “hands-on” activities, and research projects described in this issue. Though the students we are able to mentor are few, we make a big difference to the ones we do. One way we can reach more students is by increasing the number of such mentors in each of our affiliate institutions. We need to have more STEM faculty get involved with NDSGC. Let us have a simple goal of doubling the number of faculty mentors involved with the consortium in each of our affiliate institutions within the next year!

As always, this issue of *Aurora* focuses on our students, and I would like to thank Caitlin Nolby for her dedicated work and for meticulously compiling it, and Kathy Borgen for the excellent artwork and layout.


Santhosh Seelan

Space Grant Meetings



National Space Grant Meeting - Washington, D.C.

Dr. Santhosh Seelan, Caitlin Nolby, Dr. Pablo de León, and student Travis Nelson attended the 2014 National Council of NASA Space Grant Directors' Annual Spring Meeting in Washington, D.C. February 27 – March 1, 2014. They also met with United States Legislators from North Dakota to share programs and projects funded by Space Grant in the past year. Senator John Hoeven, Senator Heidi Heitkamp, and U.S. Representative Kevin Cramer were all receptive to the Space Grant program. Dr. de León and Nelson gave a presentation at the meeting titled, "Creating a Human Spaceflight Research Infrastructure in North Dakota." The National Space Grant Alliance also helps to advocate for sustained congressional support of the Space Grant Program.



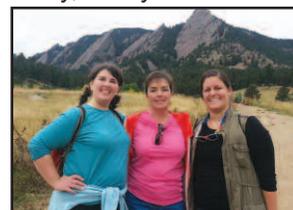
The NDSGC with Representative Cramer.



Nordahls give presentation on AIAA.

Western Regional Meeting - Boulder, CO

The fall 2014 Western Regional Meeting was held in Boulder, CO. Graduate students from North Dakota State University, Emily and Mitchel Nordahl, gave a presentation titled, "AIAA Design, Build, Fly at NDSU" regarding their involvement in the national competition. The NDSGC and students also attended the hands-on Arduino workshop, and plan to use this knowledge in high-altitude ballooning efforts and share in teacher workshops. The NDSGC was even on the winning team for the Lego Drop (thanks to the NDSU students of course.) The meeting was both fun and informative. Thank you to the COSGC for hosting!



ISGC and Nolby on COSGC hiking trip.

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.



National Student Competitions



NASA Student Launch

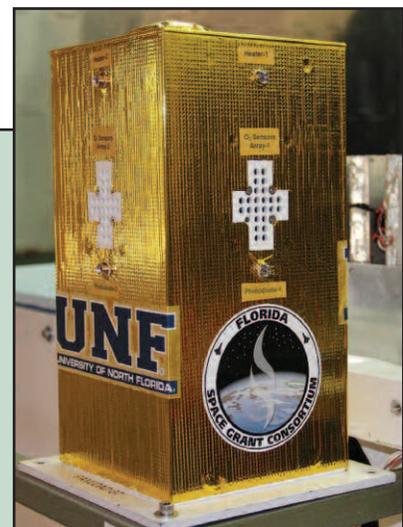
The University of North Dakota's Frozen Fury Rocketry Team designed and constructed a high-power rocket, named Aurora, which competed in NASA's Student Launch Competition in Bonneville Salt Flats, Utah in May 2014. Along with designing and building the rocket and payloads, UND students had to develop a website, reach more than 100 middle school students, and design and sew their own parachutes for rocket retrieval. The UND rocketry team passed the competitive proposal process, and completed a Preliminary Design Review, Critical Design Review, Flight



Readiness Review, and Launch Readiness Review throughout the school year. UND's rocket soared to 5,433 feet and came down with its two parachutes intact. Frozen Fury's on-board experiment successfully collected video footage of liquid movement in microgravity. Faculty lead was Dr. Tim Young with student participants: Nicole Fitzgerald, Emeke Opute, Xuchu Xu, Adam Feigum, and Andreas Oines.

HASP

The High Altitude Student Platform (HASP) is a student competition put together by NASA and the Louisiana Space Grant Consortium which allows for 12 student-built instruments to be flown on each mission. The University of North Dakota and the University of North Florida teams have collaboratively flown together since 2008. This year's UND team was led by faculty member Dr. Ron Fevig. The UND/UNF payload consisted of nano-crystalline sensor arrays which measured the ozone profile in the stratosphere. The launch was on August 9, 2014 on a zero pressure latex balloon, out of the Columbia Scientific Balloon Facility in Ft Sumner, New Mexico with a float time of ~5.5 hours. You can read more about the UND/UNF payload here: <http://goo.gl/Ls3V0l>.



National Student Competitions



Robotics Mining Competition

The University of North Dakota RAPTOR (Robot Automated for the Procurement and Transport of Regolith) team competed in the 5th Annual Robotic Mining Competition in May 2014 at the Kennedy Space Center. The team consisted of one computer science, 11 electrical engineering, and 13 mechanical engineering students at UND. The robotic mining project even performed outreach activities to encourage K-12 students to pursue a STEM career. The team also served as mentors for the local First Lego League Tournament. Advisors for the team are Dr. Jeremiah Nuebert and Dr. Naima Kaabouch.



Team members perform demonstrations with their robot to show elementary students just how cool engineering can be.



Team RAPTOR at 2014 Competition.

NASA Rover Challenge

A team of students from North Dakota State University competed in NASA's Human Exploration Rover Challenge organized by the Marshall Space Flight Center in Huntsville, Alabama in April 2014. There were a total of 70 teams, with more than 500 students participating. The NDSU Team had one of the faster assembly times of only 13 seconds. And although the team suffered failures on the course's inclined plane, they stayed positive and are excited to make some major changes to next year's vehicle. The faculty lead was Dr. Ghodrat Karami with student participants: Oliver Boeckel, Jacob Hanson, Paul Johnson, Lance Krogh, and Lindsey Feyder. The team also presented their results at the 2014 NDSGC Affiliates Meeting.



NDSU Team at competition.



NDSU's 2014 team vehicle.



AIAA Design Build Fly

The North Dakota State University American Institution of Aeronautics and Astronautics (AIAA) student team has competed in the Design, Build, Fly Competition since 2011. The 2014 challenge included a Timed Ferry Flight, Maximum Load Mission, an Emergency Medical Mission, and a Ground Taxi Mission. The team presented their results at the 2014 NDSGC Affiliates Meeting. The faculty lead is Dr. Bora Suzen with student participants: Jamison Huber, Brian Korver, Gregory Matson, Logan Noess, Ross Young, and Ryan Schuler. The team placed in the bottom half of the 80 competitors but has big plans for the 2015 competition!



NDSU team's 2014 aircraft.



NDSGC Scholarships

Every academic year, Space Grant provides each of the affiliate two year, tribal, and four year colleges with a set amount of funding for scholarships. Each college chooses its Space Grant scholarship recipients and the amount of money that each scholarship is worth.

Congratulations to this year's scholarship recipients!

Sitting Bull College

Emilee Blevins
Jason Breiner
Rose Burcham
Koby Sommer
Jason Breiner
Rose Burcham
Sunshine Claymore
Maurice Little Bear

Lake Region State College

Jayla Greene
Jessica Johanson
Amy Joshua
Carrie Nienhuis
Lindsay Louters
Clay Montag
Kyle Olson
Patrick Becker
Lincoln Larson
John Nienhuis
John Tweed
Carl Kolbo

Minot State University

Ashley Lucy
Dennis Uhrmacher
Kayla Haugen
Suzannah Miller
Elizabeth Bauder
Kaylee Dockter
Matthew Hargrove

Cankdeska Cikana Community College

Breann Jetty
Nicole Demarce
Jennifer Goggles
Brianna Foote
Chelsea Young
Terry Herman
Piagon Mckay
Kristen Ross
Darrick Ami

Dickinson State University

David Hegstad
Parker Egli
Zachary Miller
Brandi Mantz
Erin Bertelsen
Meyer Bohn
Shanta Zietz
Kelli Robinson
Travis Parker
Brandi Herauf
Dalten Kuhn

Valley City State University

Tracie Boehmlehner
Stephen Brown
Jenna Coghlan
Thomas Dodson
Alexis Getzlaff
Jacob Johnson
Michaela Halvorson
Garret Hecker
Melissa Kindelspire
Nicholas Lee
Jason Nelson
Zachery Nelson
Megan Olson
Jacob Schlecht
Kortney Groettum
William Greb
Kinsly Tarmann
Jessica Puhr
Michael Bloch
Alex Conlon
Morgan Berquist
Ben Holen
Grayson Marty
Gage Metzen
Logan Oleson
Hayden Zander
Tracie Boehmlehner
Zachary Nelson
Andrew Oksendahl
Victoria Silva
Nicole Berg
Alex Conlon
Jacob Bushaw

Bismarck State College

Leslie Beaudoin
Derek Boeshans
Alexandra Davis
Kathryn Dewitt
Zacharie Finneman
MiKaela Forster
Sydney Gangl
Lane Herberholz
Justin Jangula
Samantha Johnson
Kendra Koch
Lucas Maxwell
Lucas Meier
Catherine Nelson
Austyn Trauger
Benjamin Kuhnley
Taite Grossman
Ashley Mormann
Rachel Handeland
Dennis Evans
Thomas Krizan
Ty Rossman
Peyton Lind

Dakota College at Bottineau

Drew Ross
Tessa Walters
Imani Scott
Amanda Monson
Brandi Peck
Kelsey Jensen
Melinda Kraakmo
Colin Waldera
Karly Ailport
Amber Tikalsky
Josh Becker
Kelley Amsbaugh
Macy Martinson
Noelle Dickinson
Amanda Knoke
Andy Li
Amy Gohman
Brandy Moen
Britany Snodgrass
Joshua Hedstrom
Deanna Wuster
Kelsey Jensen
Amy Gohman
Brandy Moen
Britany Snodgrass
Joshua Hedstrom
Deanna Wuster
Melinda Kraakmo

United Tribes Technical College

Amy Jackson
Kimberlee Blevins

Fort Berthold Community College

Connie Green
Mike Deville
Nicole Wells
Britt Bruce
Felicia Dickens
Eugenia Kirk
Cedar D. Bull
Ashley Hall

North Dakota State College of Science

Daniel Tuckett
Josh Stuehnenberg
Krista Erdahl
Austin Schultz
Benjamin Isaacson
Michael Schmitt
Trevor Bresin
Darcy Jilek
Brandon Laddusaw
Jonathan Schiltz

Turtle Mountain Community College

Dara Jerome
Denver Larocque
Winter Monette
RaeAnna Cromwell
Tanner Vandal
Charles Fox
Chad Charette
Steven Belgarde
Tiffany Belgarde
Bruce Nadeau
Cole Frederick
Kayana Trottier
Shey Grant
Theresa Wilkie
Brooke DeCoteau
Heather Bruce
Tiray Azure
Charles Larocque
Stephanie Hunt
Madison Keplin
Chelsea Unger
Darrin Frederick
Curtis Lenoir
Jill Davis
Mandy Indvik
Gordon Chapman
Craig Hall
Jotannah Davis
Tad Vandal
Alberta Short
Jeffrey Baker

Mayville State University

Cherokee Durant
Jacob Eaton
Riley Francis
Karissa Hanson
Selena Hobbs
Elizabeth Hoglo
Maren Johnson
Sam Johnson
Katie Kolness
Paul Koppinger
Richard Kusisto
Brooklyn Miller
Carissa Nelson
Hannah Ness
Eric Ricard
Marcus Tucker
Cassandra Ziemer

NDSGC Scholarships



Integration Scholarship at Lake Region State College

This scholarship is given to a student who completes research as a lab assistant in a STEM field while exceling academically at LRSC. This is the 5th year the Integration Scholarship has been awarded.

Carl Kolbo
Lake Region
State College



Lillian Goettler Scholarship



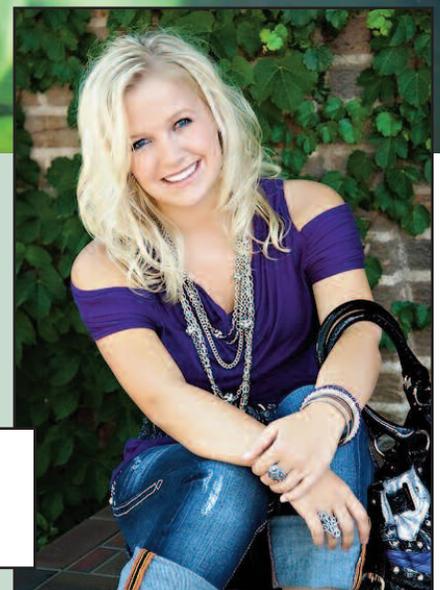
Mindy Ludlum
Mechanical Engineering
North Dakota State University

Mindy Ludlum graduated in the fall of 2014 with a B.S. in Mechanical Engineering from NDSU. She is considering pursuing a Master of Science degree in Biomedical Engineering. Having been admitted with distinction into the scholar's program on campus, she will be the first person in her immediate family to graduate from a four-year university and anticipates maintaining the high level of honor suitable to the distinction placed on her after she received a National Merit Scholarship and was accepted into the National Society for Collegiate Scholars. Thus far, she has made Dean's List all semesters in attendance and was also awarded with a research assistantship with the NDSU Mechanical Engineering Department.

Pearl I. Young Scholarship

Haylee is a junior at the University of North Dakota. She grew up in Finley, North Dakota and graduated high school as valedictorian of the Finley-Sharon Class of 2012. Haylee is majoring in Physics with an emphasis in Astrophysics. She is a member of the North American Astronomical Society and has recently been selected to participate in the 2014-2015 ND EPSCoR Advanced Undergraduate Research Awards program. Haylee currently works with Dr. Wayne Barkhouse of the University of North Dakota's Department of Physics and Astrophysics researching dwarf galaxy alignment in nearby Abell galaxy clusters.

Haylee Archer
Physics
University of North Dakota





Research Fellowships

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



Michelle Decker
Measurements of Light Pollution in the South Unit of Theodore Roosevelt National Park
Dickinson State University



Chloe Ondracek
Inverse Problem for Projectiles
Minot State University

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



Monica Hilton
Development of Soil after 60 Years at the Unreclaimed Custer Mine in McLean County, North Dakota
Dickinson State University

Research Fellowships

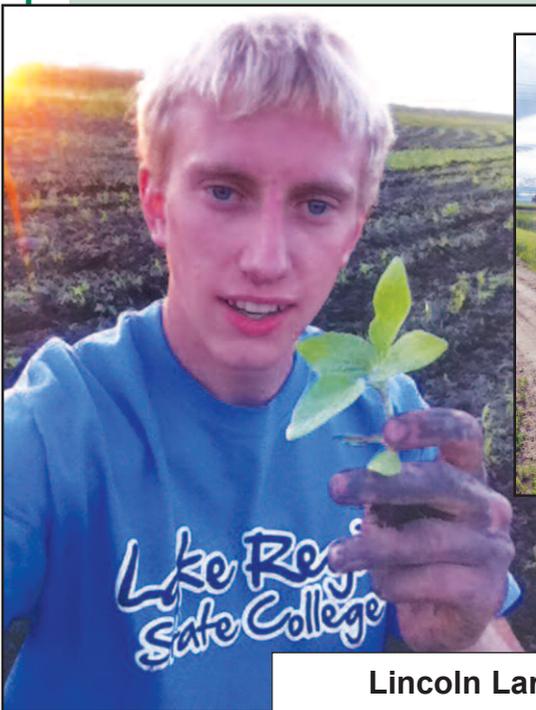


Chris Follette

Robotics Intern

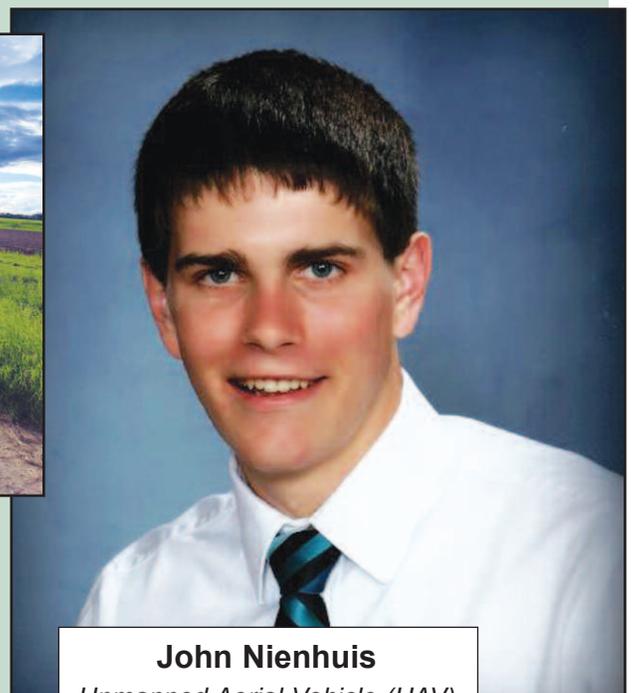
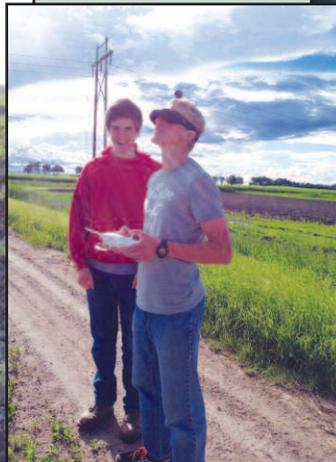
University of North Dakota

“Working at Honeybee Robotics this summer showed me what it takes to be an engineer working with spacecraft and planetary mechanisms on a daily basis. The drive, passion, and technical prowess all of the engineers showed on a daily basis is something I’ll strive to achieve every day. Thank you North Dakota Space Grant Consortium for providing funding which allowed this incredible experience to happen!”



Lincoln Larson

*Unmanned Aerial Vehicle (UAV)
Uses in Agriculture*
Lake Region State College



John Nienhuis

*Unmanned Aerial Vehicle (UAV)
Uses in Agriculture*
Lake Region State College



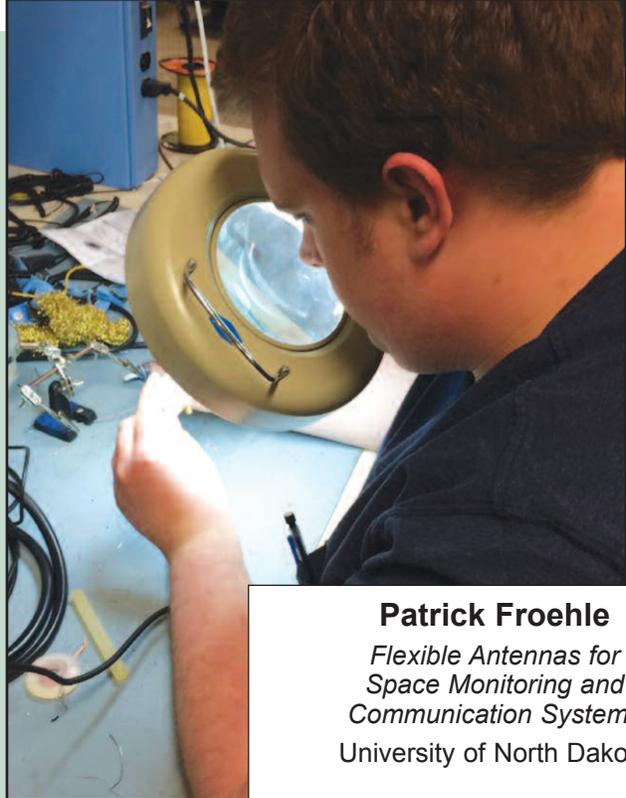
Research Fellowships



Keith (right) with astronaut Doug Hurley.

Keith Crisman

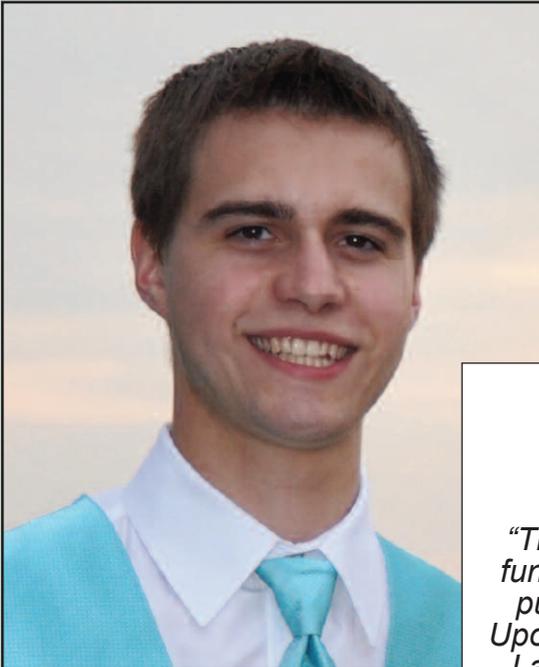
Inventory of Personality, Anxiety, and Depression on Lunar/Mars Habitat simulation participants
University of North Dakota



Patrick Froehle

Flexible Antennas for Space Monitoring and Communication Systems
University of North Dakota

“This fellowship research experience has advanced my fundamental knowledge of antenna engineering, in application to the aerospace field. This knowledge is the foundation to my goal of starting my electrical engineering career as an RF communications engineer in an aerospace related industry.”



Tyler Przybylski

Wireless Body Area Network Hardware Systems
University of North Dakota

“This opportunity provided by Dr. Fazel-Rezai and funded by the NDSGC has allowed me to continue pursuing my interests in deep space exploration. Upon graduation I will be working full time for United Launch Alliance, a NASA contractor who recently launched the test flight of the Orion Capsule, and continuing my education by pursuing my Masters of Electrical Engineering.”

Research Fellowships



Even at age seven, Tyler had a passion for space.



Tyler Hill

Development of a Prototype Movement Assistance System for Extravehicular Activity Gloves

University of North Dakota

"The funding from Space Grant has allowed me to stay at the University of North Dakota and complete my research which will provide an excellent starting point for my career in the space industry. I want to work toward a future where travel into space is a regular occurrence and developing technologies such as this that increase a person's utility in the space environment will help facilitate that."



Lucas Lindholm

Advanced Methods of Cooling of Internal Gas Turbines

Dakota College at Bottineau



Chris Follette

Preliminary Study of Components to Create MACHO (MArs Compliment to Humanity rOver) 2.0

University of North Dakota



Public Outreach Events

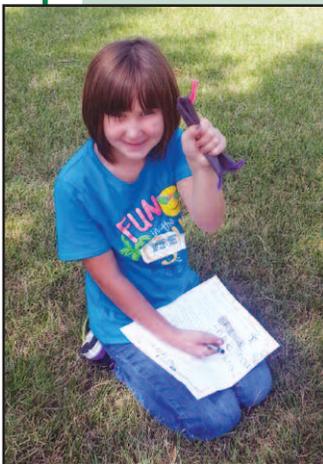
Tours of Space Labs

As the Spacecraft Simulators, Space Suit Labs, Electric Rover, and Inflatable Habitat are all a part of the Human Spaceflight Laboratory at UND and supported in part by the NDSGC, it is important that these research ventures remain visible to the public. Tours for school children on field trips, summer camps, prospective college students, the general public, and even local legislative staff are regularly scheduled events. This past year included special tours for ND retired teachers, *Nurturing American Tribal Undergraduate Research and Education* (NATURE) students, Girl Scouts, and members of the Canadian Space Society.



Space Camps at UND and Bismarck

In July and August of 2014, day camps with a focus on space and the engineering design process were conducted. The two sessions at UND were a part of the Young Scientists and Engineers Academy for students grades 2-8. The camps included tours of the Aerospace facilities, an interactive conversation with Johnson Space Center in Houston, TX on the Moon and radiation in space through NASA's Digital Learning Network, and a hands-on activity. The students designed "UV people" to test out the effectiveness of different materials in protecting their astronauts from radiation. Another camp was conducted at Centennial Elementary in Bismarck, ND where 3rd graders learned about solar system scale distances and sizes. Roughly 110 students were reached through these camps.



A 3rd grader shows off her "UV-astronaut."



Future engineers command the vertical take-off simulator at UND.

Classroom Visits

Throughout the school year, the NDSGC coordinator makes visits to classrooms statewide and conducts hands-on activities with students grades K-12. In 2014, this included visits to Grand Forks, East Grand Forks, Fargo, West Fargo, Kindred, Valley City, Bismarck, and Minot with topics ranging from black holes with calculus students to space suit design at elementary levels and even a Skype call with 7th graders in New Mexico to talk about careers in space sciences. Visits through *Junior Achievement* allowed for continued visits with the same 2nd grade classroom in the spring of 2014, combining economics with space lessons. Nearly 400 students were reached through these efforts. The expansion of these efforts is due to increased awareness of Space Grant through sessions conducted at the North Dakota Science Teachers Meeting and the Keynote Presentation given at the North Dakota Council of Teachers of Mathematics Meeting in early spring 2014. This has led to a significant increase in participation of ND K-12 teachers throughout the state in many Space Grant programs as well.

Public Outreach Events



Community-Organized Events

As a part of the Fargo Public Library Summer Reading Program, the NDSGC led multiple hands-on sessions with elementary and middle school students on robotics and mission design in discovering new planets while learning about NASA's Kepler Mission. Similar activities were also conducted at Grafton's Marketplace for kids in the spring of 2014. In partnership with the Dakota Science Center, the NDSGC organized a number of Lunar Activities for elementary-age students in East Grand Forks in March 2014. The NDSGC also judges local science fairs for middle school students. Roughly 275 students participated in these events.



Students make observations of "planets."



Students investigate major events that occurred over the Moon's lifetime.



Students create robot hands.



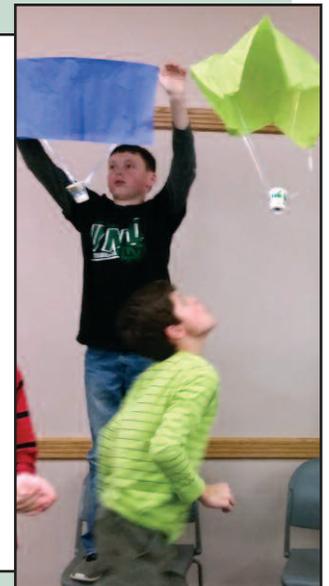
Students practice demonstrating lunar phases with a 3D model.



These included many Orion-centered activities, and a favorite of the kids was the "Design and test your own Orion capsule," an activity created by NASA. Dr. Brevik and her students also ran planetarium shows throughout the event. Dickinson State University conducts these events once a month, and the space-themed December event attracted roughly 125 people.

Dickinson Family Science Day

To celebrate the Exploration Flight Test of NASA's Orion Space Capsule on December 7, 2014, an event open to the public was held at Dickinson State University the following Saturday. Led by Dr. Corinne Brevik, the NDSGC, DSU faculty, and DSU and UND student volunteers conducted many hands-on activities for K-12 students and their families.





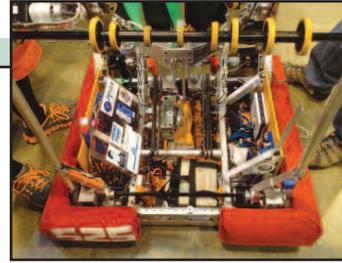
K-12 Programs



Northstar Public School team member mentors elementary student in engineering.



Thunder Robotics Team.



West Fargo Team Robot.

FIRST Robotics

In 2014, the NDSGC supported three high school teams to compete in the *For Inspiration and Recognition of Science and Technology* (FIRST) Robotics Competition. Lisa Ramey is the faculty mentor from Northstar Public School in Cando, Mike Voglewede is the Northwood/Hatton High School Team Thunder Robotics mentor, and Brent Nasset is the faculty mentor for West Fargo High School, Team Taurus Robotics. This competition gives students hands-on experience in the engineering design process, and involves countless community volunteers as well. Aside from designing, building, and testing a robot, students from all teams also worked on STEM outreach initiatives throughout the school year. WFHS student Rit Bezbaruah was chosen as a Dean's List Finalist at the Duluth, MN Regional Competition and the NDSGC supported his travel to nationals. Congratulations to all teams on a successful season!

Schroeder Middle School "Mega Launch"

During the spring semester 2014, UND Space Studies graduate students worked with 8th graders at Schroeder Middle School in Grand Forks, ND to help teams design and build payloads for a grade-wide high altitude balloon launch that took place in May. This was the second time the NDSGC supported the participation of an entire 8th grade class in high altitude ballooning. Experiments ranged from monitoring

high altitude weather patterns to testing the ability of plant sprouts to survive the harsh conditions in the upper atmosphere. The goal of these projects is to inspire students in STEM through hands-on investigations, and to encourage participation in a NDSGC-sponsored statewide competition in ballooning. Students and teachers alike enjoyed the experience, and one team even competed in the following year's Near-Space Balloon Competition organized by the NDSGC.



Student Spaceflight Experiments Program (SSEP)

In the fall of 2014, the NDSGC supported 250 elementary, middle, and high school students from West Fargo Public Schools to participate in the SSEP in which they designed experiments to be conducted aboard the International Space Station (ISS). This engaging hands-on learning experience excited the students about science and space exploration. Because there was such a range in ages involved, mentorship between grade levels was a large part of the project as well. 7th and 8th graders even had a chance to Skype with NASA engineers. Local volunteer judges evaluated 30 student proposals, selecting one finalist that will test the effects of the microgravity environment on the rusting of iron. This experiment will be launched to the ISS in April 2015.

NSBC 2014



The NDSGC funded the 4th consecutive Near-Space Balloon Competition (NSBC) in the fall of 2014. NSBC involves the design, construction, and flight of scientific payloads by middle and high school student teams from throughout the state. The NDSGC decided to compress the previously year-long event into a semester, as this more intense time frame allowed students to better understand the Project Life Cycle used by NASA. Following proposal submission and design reviews, a total of six teams participated in judging at payload integration and launch, the largest competition yet!



The double-balloon launch took place at the University of North Dakota (UND) campus on November 22, 2014, and payloads were retrieved in NW Minnesota by the teams, mentors, and UND graduate students and faculty volunteers. The balloons

reached an altitude of 90,000 feet in the stratosphere, bringing along payloads that included cameras, various environmental sensors, plants, and bacteria.

Following data analysis and final reports, top selections were made in January 2015. The first place team received a NDSGC-sponsored field trip in North Dakota related to STEM (science, technology, engineering, and mathematics). Other exceptional participants include two teams from Kindred High School and an 8th grade team from Northwood Public School.



The goal of NSBC is to provide K-12 students with opportunities to participate in hands-on activities, inspiring interest in STEM disciplines and careers, as well as encourage the families of the K-12 students to become involved in the process. Students retrieve actual data from their experiments and are able to interpret these into scientific results. This directly contributes to the STEM pipeline, and students that have participated in this program are more likely to continue in STEM disciplines in higher education and STEM careers.

Thank you to all UND volunteers, teachers, students, and their communities, and congratulations to all teams involved!



View a video of three aligned Go-Pro cameras along with altitude and time data put together by Space Studies alumnus Jonathan Schiralli: <http://goo.gl/KPKICU>



View a video by UND's Division of University and Public Affairs on this year's competition here: <http://goo.gl/Ai3oNn>



1st Place: MayPort CG Middle and High School (Team Science Geeks).



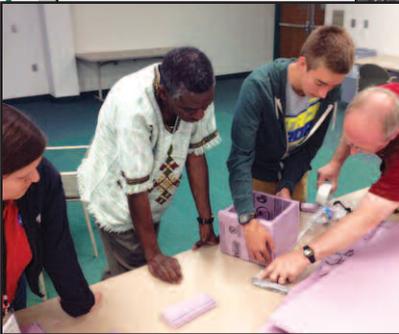
2nd Place: Shiloh Christian School (Team Absolute Zero, *Because There's Nothing Cooler!*).



3rd Place: Red River High School (Team Polaris).



AHAC 2014



James Flaten and Minnesota Space Grant student assist North Dakota Space Grant affiliate Tony Musumba in constructing a payload at the educators workshop.

The University of North Dakota hosted the 5th Annual Academic High Altitude Conference June 23rd-27th. The focus of this national conference is on the

technical aspects, research possibilities, and educational benefits of high altitude ballooning. The first two days included both a technical and educators workshop, followed by conference presentations and discussion sessions the remainder of the week. A high altitude balloon launch took place on Friday morning, launching payloads from both the educators workshop and from the statewide middle and high school ballooning competition, NSBC. Keynote speakers this year included: Matthew Nelson, President and Co-Founder of the Stratospheric Ballooning

Association, Dr. Angela Des Jardins, Director of Montana Space Grant Consortium and Montana NASA EPSCoR, and banquet guest speaker Don Day, Chief Meteorologist for Felix Baumgartner's record breaking high altitude jump.

Participants included college students, teachers, professors, and researchers in the ballooning community from across the US and Canada. The conference was a collaborative effort by the Department of Space Studies at UND, the John D. School of Aerospace Sciences, the North Dakota Space Grant Consortium, and the Stratospheric Ballooning Association. Thank you to all who participated (especially the other Space Grant consortia) and assisted in making this year's conference a success!



Affiliate Involvement



Annual Affiliates Meeting

The 2014 NDSGC Affiliates Meeting was held at the North Dakota Heritage Center in Bismarck, ND in May. Presentations included Space Grant funded student research, team projects, faculty research, and funded STEM education projects from across North Dakota. Following the meeting, the affiliates were able to tour the museum's new galleries, including the hadrosaur fossil, found in ND in 1999. Thank you to Erik Holland and his team for hosting!



Affiliate Visits

The NDSGC made visits to affiliates throughout 2014 to maintain working relationships with these institutions and to see some of the new and exciting facilities at each one. The NDSGC was able to hear about research being done at United Tribes Technical College and tour their classrooms and see GIS equipment used by their students. A visit to the North Dakota Heritage Center in July 2014 led to the creation of a 2015 student fellowship to design K-12 activities to complement new space sciences exhibits at the museum. The NDSGC also toured Fort Berthold Community College, Bismarck State College (and their state-of-the-art National Energy Center of Excellence), and the Gateway to Science Center. Thank you to all affiliates who took the time to meet with the NDSGC!



Governor Jack Dalrymple and first lady Betsy view the NDX-1 space suit on display in the new gallery.

Spacesuit Display at Heritage Center

The NDSGC partnered with the North Dakota Heritage Center in 2013 to fund student construction of the NDX-1 (North Dakota Experimental-1) Mars Prototype Space Suit to be displayed in the new Inspiration Gallery: Yesterday and Today, with a grand opening in November 2014. The exhibit includes looping videos and images of design, construction, and field testing of the space suit as well. The gallery is complete with interactive learning labs so visitors can experience hands-on investigations with each exhibit. Congratulations to the Heritage Center on this innovative expansion!



K-12 Teacher Workshops

SEEC 2014

The NDSGC coordinator attended the 21st Annual Space Exploration Educators Conference at Space Center Houston to participate in hands-on sessions designed for K-12 students. These activities and resources have been presented at various teacher workshops and classroom visits throughout North Dakota in 2014, and the trip proved to be a beneficial networking experience as well.



NDSU students observe distant worlds in "Strange New Planet" activity.

Pre-Service Workshops

The coordinator of the NDSGC traveled around the state to conduct various pre-service teacher workshops. These took place at the University of North Dakota, Valley City State University, North Dakota State University, and Dickinson State University. Education students learned about NASA classroom resources and opportunities for teachers, constructed robot hands, studied space exploration, designed missions to nearby planets, and played board games on space rocks. These workshops allow these future teachers to bring space sciences into the classroom with web resources and hands-on activities.

In-Service Teaching

The NDSGC coordinator served as the keynote speaker at the 2014 NDCTM (North Dakota Council of Teachers of Mathematics Meeting), where she shared opportunities available to K-12 teachers through the North Dakota Space Grant Consortium and NASA, and increased awareness of current NASA projects. Following the presentation, many teachers registered for NDSGC workshops, classroom visits, and the Near-Space Balloon Competition. Caitlin also presented two sessions at the NDSTA (North Dakota Science Teachers Association) Meeting in Valley City, ND where teachers completed Mars-related activities. A day-long in-service workshop was also held at Minot State University in June 2014.



Teachers complete Jupiter's Moons investigation at Minot State University workshop.

NASA in the Classroom Workshop



NASA in the Classroom

The North Dakota Space Grant Consortium hosted an educator workshop March 28-29, 2014 for in-service K-12 teachers in the region. Caitlin Nolby (NDSGC coordinator) and Angela Bartholomay (faculty at Dakota College at Bottineau) led the two-day workshop at the University of North Dakota Campus. The purpose of the workshop was to introduce classroom teachers to new and innovative ways to advance science learning with students through the use of various hands-on activities, NASA content, and astronomy teaching reflecting the Next Generation Science Standards (NGSS). Teachers incorporated these new standards into existing lesson plans while investigating the nature of science and science practices. The workshop also included an interactive tour of the Human Spaceflight Laboratory led by Space Studies graduate students, exploration of meteorites led by Dr. Mike Gaffey of Space Studies, and a planetarium presentation given by Dr. Tim Young of Physics and Astronomy. Credit for a majority of workshop presentations and investigations is given to the Astronomical Society of the Pacific. The NDSGC plans to hold a second iteration of the workshop in 2015, with improvements made to teaching strategies and new activities included.

"Thanks so much for the activity and the resources! We started today, and will continue tomorrow. The activity has been great! It is awesome to see them working together; everyone is engaged, and thinking critically. Not many 'canned' activities are actually ready for the classroom; typically I need to modify it for my room, but this one is working great! I have also shared this with some of our other instructors and at least one is going to start on Monday. He is very excited (he teaches engineering) and this can encourage interest in space AND engineering! AWESOME! Thanks again!"

– Mike McHugh, Workshop Participant





UND Human Spaceflight Laboratory

October 7, 2014 marked day one of the University of North Dakota's 30-day mission inside the Lunar/Mars Analog Habitat (LMAH). The initial mission took place in the fall of 2013; three graduate students from UND participated as "astronauts" in a 10-day mission focused on testing of the integrated components: the space suits, pressurized electric rover (PER), the docking tunnel, and the inflatable lunar habitat (ILH). This opened the door for the 2014 30-day mission with three Space Studies graduate students making up the crew. This included Tyler Hill (Mission Engineer), Tim Buli (Science Officer), and Jonathan Schiralli (Mission Specialist). Other graduate students performed the duties of Mission Control throughout the month as well.

Research projects conducted during the mission included microbial sampling in partnership with NASA's Jet Propulsion Laboratory, horticulture studies and waste production (food growth and sustainable living in a closed environment), geologic mapping of the surrounding area through both extra-vehicular

activity and the remotely operated MARS Compliment to Humanity rOver (MACHO), psychological studies, and physiological studies. The key objective of the mission was to confirm that the facility was capable of supporting a month-long mission. Much of the research conducted also provided data for master's theses at UND.

During the mission, the crew also participated in education and public outreach events, like Skype calls with K-12 classrooms. Congratulations to the crew, Dr. Pablo de León, and all UND students involved on mission success. You can read about their activities and see more pictures on their blog here: <http://spacesuit-lab.blogspot.com/>

The NDSGC is proud to have been a part of funding this endeavor, which inspires the next generation of scientists, engineers, and explorers, giving them unique, first-hand experience in various aspects of space exploration.

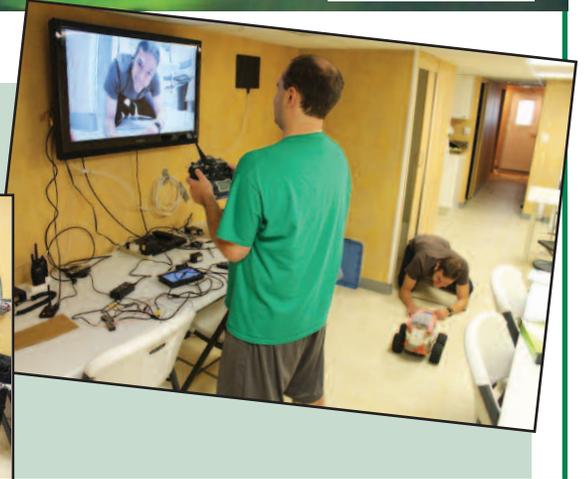
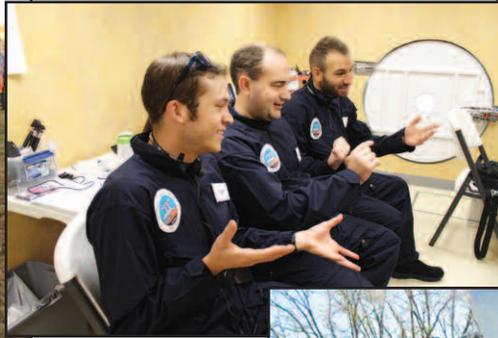
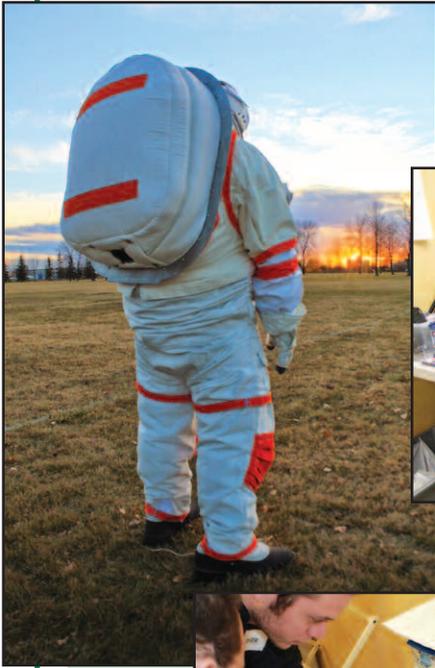


"It was an overwhelmingly positive experience, and coincides with my dream of becoming an astronaut. It was interesting to see how I would cope with being confined with other individuals and how our team dynamic evolved over that period. This was a fantastic opportunity and I am glad that I was lucky enough to be selected for it."

-Tyler Hill, 30-day Mission Crewmember



UND Human Spaceflight Laboratory

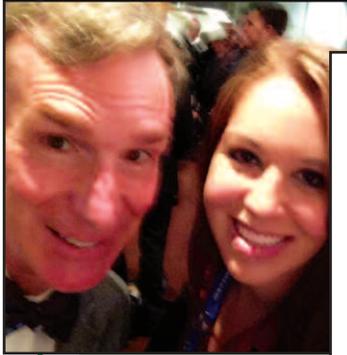


During the 30 day mission, crewmembers received visits from astronauts Karen Nyberg (STS-124 and Exp 36/37) and Doug Hurley (STS-127 and STS-135).





NASA Center Internships



Anne with "Bill Nye the Science Guy"

Anne Longlet

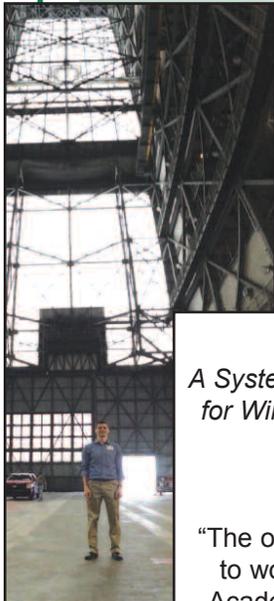
*Laboratory Calibration
State of the Art Non-Tactile
Electronic Contamination
Removal
Goddard Space
Flight Center*

"During the summer of 2014, I had the opportunity to work for NASA GSFC and got the chance to do hands on research with highly experienced scientists and engineers. Without the help of North Dakota Space Grant, I may not have had such a high level learning experience in applied sciences and such a wonderful summer!"

Lindsay Anderson

*Using Weather Radar Data
to Detect Meteorite Falls
and Calculate Strewn
Fields
Johnson Space Center*

"My Space Grant funded internship gave me a unique opportunity to explore a different research area and work with fantastic people at a NASA center."



Jordan Senff

*A System to Redirect Solar Energy
for Wireless Power Transmission
Marshall Space
Flight Center*

"The opportunity I had being able to work with NASA's Robotics Academy has made me a more technically skilled engineer. In addition, I gained valuable experience in robotics, the field in which I intend to pursue, while working on a NASA prototype project with a team of engineers."

Kendell LaRoche

*Electrification and Lightning
within Pyrocumulus Clouds
Marshall Space
Flight Center*

"This internship allowed me to partake in active research and experience what it is like working in a research setting. I am better informed about the possible career opportunities and skills necessary for different research positions. During my internship I was also able to enhance my scientific, writing, and computer programming experience."

Tim Buli

*Technology Transfer Office
Practices
Johnson Space Center*

"The level of work that I had the privilege of completing at NASA far exceeded my expectations and provided me with a new perspective on government work and a set of skills that will benefit me down whatever pathways my career may take me."



Summer Faculty Fellowships

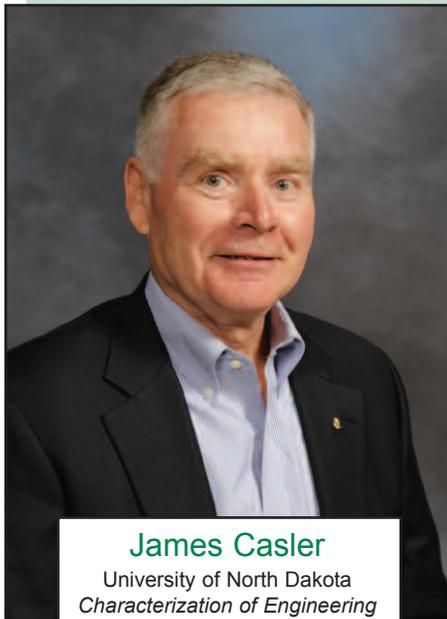


The North Dakota Space Grant Consortium provides summer faculty fellowships so that the teaching of science, technology, engineering and mathematics can be enhanced at North Dakota colleges and universities. New courses can be developed or existing courses can be upgraded to include more space science material. Faculty can also complete NASA relevant research in a STEM field. Faculty at all of Space Grant's affiliate institution of higher education are eligible to apply for these fellowships.



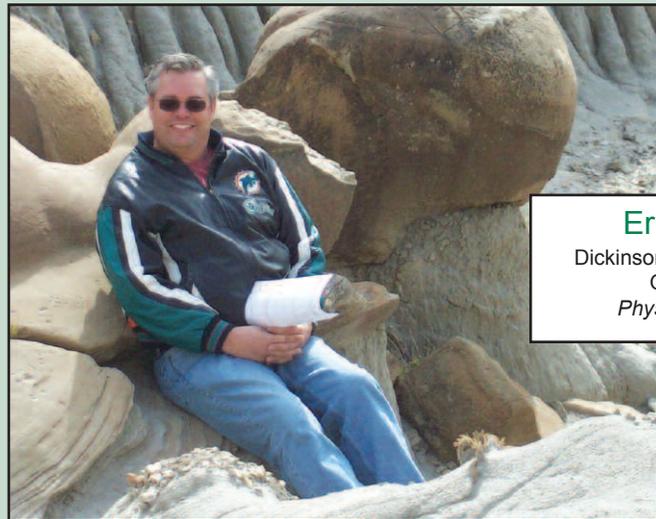
Margaret Brady

North Dakota State College
of Science, BIOL 170
General Zoology



James Casler

University of North Dakota
*Characterization of Engineering
Management in Small New
Space Firms*



Eric Brevik

Dickinson State University,
GEOL 105
Physical Geology

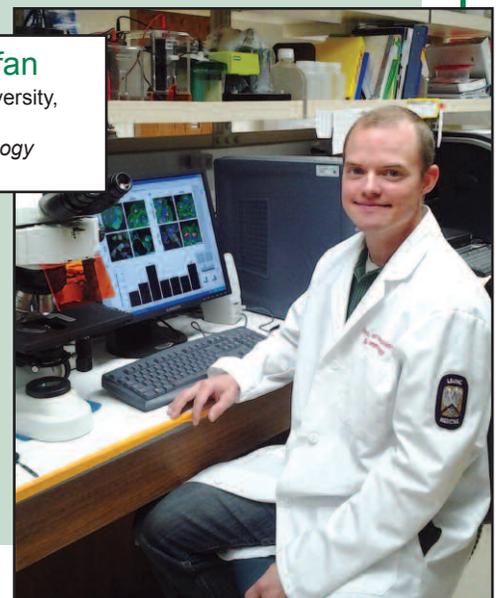


Shaun Prince

Lake Region State College
*Unmanned Aerial Vehicle (UAV)
Uses in Agriculture*

Joshua Steffan

Dickinson State University,
BIOL 305
General Microbiology





Research Project Highlight



Borchardt takes a "space selfie."

Mars Desert Research Station

The NDSGC supported Space Studies graduate student Josh Borchardt with research funding during his two week mission as a member of Crew 141 in the Mars Desert Research Station (MDRS) in the spring of 2014. Borchardt's primary objectives were to complete a Mars simulant plant growth study to compare with the results of his master's thesis, and to test MACHO, a complimentary rover to manned planetary missions. The aim of the plant growth study was to test a new hypothesis on the limit of nutrient availability and the level of soil formation required for sufficient crop growth on an early Mars settlement (using in situ resources). MACHO was then tested for its capability as a rapid science platform in a small package, habitat integrity reconnaissance, and secondary means for communication. You can read the crew's blog here:

<http://mdrs141.weebly.com/>



Through plant studies, it was revealed that hardy plants, even wetland plants, were able to survive and produce edible biomass on the "Martian" surface.

Student Travel Grants



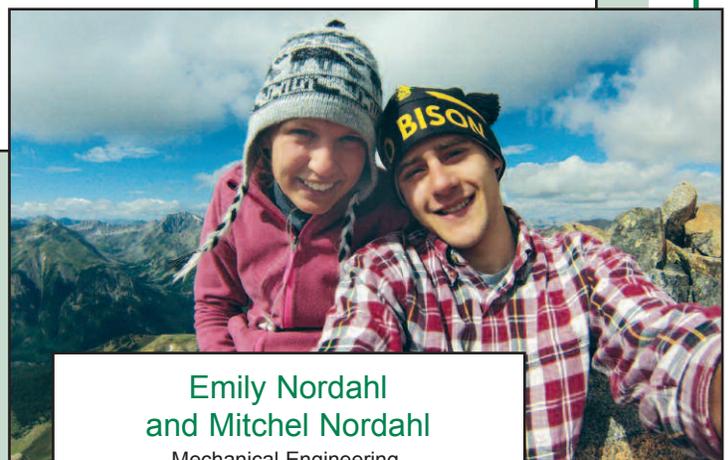
The NDSGC provides travel grants to North Dakota students to present papers or posters at conferences throughout the U.S., as well as conduct research at NASA centers. Many of the research projects presented have been funded by Space Grant. The students have the ability to not only share their research 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.

To increase awareness of Space Grant opportunities such as these, as well as internships, fellowships, and scholarship funding, the NDSGC participated in the University of North Dakota Career Fair in October 2014, attended by more than 200 students pursuing a STEM degree. Plans are to expand this practice to other campuses across the state in 2015.



Matt Zimmer

Space Studies, University of North Dakota
Lunar and Planetary Science Conference
*Precision Control of Autonomous Spacecraft
During Close-Proximity NEO Operations
Using Control Methodologies*



**Emily Nordahl
and Mitchel Nordahl**

Mechanical Engineering,
North Dakota State University
2014 Western Region Space Grant Meeting
*AIAA Design, Build, Fly at
North Dakota State University*



**Tiffany Swarmer
and Lindsay Anderson**

Space Studies, University of North Dakota
NASA Ames Research Center
*Testing of DL/H-1 Intravehicular
Activity Suit in 20g Centrifuge*



Tim Buli

Space Studies, University of North Dakota
International Mars Society Convention
*NASA Technologies for Your
Mars-Related Projects*



Meet an Affiliate



Tony Musumba
Bismarck State College

Tony Musumba has been employed at Bismarck State College for seven years. He received his B.S. in Physics (1995) and Masters in Physics (2001) in Kenya and got his Ph.D. in Physics from the University of Texas at Dallas in 2008. Dr. Musumba is currently an Assistant Professor of Physics at BSC.

He is actively involved both locally and nationally with the American Association of Physics Teachers (AAPT). At the local level, he serves as Section Representative and Vice-President of North Dakota AAPT. Nationally, he is on the AAPT Committee on Diversity and is active in the Two Year College Committee.

For the last five years Tony's students have created end of semester projects involving video analysis of sports, racing, running, and other fast motion activities. Tony enjoys working with his physics colleagues in developing activities for physics students at the introductory level. He is currently involved in Lab writing workshops with a National Science Foundation funded project with Tom O'kuma of Lee College in Baytown, TX and Dwain Desbien at Estrella Mountain Community College in Avondale, AZ.

Tony has enjoyed involvement in the North Dakota Space Grant meetings where he is able to connect with other affiliates and collaborate on projects. One of Tony's highlights during the summer of 2014 was attending the Academic High Altitude Conference at UND, fully sponsored by the NDSGC, where he also participated in the educators workshop, hoping to start a high altitude ballooning program at BSC in the future. Tony has been an active member of Space Grant since 2008 and he is a one of a kind educator, truly passionate about inspiring the next generation of scientists.

Tony is married to Alice who works at the State Health Department and they have one daughter, Dora and a son, Terry.



Jack Science Center, Bismarck State College. Photo courtesy of bismancafe.com

Student Success Story - *Brian Badders*



Brian Badders

Brian Badders holds B.S. degrees in Aerospace Engineering and Mechanical Engineering from Case Western Reserve University in Cleveland, OH, and a M.S. in Space Studies from the University of North Dakota. His leadership qualities and expertise as a graduate student made him an invaluable asset to the Space Grant program.

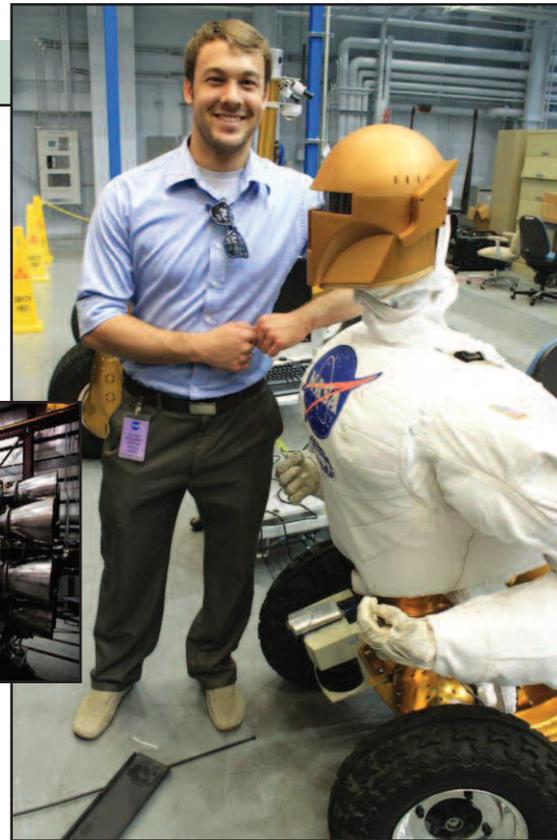
While a student at UND, Badders was involved in many Space Grant activities. He was the lead engineer of the Frozen Fury Rocket Team at UND, which launched high power rockets in NASA's Student Launch competition. He supported the mechanical design of an ozone sensor array payload to fly on NASA's High Altitude Student Platform (HASP) flight and was an integral part of the success of the Near-Space Balloon Competition (NSBC), providing aerospace expertise to K-12 teams from throughout the state. Badders worked as a Graduate Research Assistant for the Dakota-Alpha CubeSat program on the initial design of UND's first satellite and also characterized requirements for analog testing of Portable Life Support Systems used in the university's Human Spaceflight Laboratory. As President of the Dakota Space Society, the UND Chapter of the Students for the Exploration and Development of Space, Badders encouraged fellow students to get involved in space science and engineering whenever possible.

In the summer of 2013, Badders graduated from the NASA Ames Academy for Space Exploration, NASA's premiere leadership training program. He worked with a team of international scientists and engineers from 6 different countries on the development of a universal bioreactor platform capable of advanced testing of biological samples on the International Space Station.

Badders is a very determined and hard-working individual, and it is no surprise to the NDSGC that he landed a position as Vehicle Control Engineer at SpaceX in 2013. He is one of just a handful of Vehicle Control engineers in the Cape



Falcon 9 Rocket with Landing Legs installed at the SpaceX Hangar at Launch Complex 40 in Cape Canaveral.



Canaveral Mission and Launch Operations group. Vehicle Controllers are responsible for every command sent to the Falcon 9 rocket from initial avionics and propulsion checkouts, to initiating terminal count auto-sequences on launch day.

While at SpaceX, Brian has already worked to successfully launch six Falcon 9 rockets carrying payloads to space. He works directly with customers and satellite manufacturers on integrating their spacecraft with the Falcon 9 rocket and supports sending SpaceX's Dragon Capsule to the International Space Station for cargo resupply missions.

He has become the Responsible Engineer at Cape Canaveral for the Falcon Support System – and is currently building up SpaceX EGSE alongside that of NASA's Apollo and Space Shuttle programs at the historic Launch Pad 39A to support future launches of SpaceX's new heavy lift rocket, the Falcon Heavy. Brian says that his vast experiences as a Space Grant student have helped him become involved in these and several other exciting projects at SpaceX. This is just the start of Brian's journey as a STEM professional, and we wish him luck in the rest of his career!



**BISMARCK
STATE COLLEGE**

**Bismarck
State College**



**Cankdeska Cikana
Community College**



**Dakota College
at Bottineau**



**DICKINSON
STATE UNIVERSITY**

**Dickinson
State University**



**Fort Berthold
Community 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**



**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**