The 2017 Near-Space Balloon Competition Handbook

The North Dakota Space Grant Consortium is proud to host a student launch competition for middle and high schools in North Dakota, offering the opportunity for students to design and conduct a real space mission, combining hands-on STEM education with a real-world, inquiry-based, and NASA-relevant research project.

Welcome to this year's Near-Space Balloon Competition (NSBC)! We thank you for taking the time and initiative to become the NSBC advisor and role model for your students. Because of you, the middle and high school students in your classroom have the opportunity to apply their formal education towards a real-world scientific mission. How many out-of-school projects can say they've reached the edge of space? Students will see the blue sky transform into darkness and view Earth from an entirely new and awe- inspiring vantage point, giving special significance to the experiments they created. Promoting passion for science, technology, engineering, and math (STEM) is the goal of science educators, and we are thrilled to partner with you to help achieve this goal and inspire future generations.

NSBC is a unique launch program that allows students to become real scientists: they design their own experiments, conduct an actual space mission, and pursue scientific solutions to real problems. Numerous scientific investigations can be conducted by experiments onboard a high altitude balloon, no matter if the student design teams are comprised of 6th graders or 12th graders. The experiments designed will fly to approximately 100,000 feet above sea level- above 99% of Earth's atmosphere! After liftoff, students will monitor the location of the balloon throughout its entire flight. Using the same tracking systems as the UND graduate student chase team, NSBC participants will have the opportunity to track and chase the balloon, finding and recovering their payloads after they land. Following the flight, students will recover the data from their payloads and complete final analyses. Their final reports will reveal their conclusions and lessons learned, making them real space scientists!

We at the North Dakota Space Grant Consortium (NDSGC) and the University of North Dakota (UND) love inspiring the next generation with space science, especially through unique programs like NSBC. Ballooning offers such a rare learning opportunity and we are excited to work with you and your students to see what scientific discoveries they come up with this year!

Sincerely,

The ND Space Grant Team,

Marissa Saad

NSBC Manager

NSBC Flight Director

NDSGC Coordinator

Caitlin Nolby

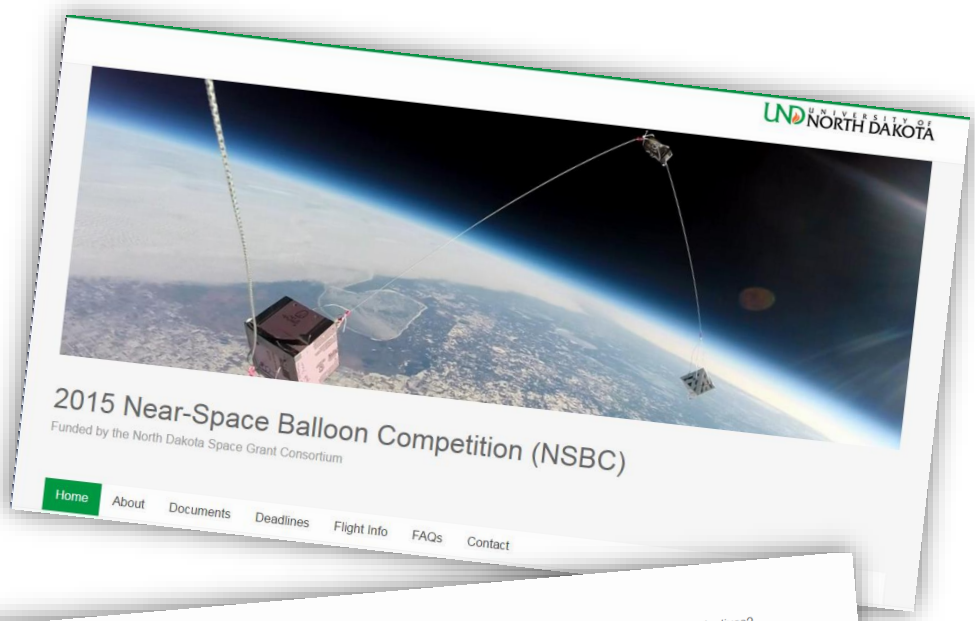
NSBC Manager

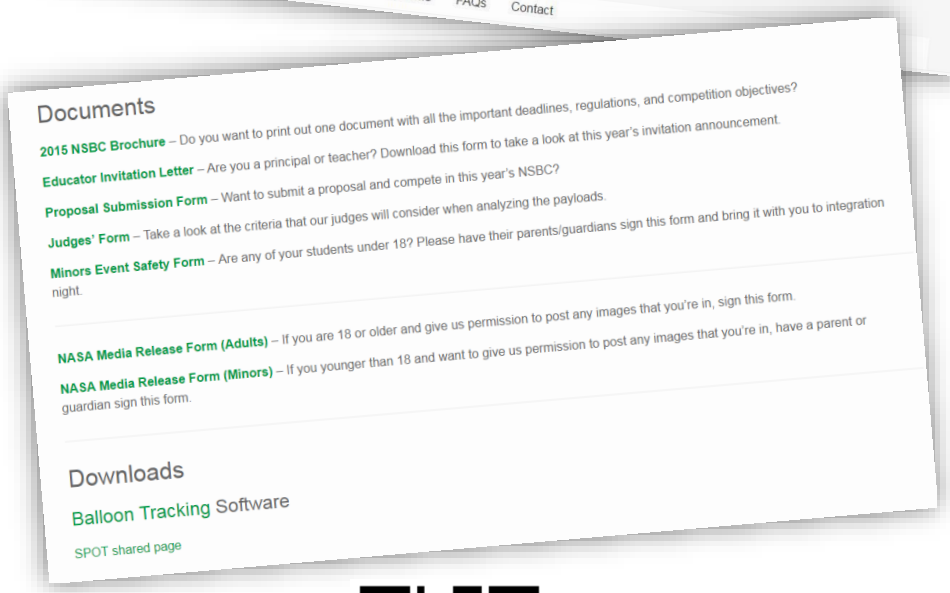
NDSGC Deputy Director

The Near-Space Balloon Competition can be found at:

blogs.und.edu/nsbc

Visit this site for schedule updates, submission forms, downloads, videos, images, and other material!





Everything you need throughout the competition can be found here!

NSBC Website

Introduction

Since 1990, the **North Dakota Space Grant Consortium (NDSGC)** has been the premier NASA higher education program in the state by supporting diverse and effective programs that aim to establish a robust and evolving NASA infrastructure. These efforts have led to a variety of K-12 programs, such as high altitude ballooning competitions. NDSGC also bestows great avenues to involve females and underrepresented minorities in our NASA activities, as well as contributing to the STEM and technical workforce.

NDSGC Director: **Dr. Jim Casler,** casler@space.edu

NDSGC Deputy Director: **Caitlin Nolby**, cnolby@space.edu

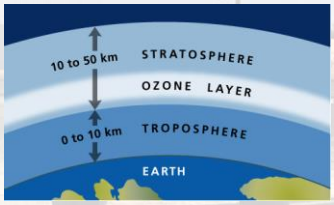
NDSGC Coordinator: **Marissa Saad**, msaad@space.edu

The NDSGC established the **Near-Space Balloon Competition (NSBC)** in 2011, inviting middle and high school students from across the state to participate. The NSBC is a wonderful program that offers hands-on experience with teamwork, computer science, engineering, and technology. Students conduct their own space-based, NASA-relevant research onboard a helium-filled high altitude balloon. The experiments will ascend to nearly 19 miles, or 100,000 feet, above sea level.

Multidisciplinary subject matter, taken directly from your classroom textbook, can be integrated into a balloon launch. A single payload can study multiple subjects at the same time – a true innovative STEM platform. Are your students studying about the layers of the atmosphere? *Travel through them!* Are they learning about thermodynamics? *Experience it!*

Every student and educator from across North Dakota is encouraged to venture into the skies with us. The imagery received from near-space and the lessons learned will be so rewarding that you will want to share your experiences with colleagues, family, and friends.

High Altitude Balloons, or Near-Space Balloons, are large weather balloons that carry scientific payloads up to the edge of space. Balloons are a fun and versatile platform for transporting experiments, sensors, and cameras high into our atmosphere. Since they are low cost, eco-friendly, and easy to operate, they are ideal for small teams looking to design and conduct their own space missions from start to finish- whether the teams are middle school students or NASA scientists. For NSBC, the North Dakota Space Grant Consortium (NDSGC) uses 1500-gram latex balloons filled with helium. Parachutes are secured to the bottom of these balloons, with the experiments housed in payload boxes suspended beneath. The experiments will ascend to nearly 100,000 feet (31km), or about 19 miles above sea level. The balloon will climb above 99% of Earth's atmosphere; onboard cameras capture and return images of breathtaking sights. As the balloon ascends through the atmosphere, the outside pressure drops, causing the balloon to expand until it ultimately bursts when it reaches the edge of the atmosphere- this location is known as the near space environment. Upon bursting, the parachute opens up and the payloads float safely back to Earth.



http://goo.gl/35ISe1

During flights, high altitude balloons travel through two atmospheric layers- the troposphere and the stratosphere (as well as the transitional tropopause layer between the two). This unique vantage point allows students to investigate a wide variety of features and phenomena, like the temperature profile of the atmosphere, where temperature drops though the troposphere, remains constant within the tropopause, and increases in the stratosphere. Students could study properties of the ozone layer, which is located in the stratosphere. The high altitudes reached by our balloons could also allow students to design experiments based on remote sensing, a way of measuring the Earth from a distance that cannot be reached by traditional aircraft. There is a great deal of potential for creativity in NSBC experiments, since the edge of space that we reach is not only too high for traditional aircraft, but is also too low for satellites.

The entire balloon flight lasts about two hours- one and a half hours for ascent, and a half hour for descent. Depending on how many payloads are on board, we fill the balloons so they ascend at approximately 1000 feet per minute, descend at approximately 3000 feet per minute, and travel about 60 nautical miles radially (usually due East). In order to keep pilots, passengers, and people on the ground safe, the Federal Aviation Association (FAA) has created a set of regulations to govern balloon launch procedures. Before launching, a Notice to Airmen (NOTAM) must be filed with the closest airport. Launches may only be conducted when the cloud cover is less than 50%, ensuring that pilots will be able to see the balloon. Various other regulations determine payload size, launch location, etc., and can be found in the Federal Aviation Regulations (FAR) part 101. NDSGC always follows applicable rules and regulations to ensure that safety is achieved.

In order to keep pilots safe, the Federal Aviation Association (FAA) governs balloon launches. The NDSGC files Notices to Airmen (NOTAMs) with the nearby airport (Grand Forks International irport) and complies with all rules and regulations found in the FAA Regulations (FAR) 101.

The Sky's the Limit!

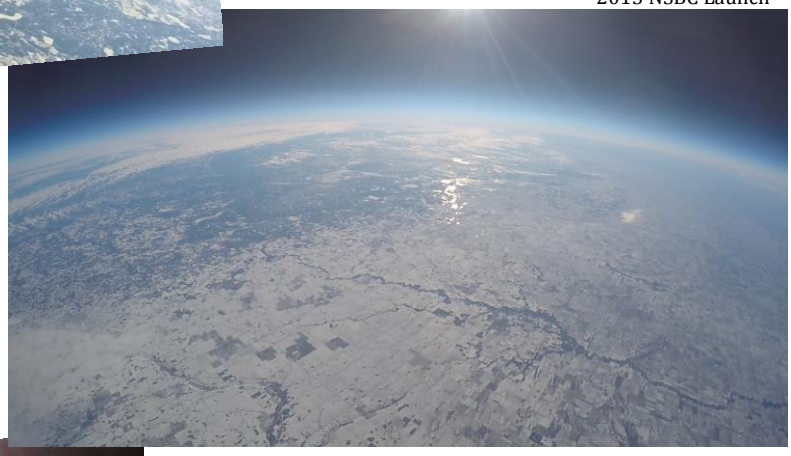
We ascend approximately **19 miles (100,000 feet)** above sea level!

2013 Valley Middle School Launch

NSBC Spring 2015

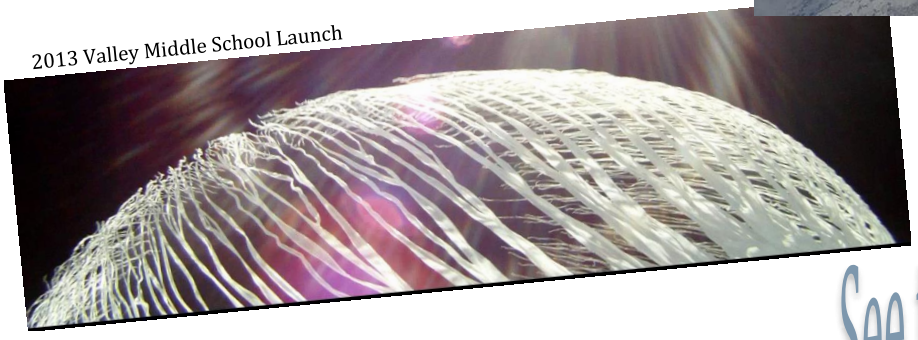
Up here, there's only **1/100th** of the pressure found at sea level – that means you're above **99%** of the atmosphere!

2015 NSBC Launch



The blue sky disappears, revealing the dark void of space!

2013 Valley Middle School Launch



See the bursting of the balloon!

The Next-Generation Science Standards (NGSS) are the future educational standards for K-12 students in the United States. Critical thinking, communication skills, and hands-on learning will be emphasized. Students will participate in activities that provide crosscutting concepts, inquiry-based investigations, and the engineering design process.

Balloon launches provide an educational platform that incorporates the NGSS entirely. A group of students, collaborating together, could study a myriad of subjects with just one payload. This launch can easily be integrated into the pre-existing curriculum, reinforcing the in-class subject material.

The NSBC "relates to the interests and life experience of students" (NGSS Lead States. 2013. *Next Generation Science Standards: For States, By State*s). With hard work and effort, students will answer their scientific questions using their own creative methods. Whether they are launching their own camera or custom-built Arduino circuit boards, they will be proud of their results.

2013 Eighth Grade Valley Middle School Launch

2015 NSBC Integration Night; Kindred team (left), Shiloh Christian (right)

2014, Content Standards. ND.gov, https://www.nd.gov/dpi/uploads/132/NDScienceStandardsDraftFormat2_HSETS.pdf. Accessed Jan 7, 2016
North Dakota Science Content Standards, Draft: April 2014, Released for Public Comment is based on the Next Generation Science Standards*.
*NGSS Lead States. 2013. Next Generation Science Standards: For States, By States. Washington, DC: The National Academies Press.

Science Standards

A high altitude balloon launch conveniently conforms to the majority of the NGSS performance expectations. Also found in the standards, the expectations:

> "[B]lend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain **real world phenomena** in the physical, biological, and earth and space sciences" and "focus on students developing understanding of several scientific practices. These include developing and using models, **planning and conducting investigations**, **analyzing and interpreting data**, using **mathematical** and **computational thinking**, and **constructing explanations**; and to use these practices to demonstrate understanding of the core ideas. Students are also expected to demonstrate understanding of several of engineering practices including **design** and **evaluation**".
>
> (NGSS, 2014)

Engineering Design

The NSBC launch reinforces the middle school engineering standards. It uses multidisciplinary opportunities to help students achieve all expectations. They will define a problem, develop possible solutions, and improve their design (NGSS, 2015). It states:

> "[b]y the end of 8th grade students are expected to achieve all four performance expectations related to a single problem in order to understand the interrelated processes of engineering design"
>
> (NGSS, 2015).

The NSBC uses real life investigations to support these science and engineering requirements. Students are expected to demonstrate an understanding of multiple practices, ideas, and concepts – all deriving from the STEM disciplines. The following highlighted expectations are just a few examples of how an NSBC launch can be integrated into the curriculum:

2014, Content Standards. ND.gov, https://www.nd.gov/dpi/uploads/132/NDScienceStandardsDraftFormat2_HSETS.pdf. Accessed Jan 7, 2016
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Middle School Performance Expectations

Middle School NGSS Physical Science Standards	Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	NSBC Applications
Matter and its Interactions				
MS-PS1-3: "Gather and make sense of information to describe that synthetic materials come from natural resources and impact society."	*Using Models* "Obtaining, evaluating, and communicating information" 	*Properties of Matter* "Each pure substance has characteristic physical and chemical properties"	*Function* "Engineering advances have led to important discoveries in virtually every field of science" "The uses of technologies are driven by societal needs" Students **gather** their own data, **analyze** it, and **share** it in a final report.	Astronauts on the International Space Station (ISS) depend on synthetic materials to survive. When they venture out on extravehicular activities (EVAs), or spacewalks, they depend on the synthetic materials in their space suits to protect them from micro-meteroids, to keep them warm and insulated, and, above all, keep them alive!
MS-PS1-4: "Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed"	*Using Models* "Developing, using, and revising models to describe, test, and predict more abstract phenomena"	*Properties of Matter* "Gases…are made of molecules…that are moving about relative to each other"	*Cause and Effect* "Cause and effect relationships may be used to predict phenomena in natural systems"	Balloons rise to approximately 100,000 feet – almost three times as high as commercial airplanes! With this advantage, students can study the temperature profile of the troposphere AND stratosphere.
MS-PS1-6: "Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes"	*Constructing Explanations and Designing Solutions* "Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets a specific design criteria and constraints"	*Chemical Reactions* "Some reactions release energy, others store energy" *Developing Possible Solutions* "A solution needs to be tested, then modified"	*Energy and Matter* "The transfer of energy can be tracked as energy flows through a designed or natural system"	In the vacuum of space, thermal energy can not transfer. Satellites and spacecraft actually *overheat* instead of freeze, because there is no air to dissapate away the heat that the electonics produce! Students can investigate the properties of exothermic reactions – hand warmers – from an altitude of 100,000 feet!

2014, Content Standards. ND.gov, https://www.nd.gov/dpi/uploads/132/NDScienceStandardsDraftFormat2_HSETS.pdf. Accessed Jan 7, 2016
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Motion and Stability: Forces and Interactions				
Middle School NGSS Physical Science Standards	**Science and Engineering Practices**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**NSBC Applications**
MS-PS2-4: "Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects"	*Engaging in Argument from Evidence* "Construct and present oral and written arguments supported by empirical evidence and scientific reasoning"	*Types of Interactions* "Gravitational forces are always attractive There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass"	*Systems and System Models* "Models can be used to represent systems and their interactions"	Does the balloon have an attractive force, like the Earth? How does something's distance from the sun affect the gravitational force? Launch an accelerometer! Take a look at the descent rate!
*MS-PS2-4: "*Construct and interpret graphical displays of data to describe the relationship of kinetic energy to the mass of an object and to the speed of an object"	*Analyzing and Interpreting Data* "Extending quantitative analysis to investigations"	*Definitions of Energy* "Motion energy is properly called kinetic energy"	*Scale, Proportion, and Quantity* "Proportional relationships among different types of quantities"	KE lesson – ascent vs descent rates, with constant mass. Conduct a lesson on how to use and make graphs based off of NSBC data. Use tables, diagrams, or models. Investigate how speed is a ratio of distance traveled to time taken.
MS-PS3-2: "Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in a system"	*Developing and Using Models* "Develop a model to describe unobservable mechanisms"	*Definitions of Energy* "A system of objects may contain stored (PE) energy, depending on their relative positions"	*System Models* "Models can be used to represent systems and their interactions"	Use ballooning to emphasize relative amounts of gravitational potential energy through its ascent vs descent. Analyze the potential energy of the balloon – why does it pop when it expands? How does altitude affect the potential energy of our balloon? NSBC is similar to a rollar coaster on Earth, but better!
MS-PS3-3: "Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer"	*Constructing Explanations* "Apply scientific ideas to design, construct, and test a design of an	*Conservation of Energy* "Temperature is a measure of the average kinetic energy of particles of matter	*Energy and Matter* "The transfer of energy can be tracked as energy flows through a designed or natural system"	Investigate different materials to see which ones maximize the transfer of thermal energy.

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	object, tool, process, or system”	Energy is spontaneously transferred out of hotter regions and into colder ones”		Test the insulation of your payload (ex. the styrofoam).
Engineering Design				
MS-ETS1-1: “Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions”	*Asking Questions and Defining Problems* “Define a design problem that can be solved through the development of an object, tool, or process”	*Defining and Delimiting Engineering Problems* “The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful”	*Infulence of STEM on Society and the Natural World* “The uses of technologies are driven by…the findings of scientific research”	After creating a hypothesis to a real-life problem and researching it, students can launch a self-designed experiment to near-space.
MS-ETS1-2: “Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem”	*Engaging in Argument from Evidence* “Evaluate competing design solutions based on jointly developed and agreed-upon design criteria”	*Developing Possible Solutions* “There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem”		Students will plan carefully, just like real NASA scientists. Students can research past experiments and revise the designs to improve the object, tool, or process.
MS-ETS1-3: “Analyze data from tests to determine similarities among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success”	*Analyzing and Interpreting Data* “Analyze and interpret data to deterine similarities and differences in findings”	*Developing Possible Solutions* “Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors”		Use data from sensors to analyze and interpret near-space conditions! For example, launch a pressure and temperature sensor, compare the data sets, and determine similarities and differences.

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High School Performance Expectations

Motion and Stability: Forces and Interactions				
High School NGSS Physical Science Standards	**Science and Engineering Practices**	**Disciplinary Core Ideas**	**Crosscutting Concepts**	**Applications**
HS-PS2-2: "Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system"	*Using Math and Computational Thinking* "Use mathematical representations of phenomena to describe explanations"	*Forces and Motion* "If a system interacts with objects outside itself, the total momentum of the system can change"	*Systems and system models* "when investigating a system, the boundaries and initial conditions of the system need to be defined"	Students will create graphs from the NSBC flight data. They will think quantitatively when reporting their results.
HS-PS2-3: "Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision"	*Constructing Explanations and Designing Solutions* "Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects"	*Forces and Motion* "If a system interacts with objects outside itself, the total momentum of the system can change"	*Cause and Effect* "Systems can be designed to cause a desired effect"	Have you ever protected an object after it plummets back to Earth, travelling 3,000 ft/min, from 100,000 feet? Design an enclosure that will protect an egg, a lightbulb, or another fragile object.
Motion and Stability: Forces and Interactions				
HS-PS3-3: "Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy"	*Constructing Explanations and Designing Solutions* "Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge"	*Definitions of Energy* "Energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy"	*Energy and Matter* Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system.	Creative students could design their own device, such as a wind turbine (it gets windy during our ascent!) or a solar panel that will power a device.

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HS-PS4-2: "Evaluate questions about the advantages of using a digital transmission and storage of information"	*Asking Questions and Defining Problems* Evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.	*Wave properties* "Information can be digitized; in this form, it can be stored reliably in computer memory and sent over long distances as a series of wave pulses"	*Stability and change* "Systems can be designed for greater or lesser stability"	Students will track and plot the balloon in real-time, using trajectory data sent by an onboard radio. Is this method always reliable? What happens if clouds interfere, the signal is lost, or our ground station computers fail? What happens if this was a life-or-death scenario, with astronauts relying on our transmissions? Our first-hand experience will allow the students to evaluate digital transmission.
HS-PS4-5: "Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy"	*Obtaining, Evaluating, and Communicating Information* "Communicate technical information in multiple formats"	*Energy in Chemical Processes* "Solar cells are human-made devices that likewise capture the sun's energy and produce electrical energy"	*Cause and Effect* "Systems can be designed to cause a desired effect"	Launch a solar panel and analyze the data! Instead of an in-class experiment, get hands-on at 100,000 feet! Where else can you travel through the ozone layer, testing solar panels above 99% of the atmosphere?
HS-PS4-6: "Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering"	*Constructing Explanations and Designing Solutions* "Design a solution to a complex real-world problem, based on scientific knowledge, and tradeoff considerations"	*Optimizing the Design Solution* "Criteria may need to be broken down into simpler ones that can be approached systematically"		Design a solution to a scientific problem, such as remote sensing for a space exploration mission! Consider designing a rover that needs to analyze its landing site! What would you look for and what would you avoid – rivers, trees, or farms? Another mission could be a seed germination test. After launching tomato seeds, plant them on Earth, and against a control group, see if a near-space trip has any effects.

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2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

2013 Valley Middle School Launch

Students will design their own payloads, or small containers, that protect, insulate, and transport the experiments. For the NSBC launch, payloads must:

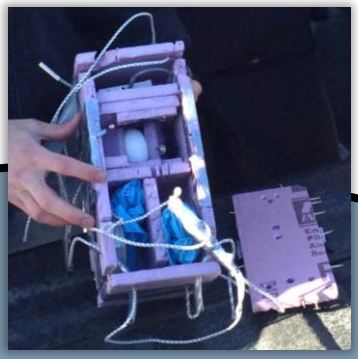
- Be smaller than a 2' x 2' x 2' volume
- Weigh less than 1.5 pounds
- Contain no live animals
- Contain no projectiles, gliders, or remote operated free-flyers
- Contain no explosives, poisons, flammable substances, etc. If you are unsure about a substance, ask and we will let you know!

If the payload to be flown is in question as to whether or not it is safe, the NSBC coordinators will conduct a safety review of your payload. Please, include all material details of your design.

Turbulent winds, cold temperatures, and air resistance all affect your experiments. Styrofoam containers are a popular choice of material. They are lightweight, durable, and insulating. Some examples are shown below.

When designing your payload, it is important to consider:

- **Do you need to build compartments?** Compartments provide support and separation from other experiments. They can also support the weight of a camera or categorize specific scientific trials.
- **Do you have the most efficient size?** It is best to design the payload to be as aerodynamic as possible. In the past, NSBC students have created spheres, cubes, triangular pyramids, and rectangular prisms.
- **What color is your exterior?** There is no color requirement for NSBC, but a bright color increases its visibility and aids in recovery.



2015 Bismarck Team

2013 Eighth Grade Valley Middle School Launch

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

The North Dakota Space Grant Consortium (NDSGC) and the University of North Dakota (UND) will be holding the sixth annual Near Space Balloon Competition in the fall of 2016. We invite all interested North Dakota 6th-12th grade students to submit a payload proposal using this form. Please submit completed proposal forms by **October 10rd, 2017** by email or mail to:

Clifford Hall Room 513
4149 University Avenue Stop 9008
Grand Forks, ND 58202-9008

Teams will be notified of their proposal's acceptance by **October 12, 2017**. Accepted teams will be reimbursed up to $250 for supplies and additional travel funds will be provided for your team to attend and participate in the balloon launch.

For more details about the competition, please visit blogs.und.edu/nsbc.

Tentative Schedule of Events

October 10, 2017	Proposals Due
October 12, 2017	Teams Notified of Acceptance
October 16, 2017 – October 20, 2017	Web meeting for accepted proposals (Individual Teams)
October 30, 2017-November 3, 2017	Midterm progress report web meeting (All Teams)
November 17, 2017	Integration Night (Backup December 1, 2017)
November 19, 2016	Launch Day (Backup December 2, 2017)
December 18, 2017	Final Reports Due (Backup January 5)
TBD January 2018	Judges Ceremony

If you have any questions please contact Marissa Saad, Denise Buckner, or Peter Henson by email at balloons@ndspacegrant.org.

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

I. Payload Guidelines

We encourage you to be creative when designing your payload. However, we must enforce the following design limitations, in order to comply with FAA safety regulations.

1. The fully completed payload MUST be 1.5 pounds or lighter.
2. Payloads may not exceed 2 ft x 2 ft x 2 ft.
3. Please do not launch animals! (Plants are allowed).
4. If you wish to use any radio equipment, please contact us.
5. Please do not incorporate anything that may explode, has a projectile, or could accidentally contact another payload.

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

Team Information

School: _____

Faculty Mentor Name: _____

Contact Email: _____

Phone: _____

Mailing Address:

_____

_____

_____

Team Name: _____

(Attention teachers: if your NSBC team is your entire class, you may add more than 20)

Team Member	Grade		Team Member (continued)	Grade
1.			11.	
2.			12.	
3.			13.	
4.			14.	
5.			15.	
6.			16.	
7.			17.	
8.			18.	
9.			19.	
10.			20.	

II. NSBC 2017 Mission Objective

A. Earth and Atmospheric Sciences

Earth is the pale blue dot we call home. Although we might send people to live on Mars, the Moon, or another planet in the future, for now we are Earthlings alone. As inhabitants of the Earth, understanding the science of our planet and practicing responsible stewardship for our home is very important! We are all responsible for the care of Earth, and analyzing plants and rocks on the planet, studying the ocean, learning about the atmosphere, and looking at weather patterns are all essential parts of responsible stewardship, and are vital for life.

Learning about rocks teaches us about the history and science of the planet. Studying plants allows us to develop sustainable agriculture that supports and feeds us. Atmospheric sciences are important because they teach us about the air we breathe, the gasses that insulate and protect the planet, the sun's light, UV radiation, and the atmospheric filter through which we see space. Studying pollution is important because it affects our health and the health of the planet. Analysis of weather patterns is another essential part of Earth science; measuring wind speed and direction, pressure, and temperature allows us to make accurate forecasts. This is especially evident in light of the recent hurricanes sweeping across the world. Understanding our world is necessary for a sustainable, healthy life and we should all strive to use science to learn everything we can about our home and how it functions.

Earth sciences are wide reaching, and ballooning provides a platform for studying many aspects of Earth and planetary sciences. Remote sensing from balloons allows us to image the Earth to learn about agricultural and oceanographic trends. Measuring atmospheric conditions from a balloon that ascends to 100,000 feet allows student scientists to gather data that could not be collected from Earth or even from a satellite orbiting above. As the balloon passes through the ozone layer, students can learn about this important part of our atmosphere. Collecting data on the sun's rays is another possible topic for students to study, and as balloons reach super high altitudes, great information can be discovered! There are many Earth and atmospheric science experiments that can be conducted from the NSBC balloon- the sky isn't the limit here!

In addition to learning about the Earth, NSBC promotes STEM (science, technology, engineering, and mathematics) education and allows students to see the importance of these fields. This year we especially hope to emphasize how all four of these disciplines are intertwined and encourage students to explore as many of the four categories as they can. Missions the students design will focus on scientific experiments, and utilizing technology is a key element of successful experiment design and data collection. Creating payloads and physically building the internal components means students are engineers, and math is applied to almost every science mission. Students are encouraged to use technology to their advantage- NeuLogs, Raspberry Pis, Arduinos, and solar panels are just a few of many technological tools that are inexpensive, versatile, and easy to use. The NSBC website provides links to get started, should students wish to utilize these tools.

III. Payload Details

A. Payload Analysis

1. Describe the objective(s) for your payload.

2. What is your hypothesis for the experiment?

3. Describe how the experiment will meet your objective(s).

4. What is the control group for your experiment?

5. How will you record the data?

6. Describe how your payload objectives apply to Earth and atmospheric sciences. What scientific outcomes do you predict?

B. Please provide a material list and rough budget for your payload:

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

Materials	Quantity	Cost

C. **Please provide a sketch or schematic of your proposed payload. (Attachments are acceptable.)**

Note: Submitted designs must indicate where the balloon string will run through payloads. Teams must attach clear vinyl **tubing** (found at Menards, Lowe's, etc.) in this designated spot. UND launch teams will later pass the string through this tubing. Consider how your payload will oscillate and rotate during flight, when suspended with the string.

If you would like more information about preparing your payload with tubing, please email balloons@ndspacegrant.org or refer to your **NSBC Handbook (page 17)**.

Costs: The NDSGC will financially support each team with $250.00 for payload materials, sensors, and other equipment. Teams will purchase the supplies themselves, save the receipts, and send them into the Space Grant team for reimbursement.

The big question is: **what sensor should your students use?**

Before selecting the hardware, make sure your students know what they want to study. Are they interested in the temperature or pressure profile? Do they have a solid hypothesis? Do they know what end results they hope the balloon flight produces?

Purchasing a sensor should be the last step in a well-thought out process.

Check out some noteworthy data loggers, used by past NSBC teams and other student activities!

SparkFun

www.learn.sparkfun.com

Educator's Discount Offered!

Adafruit

https://www.adafruit.com/

Digikey

https://www.digikey.com/

Great 24/7 one on one live chat support

Arduino

https://www.arduino.cc/

Micro computers similar to Raspberry Pi- also simple to learn and teach!

Onset Data Loggers

www.onsetcomp.com

HOBO Data Loggers

www.onsetcomp.com and Amazon.com

NeuLog Sensors

www.neulog.com and Amazon.com!

Raspberry Pi

https://www.raspberrypi.org

Micro computer- easy to learn, versatile, and very cheap. Lots of useful tutorials here!

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

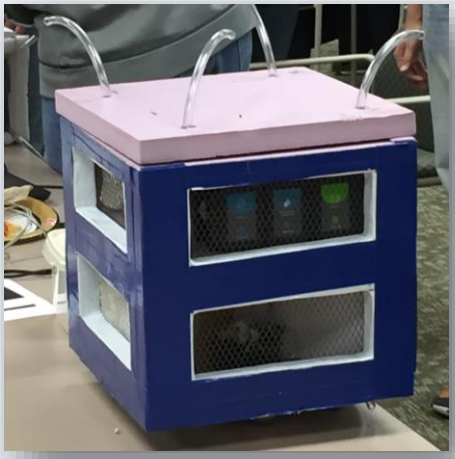
Here are some helpful tips for when students start to design and build their payload:

Make the payload as compact as possible; extra space is impractical when flying!

2014 Northwood NSBC team constructing their spherical payload

Hot Glue vs Strapping Tape

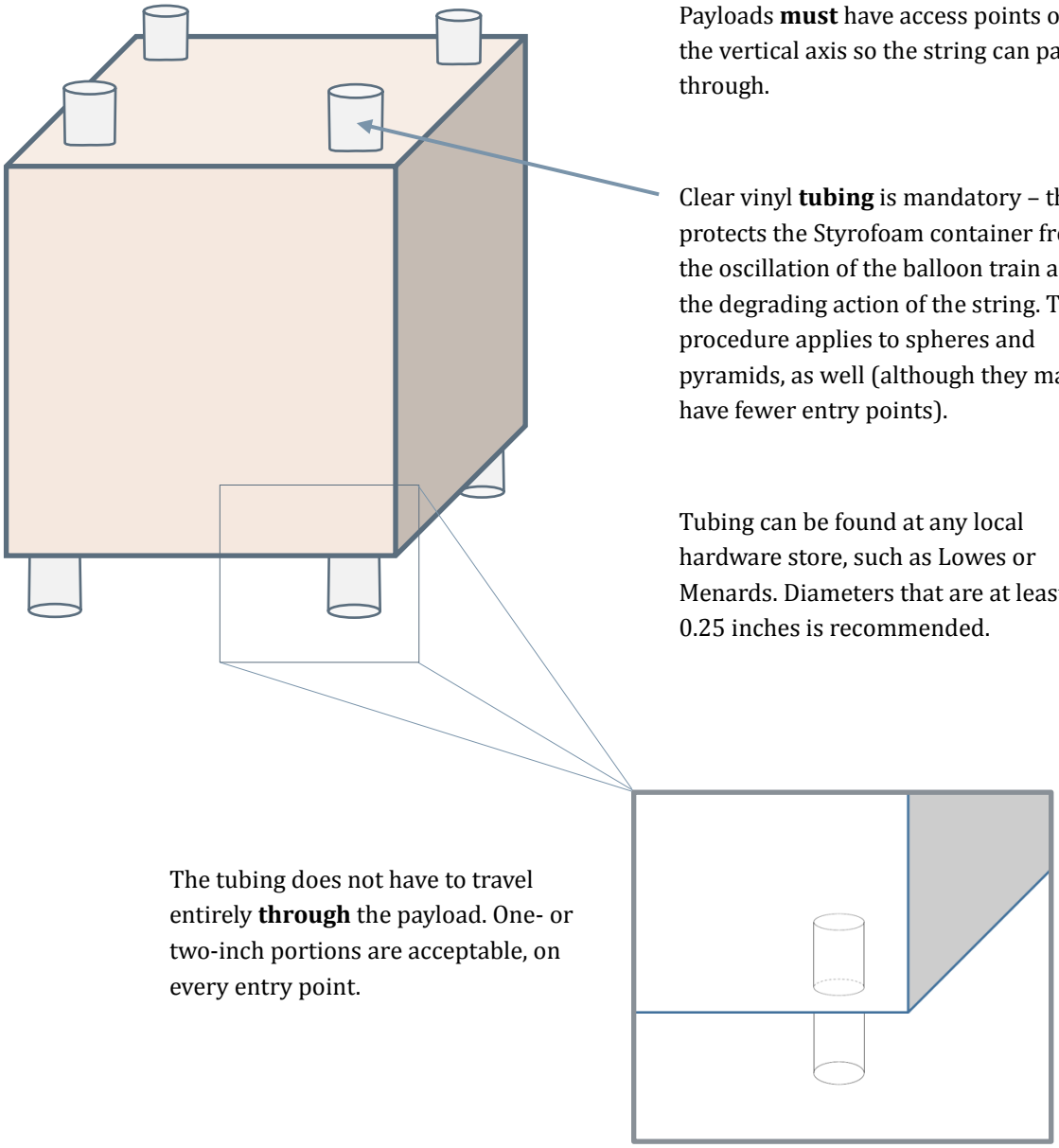
Hot glue is handy, but not guaranteed to hold up against the frigid temperatures at altitude (-80°F). The glue may shatter if something impacts it. Be sure to only use the low setting- high heat settings will cause the glue to melt your Styrofoam! In addition to using glue, strapping tape is recommended. It has striated fiberglass filaments embedded within it to add strength. These filaments are hard to accidentally tear, unless you're cutting it with scissors. Make sure anything valuable on the outside of



2015 Kindred NSBC Team's Payload

All cubed payloads must have four designated entry points to secure the string (as seen in Image 2). During a flight, the payloads experience turbulent swaying, which can deteriorate the Styrofoam around the string. The tubes do not have to pass continuously through the payload, but need to be present anywhere the string passes through the perimeter of the payload. All other designs (spheres, pyramids) may have one or two entry points lined with vinyl tubing. More information is included on the following page.

Follow the following procedure when designing your payloads. Any deviations must be specified, explained, and cleared with NDSGC within the proposal phase. We encourage creativity, while maintaining the safest configurations for all teams. Styrofoam, acting as the container, is preferred, but not mandatory. Styrofoam is light, strong, and insulating.



Payloads **must** have access points on the vertical axis so the string can pass through.

Clear vinyl **tubing** is mandatory – this protects the Styrofoam container from the oscillation of the balloon train and the degrading action of the string. This procedure applies to spheres and pyramids, as well (although they may have fewer entry points).

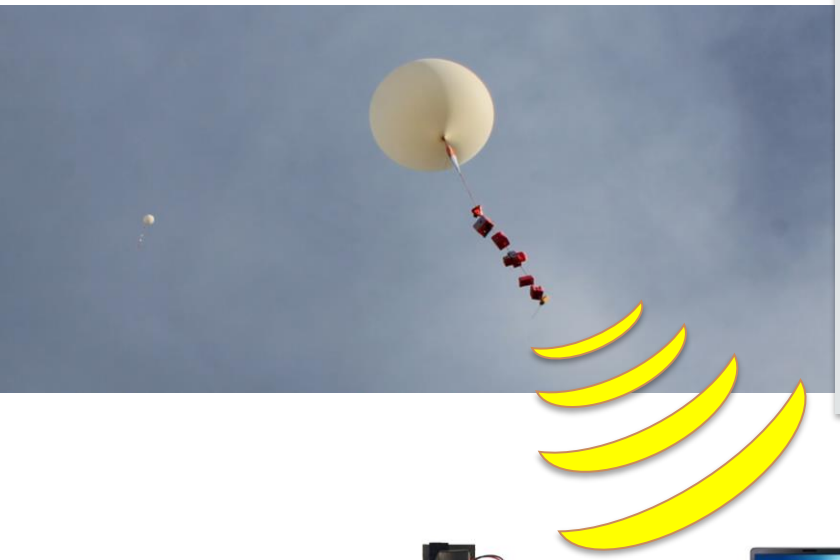
Tubing can be found at any local hardware store, such as Lowes or Menards. Diameters that are at least 0.25 inches is recommended.

The tubing does not have to travel entirely **through** the payload. One- or two-inch portions are acceptable, on every entry point.

Interfacing with Ground Systems––

NDSGC uses two main methods to track the balloon:

1



Our primary method is a HAM radio. A transmitter onboard the balloon will transmit its location, altitude, and velocity every 15 seconds. The tracking team will use computers to plot the coordinates on a map. All student chase teams will be able to see these coordinates.

2

The secondary tracking system is a GPS. We use an iridium GPS, which is very accurate and reliable, and use a SPOT tracker as a backup GPS. Both of these units transmit their location to a satellite, which plots the coordinates on a map online. Anyone with internet access can see the balloon's flightpath!

Type this in to track the SPOT devices!

http://goo.gl/QqJK2K

Scan this QR code for the SPOT website, or download the free SPOT app to your smartphone!

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

What will your students actually *do*?

Research

Each team must select a scientific problem, propose an experiment designed to answer that problem, and develop a hypothesis for their project's outcome.

Students will present this researched space knowledge at integration night (how does your experiment apply to space?) and in the final report.

See "integration night presentation guidelines" for more information.

Design

2013 Northwood student designing their pyramid payload

Students will submit a sketch of their proposed payload, including size dimensions. This can be produced by hand or electronically, as long as it is detailed and legible. Payload designs should highlight the science experiment inside and be as compact as possible.

Construction

2013 Valley Middle School constructing their payload

Students interested in building their experiment's container, or payload, can participate with the construction. Commonly used materials include Styrofoam, zip ties, hot glue, strapping tape, duct tape, Velcro, and vinyl tubing.

Launch and Chase

2013 Valley Middle School at the landing site

Are all of your students attending the launch? All NSBC students, teachers, and chaperones will follow the balloon in a school bus. Everyone on the bus will be able to visualize and plot the balloon's location on a map throughout the entire mission. Students will be engaged and help track the balloon with the help of UND graduate students.

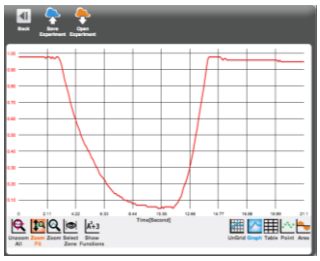
Analysis

2013 NSBC post-flight biological experiment

After the payloads are recovered, students will analyze their science data, imagery, or engineering experiments. Students will have approximately one month after the launch to complete all analyses.

Information can be compiled into graphs or tables – images are helpful, too!

Final Report



2013 NSBC post-flight pressure data

The final report is a concise document displaying what the students learned. In this section, they will state their problem, hypothesis, methodology, results and analysis, and final conclusions (was their hypothesis correct? Why or why not?).

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

MILESTONES*	DATE
Proposals Due	**October 10, 2017**
Acceptance Letters Announced	**October 12, 2017**
Individual Team Web Meetings	**October 16-20, 2017**
Integration Night	**November 17, 2017**
(Backup Integration Night)	December 1, 2017
Launch Day	**November 18, 2017**
(Backup Launch Day)	December 2, 2017
Final Reports Due	**December 18, 2017**
(Backup Report Date)	January 8, 2018
Judges Ceremony	TBD **January 2018**

*All dates are subject to change depending on weather, technical delays, and NSBC project managers' decisions.

PROPOSAL SUBMISSION

When: Last week of September

Student teams will submit a proposal where they will explain their science objectives. They will research the problem, form a hypothesis, and list their required materials. A proposal submission form can be found on the NSBC website (blogs.und.edu/nsbc). Teams will be notified if their proposal has been accepted by the first week of October.

PRELIMINARY MEETING

When: Second week of October

Duration: 30 min

All teams will participate in the preliminary meeting, held via a videoconference. Each team will select a date and time that is most convenient for them. Web capabilities include Skype, FaceTime, Google Hangouts, Connect Pro, and any other preferred method.

This opportunity allows students to meet the NSBC coordination team and ask any engineering or science questions. Coordinators will assess each team's direction and intentions, offering assistance and guidance.

CRITICAL DESIGN REVIEW

When: Third week of November

Format: Email or web call

Student teams will send the NSBC coordinators a final status update on their payload. The students will provide their payload's final weight and dimensions. All additional questions can be answered. Additionally, teachers will provide the NDSGC with the number of hotel rooms required for each team. Please refer to "Reserving Hotel Rooms" for more information.

At this time, teams will receive a document with travel and integration logistics and instructions.

Remember, communication will be ongoing throughout the competition. The NSBC coordination team members are not judges and can be contacted throughout the entire competition.

Judging

Student NSBC teams will be judged on a standard set of criteria, which can be found on the following page. There are five categories: 1) the quality of the proposal, 2) the actual payload, 3) the student presentation at integration night, 4) the team dynamics during the launch, and 5) the quality of the final report. Teams can earn a total of 125 points.

The grand prize winner will earn the opportunity to participate in a NDSGC sponsored STEM-activity (ex. Gateway to Science Center, Fargo Air Museum, etc.) or a trip to the John D. Odegard School of Aerospace Sciences at the University of North Dakota. The trip to UND includes a tour of the **Aviation facilities (including a high altitude chamber),** a tour of the **Human Space Flight Laboratory (space suits and spacecraft simulators),** a tour of the **UND Observatory**, and a tour of **real meteorites and fossils (you can hold them!).** Additionally, the winning team will have the opportunity to participate in a human spaceflight mission at the UND Lunar/Martian habitat in the spring semester. They can observe the astronauts, assist in a real EVA (extravehicular activity), participate in mission control, or design an experiment for the crewmembers to perform!

The judging ceremony for the *first* NSBC in 2011 - it was originally called the ND High Altitude Balloon Student Payload Competition!

Human Space Flight Lab

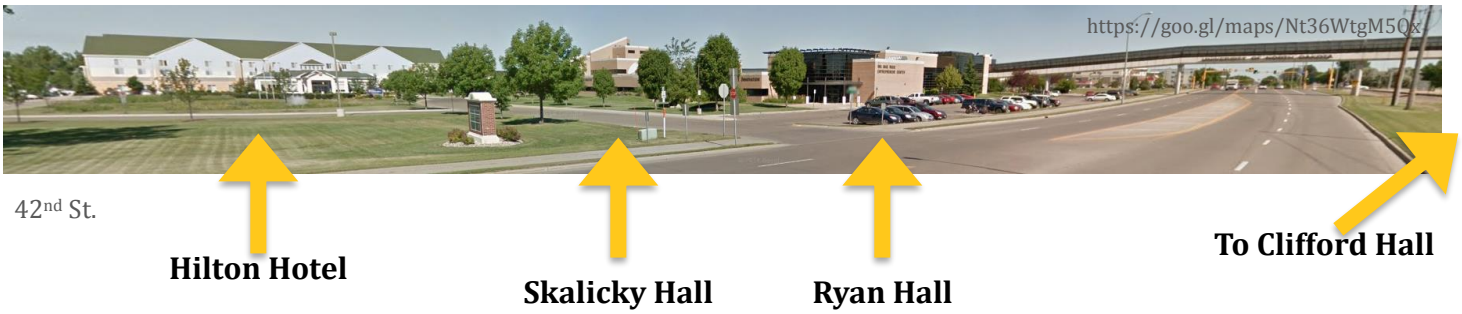
Simulators

Observatory

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

Category	2017 NSBC Judging Form Points range from low (1) to high (5)	Points	5	4	3	2	1
Proposal							
	Clear statement of their objectives and a hypothesis	5					
	Control and *variables* clearly listed and explained	5					
	Originality of research idea	5					
	The proposal shows the team researched the Earth	5					
	Sufficient preliminary design	5					
	Explanation of how their research will be applicable to stewardship of Earth	5					
	Subtotal	**30**					
Payload	Follows all size and material guidelines	5					
	Payload design best supports the science within	5					
	Good workmanship, noticeable effort and time put in	5					
	Aerodynamic, compact design with no wasted space	5					
	Subtotal	**20**					
Presentation	Understanding of their payload	5					
	Understanding of the science (and the Earth)	5					
	Articulated contribution by each team member	5					
	Team spirit and unity	5					
	Subtotal	**20**					
Launch Day	Sportsmanship (Did they assist other teams? Willing to share post-flight data?)	5					
	Demonstration of critical thinking, problem solving, and decision making	5					
	Team communication, work ethic, and attitude	5					
	Subtotal	**15**					
Final Report							
	Explanations and Analysis of their data	5					
	Overall presentation of the final report (neatness of data and figures)	5					
	Accurate grammar, spelling, citations	5					
	Report has all components (procedures, materials, analysis, conclusions)	5					
	Did the team appropriate their funds efficiently?	5					
	Did they explain how their experiment is applicable to stewardship of Earth?	5					
	Report shows substantial research of the Earth	5					
	Subtotal	**35**					
	Total Available Points	**120**					

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form



Skalicky Hall, Room 211

4300 James Ray Drive

Grand Forks, ND 58202

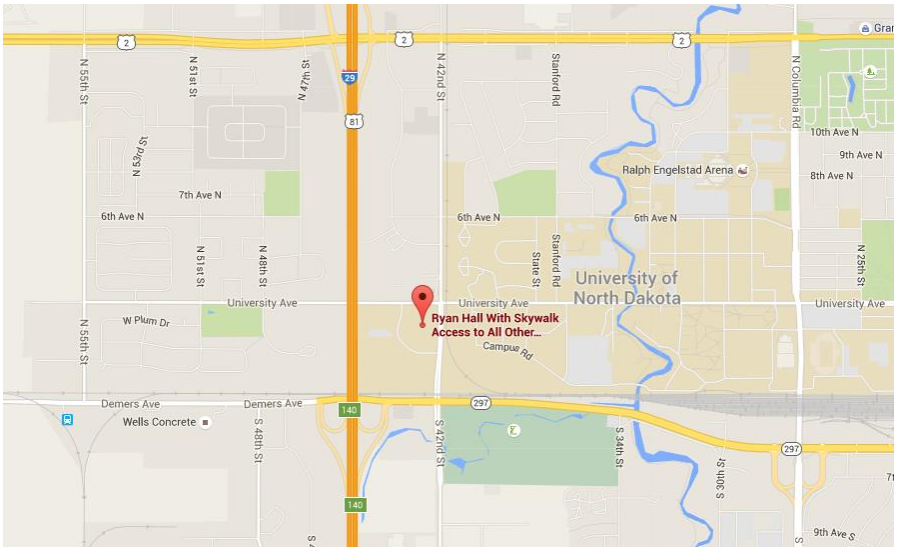
Hilton Hotel

4301 James Ray Drive

Grand Forks, ND 58203

Hotel Information

Directions from I-29: Take **exit 140**. Turn right onto Demers Ave, turn left onto S 42nd St, and turn left onto James Ray Drive.



Hilton Hotel

Phone Number

(701) 775 - 6000

Hilton Garden Inn

https://goo.gl/OvxwRz

Parking can be found at the Hilton Hotel (for free), or in visitor parking behind Skalicky Hall. An indoor walkway connects all the buildings shown above.

How to Reserve your Hotel Rooms

All teams will stay at the Hilton Garden Inn Hotel – this comes at no cost to your team.

Each team must report the number of rooms you require to the NDSGC team by the critical design review (see "Mandatory Reports" section) web-meeting.

Teams should not call, reserve, or pay for their own rooms.

Hilton Hotel

Non-smoking

Business Center

Indoor Pool

Fitness Room

Complimentary Wi-Fi

Full Service Restaurant

Participants will be reimbursed for meals not provided by the NDSGC, using the state-rate per diem.

Hotel Hours

Check-in: 3:00 pm

Check-out: 12:00 pm

We will not be able to locate the payloads and return back to Grand Forks in time for check-out. Please take all your belongings with you when we chase the balloon.

Please see the "Travel Tips" section for additional reimbursement information.

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

2016 NSBC

What is Integration Night?

On the Friday evening before the launch, all student teams will meet on the UND campus, in Skalicky Hall, Room 211.

Teachers and students may need to be prepared to leave early from school to make the 4 pm meeting time.

At integration night, payloads will be inspected for launch. Judges will observe and interview teams, the weights and dimensions of each payload will be taken, and the payloads will be strung up for integration onto the balloon! Additionally, teams will be given the go- or no-go for launch.

After looking at the weather forecast, NSBC coordinators will email all teams by **Wednesday at 3:00pm** to inform them if they should depart for UND.

NSBC Coordinators will deliver a short introductory presentation, including the background of balloons, the scientific objectives of the mission objectives, and the logistics and safety procedures for the morning launch.

Student Presentations

Requirements:

- Why their research is relevant to the NSBC main objective (Mars, Moon, Earth, etc.)
- Their scientific and engineering objectives
- Their hypotheses, controls, and variables
- Their motivation for the design
- Any obstacles faced with the construction

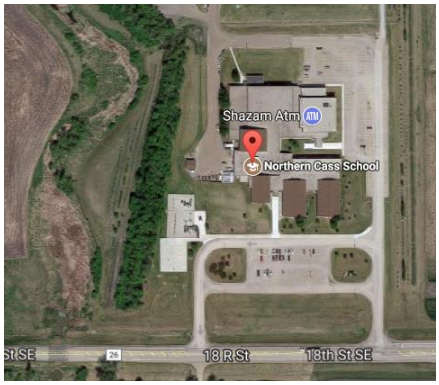
To conclude, members of the UND launch team will string up all student payloads and connect them to the parachute. **Payloads must have the vinyl tubing in place before integration night.** (See "Payload Schematics" section for tubing instructions).

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

Northern Cass School

16021 18th St SE, Hunter, ND 58048

Teams will meet in the Clifford Hall parking lot at 6:30 a.m. to load up the equipment, board the busses, and leave for the launch site- its is about an hour away, so we will leave at 7, arrive at 8, fill the balloons, and launch at 9!



Everyone will meet in the garage and finalize their sensors and cameras and secure their containers. Make sure NASA stickers and contact information are clearly visible on the outside of the payloads. Then we will head to the launch site!

If your team is launching a **camera** (or anything with a limited battery lifespan) and you are able to access it without opening up your payload, then your team members should wait as long as possible to turn it on. Filling up a balloon takes almost a half hour. Turn on cameras **after** the balloon is filled and the launch team arrives to the exact launch location.

FILLING THE BALLOON:

The balloon will be filled with helium, until the lift of the balloon is at least two pounds lighter than the total weight of the payload chain. The diameter of the balloon will expand approximately five to eight feet in diameter. Then, the string of payloads will be tied to the neck of the balloon and the entire payload train will be carried and walked to the appropriate launch location.

It can be very cold during the launch. Remember to bring warm winter gear: hats, gloves, jackets, etc.!

Launch Operations for Student Teams:

2013 NDSGC Balloon Launch

6:30 AM

- Meet outside Skalicky (where the busses are!)
- Finalize all payloads
    - Ensure your tracking system is operational
- Load up equipment

7:00 AM

- Leave for Northern Cass

8:00 AM

- Arrive and unload equipment
- Fill balloon
- Tie up payloads

9:00 AM

- Launch the balloon!
- All teams assemble in the bus (chase vehicle)
- Main chase vehicle leads the caravan, student teams follow behind

2011 Balloon Launch

Payload Send-off

We will discuss this together, but the student holding your team's payload should be prepared for a variety of lift-offs. Depending on the wind and release of the balloon, the payload train may gradually lift out of the students' hands, or violently burst upwards. It is a good precaution to have the students stretch out their arms and hold the payload as far away from their face as possible.

Upon payload recovery:

Only the designated payload recovery specialist, wearing reflective gear, will venture out to retrieve the balloon (after gaining landowner's permission). Students must remain by the cars and await the return of their experiments.

At this time, students should document all the time-sensitive information and image their payload before any outside variables affect their data.

It may be wise to bring snacks for the minimum 3-hour chase!

2013 NSBC Recovery

Rules and Regulations

Ballooning is a fun activity, but some safety procedures are in place so that everything runs smoothly. There will be numerous participants and spectators around Ryan Hall's garage, filling site, and launch site. Please take caution when navigating around sensitive filling apparatus.

Please read these carefully.

1. **Do not stand behind the helium tanks**. Helium, an inert gas, is much safer than hydrogen – but when it is compressed in a cylinder, it could potentially turn into an uncontrolled projectile.

2. Do not stand near or on the **filling tubes**, regulator, or other launch site equipment.

3. **Students may not ride in a state vehicle**. Everyone will have pre-designated bus assignment.

4. Students cannot venture out on **private land** to retrieve the payloads. If the payloads fall on someone's land, the NDSGC payload retrieval specialists will transport it to the road, where students will be able to analyze their experiments.

5. Please leave all **drones**, other remote controlled objects, and hover boards at home.

What should you include?

Introduction

Include a quick background on the mission destination (this year's destination is Earth) and highlight your mission objectives. What was your motivation for the experiment – would your design assist future human exploration? What are your variables and controls?

Materials List

What materials, tools, or objects did you use to construct your payload? Why did you select your equipment over other options? If it was found online, provide its web link. How much did everything cost?

Procedure

If someone was trying to reproduce your payload design and functionality, how would they do it? What timeline would they follow?

Results

Include your balloon-borne data. Display and explain your graphs, tables, and images.

Conclusion

Discuss your experiment - was your hypothesis true? What did you learn?

If your experiment did not perform as expected, discuss what changes and alterations you could make for a future launch. Remember, if something broke or failed, that's part of the learning process – it happens to NASA scientists, too!

If someone else was replicating your experiment in the future, what advice would you give them?

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

Dear Educators and Students,

On behalf of the North Dakota Space Grant Consortium and the University of North Dakota, thank you for your participation in this year's Near Space Balloon Competition.

As a valued participant, your opinions are important to us and we invite you to please fill out our short survey. This year's survey will be distributed to teams, online. You will receive a survey link during NSBC's integration night.

Completion of this survey is voluntary and all questions are optional. Your responses will remain anonymous and will in no way influence the judging of your payload or affect your standing in competitions present and forthcoming. Please answer all questions truthfully and as completely as possible.

If you have any questions or concerns, or if you require clarification on any of the survey questions please contact us at balloons@ndspacegrant.org.

Media Release for Parent and Minor

I, _____, am the parent/guardian/legal representative of
(Please print your name)

_____ and do hereby give permission
(Please print name of child)

for the above-named minor child (hereinafter "Minor") to be photographed and/or videotaped by NASA or its representatives. I understand and agree that the photographs and/or videotapes containing the image and/or voice of the Minor may be used in the production of instructional and/or promotional materials produced by or on behalf of NASA (hereinafter the "Program") and that such materials may be distributed or broadcast to the public and displayed publicly. I also understand that my permission to use the photographs and videotapes is for an unlimited duration and that neither I nor the Minor will receive any compensation for granting this permission or for the use, if any, by NASA of the Minor's image and/or voice.

I acknowledge that NASA has no obligation to use the Minor's image or voice in connection with the Program.

I hereby unconditionally release NASA and its representatives from any and all claims and demands arising out of the activities authorized under the terms of this agreement.

By signing below, I represent that I am at least 18 years of age and am the parent/guardian/legal representative of the above-named Minor. I have read the foregoing agreement and am familiar with all of the terms and conditions thereof and I consent to its execution by the Minor. I agree that neither I nor the Minor will revoke or disaffirm the this agreement at any time.

Signature of Parent/Guardian/Legal Representative of Minor:_____

Relationship to Minor:_____ Date:_____

Name and Location of Event:_____ Near-Space Balloon Competition at the University of North Dakota

Signature of Minor:
_____

2017 Near Space Balloon Competition (NSBC) Proposal Submission Form

NASA Media Release for Adults
(Do Not Use for Minors)

I, _____ do hereby give permission to be
(Please print name your name)

interviewed, photographed, and/or videotaped by NASA or its representatives in connection with a NASA production.

I understand and agree that the text, photographs, and/or videotapes thereof containing my name, likeness, and voice, including transcripts thereof, may be used in the production of instructional, promotional materials, and for other purposes that NASA deems appropriate and that such materials may be distributed to the public and displayed publicly one or more times and in different formats, including but not limited to, webites, cablecasting, broadcasting, and other forms of transmission to the public. I also understand that this permission to use the text, photographs, videotapes, and name in such material is not limited in time and that I will not receive any compensation for granting this permission.

I understand that NASA has no obligation to use my name, likeness, or voice in the materials it produces, but if NASA so decides to use them, I acknowledge that it may edit such materials. I hereby waive the right to inspect or approve any such use, either in advance or following distribution or display.

I hereby unconditionally release NASA and its representatives from any and all claims and demands arising out of the activities authorized under the terms of this agreement.

By signing below, I represent that I am of legal age, have full legal capacity, and agree that I will not revoke or deny this agreement at any time.

I have read the foregoing and fully understand its contents.

Accepted by:

Signature:_____ Date:_____

Name and Location of Event: Near-Space Balloon Competition at the University of North Dakota

Address: 4149 University Drive Stop #9008, Clifford Hall Rm 513, Grand Forks, ND 58202

Telephone: 701-777-4161

Email Address: _____

UND Safety Agreement Form - Minors

PARENT'S OR GUARDIAN'S AGREEMENT OF
WAIVER OF LIABILITY, INDEMNIFICATION, AND MEDICAL RELEASE

To be signed by adults if the participant is under 18 years of age.

Acknowledgment and Assumption of Risk

The undersigned parent and/or legal guardian does hereby acknowledge that he/she is aware of the dangers and the risks to the participant's person and property involved in participating in:

_____

I understand that this activity involves certain risks for physical injury, including, but not limited to:

_____

The undersigned parent and/or legal guardian and participant understand that this activity involves certain risks for physical injury to the participant. We also understand that there are potential risks of which may presently be unknown. Because of the dangers of participating in this activity, the undersigned parent and/or legal guardian and participant recognize the importance and the participant agrees to fully comply with the applicable laws, policies, rules and regulations, and any supervisor's instructions regarding participation in this activity.

The undersigned parent and/or legal guardian and participant understand that the University of North Dakota does not insure participants in the above-described activity, that any coverage would be through personal insurance, and the University of North Dakota has no responsibility or liability for injury resulting from this activity.

The undersigned parent and/or legal guardian acknowledges that the participant voluntarily elects to participate in this activity with knowledge of the danger involved, and hereby agrees to accept and assume any and all risks of property damage, personal injury, or death.

Waiver of Liability and Indemnification:

In consideration for being allowed to voluntarily participate in the above-referenced event, on behalf of myself, the participant, his/her personal representatives, heirs, next of kin, successors and assigns, the undersigned parent and/or legal guardian forever:

a. waives, releases, and discharges the University of North Dakota and its agencies, officers, and employees from any and all liability for the participant's death, disability, personal injury, property damages, property theft or claims of any nature which may hereafter accrue to the participant, and the participant's estate as a direct or indirect result of participation in the activity or event; and

b. agree to defend, indemnify, and hold harmless the University of North Dakota, its agencies, officers and employees, from and against any and all claims of any nature including all costs, expenses and attorneys' fees, which in any manner result from participant's actions during this activity or event.

Consent is given for the participant to receive medical treatment, which may be deemed advisable in the event of injury, accident or illness during this activity or event. This release, indemnification, and waiver shall be construed broadly to provide a release, indemnification, and waiver to the maximum extent permissible under applicable law.

I, the undersigned parent and/or legal guardian, affirm that I am freely signing this agreement. **I have read this form and fully understand that by signing this form I am giving up legal rights** and/or remedies which may otherwise be available to myself, the minor participant regarding any losses the participant may sustain as a result of participation in the activity. I agree that if any portion is held invalid, the remainder will continue in full legal force and effect.

READ BEFORE SIGNING

Name of Minor: _____ Age of Minor: _____

Signature of Parent/Guardian: _____ Date _____

Printed Name of Parent/Guardian: _____ Date _____

Witness: _____ Date _____

(To be retained by originating department)

Student/Non-employee Travel Expense Worksheet Tips and Info

When planning or submitting your travel expenses to UND, please follow the tips below.

Planning your travel:

- Current per diem rates for meals for students and non-employees is **$46 per day** for travel in North Dakota. That rate is $35 for state employees. Other city rates are provided on request. Receipts are not necessary.
- If non-employees purchase food for other students, they may **submit receipts to the North Dakota Space Grant Consortium** for reimbursement.
- Current mileage rate in ND is 54 cents per mile for using a personal vehicle for travel.
- If renting a bus or van for travel outside the state of ND, educators should follow their school district's policies for rentals with companies that have secured a group plan with them. These plans typically include liability and comprehensive insurance coverage and at a much lower daily rental rate. **If you use a vehicle rented outside of these group plans, UND will NOT cover additional vehicle rental charges such as navigation systems, any type of insurance coverage such as liability or comprehensive insurance.** Typically, if you own a car, your policy should cover rental car accident and liability insurance if reserved in your name. Check with your insurance carrier to verify that you are covered.
- Your submitted hotel receipt should show a zero balance and **proof of payment**. If it does not, you will be required to obtain one, or provide a credit card statement showing proof of payment.

Submitting your travel expense worksheet:

- Check the box for ND State Employee, Non-employee, or student. Only UND students check the student box. Other students are considered non-employees. All state employees should check the ND State Employee box---this includes all state universities and colleges.
- Travelers should **only** complete the top 1/3 up to "Expenses to be Reimbursed" and sign the form at the bottom. Office staff will complete the expense section using receipts and details you provide.
- Sharing of hotel rooms by students is allowable and must be indicated on the hotel receipt by the person submitting the expense. Please indicate the names of each person in a room.
- Receipts are required for all expenses including, but not limited to gas, parking, highway tolls, hotel, registration fees, car rental, airline tickets, airline luggage fees, etc. Meal receipts are not required as you are reimbursed on a standard per diem rate as provided above.
- If you are missing a receipt, a missing receipt form will need to be signed.

W9 Tax Form

Form **W-9**
(Rev. August 2013)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

Give Form to the requester. Do not send to the IRS.

Print or type
See Specific Instructions on page 2.

Name (as shown on your income tax return)

Business name/disregarded entity name, if different from above

Check appropriate box for federal tax classification:
☐ Individual/sole proprietor ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=partnership) ▶

☐ Other (see instructions) ▶

Exemptions (see instructions):
Exempt payee code (if any)
Exemption from FATCA reporting code (if any)

Address (number, street, and apt. or suite no.)

Requester's name and address (optional)
University of North Dakota
Accounting Services
264 Centennial Drive Stop 8356
Grand Forks ND 58202-8356

City, state, and ZIP code

List account number(s) here (optional)

Part I **Taxpayer Identification Number (TIN)**

Enter your TIN in the appropriate box. The TIN provided must match the name given on the "Name" line to avoid backup withholding. For individuals, this is your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the Part I instructions on page 3. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN* on page 3.

Note. If the account is in more than one name, see the chart on page 4 for guidelines on whose number to enter.

Social security number
☐☐☐ – ☐☐ – ☐☐☐☐

Employer identification number
☐☐ – ☐☐☐☐☐☐☐

Part II **Certification**

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me), and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding, and
3. I am a U.S. citizen or other U.S. person (defined below), and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions on page 3.

Sign Here Signature of U.S. person ▶ Date ▶

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. The IRS has created a page on IRS.gov for information about Form W-9, at *www.irs.gov/w9*. Information about any future developments affecting Form W-9 (such as legislation enacted after we release it) will be posted on that page.

Purpose of Form

A person who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) to report, for example, income paid to you, payments made to you in settlement of payment card and third party network transactions, real estate transactions, mortgage interest you paid, acquisition or abandonment of secured property, cancellation of debt, or contributions you made to an IRA.

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN to the person requesting it (the requester) and, when applicable, to:

1. Certify that the TIN you are giving is correct (or you are waiting for a number to be issued),
2. Certify that you are not subject to backup withholding, or
3. Claim exemption from backup withholding if you are a U.S. exempt payee. If applicable, you are also certifying that as a U.S. person, your allocable share of any partnership income from a U.S. trade or business is not subject to the withholding tax on foreign partners' share of effectively connected income, and
4. Certify that FATCA code(s) entered on this form (if any) indicating that you are exempt from the FATCA reporting, is correct.

Note. If you are a U.S. person and a requester gives you a form other than Form W-9 to request your TIN, you must use the requester's form if it is substantially similar to this Form W-9.

Definition of a U.S. person. For federal tax purposes, you are considered a U.S. person if you are:

- An individual who is a U.S. citizen or U.S. resident alien,
- A partnership, corporation, company, or association created or organized in the United States or under the laws of the United States,
- An estate (other than a foreign estate), or
- A domestic trust (as defined in Regulations section 301.7701-7).

Special rules for partnerships. Partnerships that conduct a trade or business in the United States are generally required to pay a withholding tax under section 1446 on any foreign partners' share of effectively connected taxable income from such business. Further, in certain cases where a Form W-9 has not been received, the rules under section 1446 require a partnership to presume that a partner is a foreign person, and pay the section 1446 withholding tax. Therefore, if you are a U.S. person that is a partner in a partnership conducting a trade or business in the United States, provide Form W-9 to the partnership to establish your U.S. status and avoid section 1446 withholding on your share of partnership income.

Cat. No. 10231X Form **W-9** (Rev. 8-2013)

Thank You, Good Luck, and Have Fun!

NSBC Website

NSBC Website: blogs.und.edu/nsbc

NSBC Email: balloons@ndspacegrant.org

Facebook: North Dakota Near-Space Balloon Competition (NSBC)

https://goo.gl/2pwmnM

Facebook

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