2012-’13 National Student Solar Spectrograph Competition

Participant Handbook

October 31, 2012 Rev A

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Introduction

The goal of this project is to design and build a spectrograph and carry out a ground-based spectroscopy experiment of your choosing. Each team will have the 2012-'13 academic year to declare a science goal, design and build their instrument, collect and analyze data, and perform some type of educational outreach. Teams will travel to Montana in May 2013 to demonstrate their instrument and their findings in a competition-style format.

Project Outline

- Declare a science goal. The point of this declaration is to demonstrate your team’s capability to “figure something out” using your spectrograph.
- Design and build a spectrograph on a budget of $2,000.
- Use your instrument to collect data, which you will analyze and present.
- Provide educational outreach in your community, such as a demonstration to a class or a presentation on solar science.
- Present your work during the competition in the form of a research poster and three ten-minute talks, to address Design and Build Activities, Outreach, and Results).

Competition Rules and Guidelines

- Teams may be comprised of three to seven undergraduates of any applicable field of study.
- All teams must be sponsored by a faculty advisor.
- Graduate students may aid teams in an advisor/ mentor role, but may not be active team members.
- Teams will submit specific science goals; some scoring elements will be judged based on the science goals submitted.
- Project budget must be within $2,000. Funds may be obtained through NSSSC Build Awards or other channels.
- The Sun may be your team's object of study or a light source for an experiment outside of solar science, but no other light sources are allowed. (The exception to this is an integrated light source that is used for calibration purposes only).
- A laptop may be used to interface with your spectrograph for instrument control and data collection. The laptop does not need to be included in your $2,000 budget and Build Award funds may not be used towards its purchase.
- Shipping charges should be accounted for as part of the $2,000 budget.
- Teams are encouraged to collect data relevant to their science goal before the competition dates. However, judging will be based on results obtained at the competition. This is to prevent an unfair advantage to teams with access to solar tracking hardware.
- Any type of telescope that is used with your spectrograph, whether it is a single lens or a commercial telescope, must be included in your budget.
- Any hardware that is donated to a team by a faculty member, inherited from a previous project, or otherwise obtained at no cost must be accounted for in the budget at retail value.
- A selection of diffraction gratings is being provided by Richardson Gratings. Each team is allowed one grating free of charge (and outside of the $2,000 budget constraint).
- On the competition days, you will have access to a heliostat that provides a fixed beam of sunlight. The heliostat mirrors are larger than four inches but for cost and standardization reasons we are limiting the maximum diameter of aperture to four inches (102mm). Larger apertures are not allowed. Details can be found below as well as on the competition website at http://spacegrant.montana.edu/iris/resources.html
- Heliostat use is optional and based upon your science goal.
- Wavelength calibration of your instrument is expected. Output of a normalized intensity, however, is optional based on your team's needs. Each team needs to figure out their calibration and present this calibration data as part of your Project Report.

Competition Information

The NSSSC culminates with all participating teams travelling to Bozeman, MT on May 15-19, 2013 to showcase their spectrograph designs as well as their science results. Daily activities will be held on the rooftop of AJM Johnson Hall and in various lecture halls on the campus of Montana State University. Each team will be given a designated area in a lab to call "home" for the competition. It is in this area that teams can work on staging their spectrograph for the competition. AJM Johnson Hall has a series of telescope pedestals that have been adapted for use during the competition.

Diffraction Gratings and Handbook

A warm "thank you!" to Chris Palmer at Richardson Gratings/Newport for supplying each student with a handbook during the 2010-'11 Pilot Run. These handbooks are no longer in print, but a digital copy can be found at http://gratings.newport.com/information/handbook/handbook.asp.

IMPORTANT: The diffraction grating will likely be the most sensitive and fragile component in your design, and it is a critical one. Every team member should carefully review the grating handling instructions found in Chapter 15 of the Newport handbook before your grating arrives.

A selection of two-inch square diffraction gratings is being provided by Richardson Gratings. Each team is allowed one grating free of charge. Available competition gratings and their specifications can be found at spacegrant.montana.edu/iris/gratings.html

Once your team has decided on a grating, please send your selection and shipping instructions to Randy Larimer.

Competition Area and Heliostat Interface

During the competition days, each team will have at least two 90-minute periods* during which they will collect data to support their science goal. The following will be available to each team during the on-site data collection periods:

- A heliostat equipped with a high-precision mirror providing a fixed beam of Sunlight at 45° from normal.
- An area of 4 ft x 8 ft in front of your assigned heliostat in which to setup your spectrograph.
- Shade tents to accommodate viewing of LCD laptop displays. These tents will be staged far enough away from the heliostats to avoid interference. Teams are required to provide their own interface cables to the spectrographs. Distances to laptops may be up to 20 feet.
- At least one 120V @ 10A power outlet at the heliostat. Power will also be available at the shade tents for laptops.

PLEASE NOTE: On-site data collection will be held on a rooftop with a concrete tile floor. These tiles are not perfectly level. Your spectrograph should be equipped with adjustable legs or some other means of achieving stability on uneven ground.

*In the case of inclement weather, this time may be reduced or substituted with in-lab performance measurements. The competition schedule is tentative and may be restructured in order to give teams an equal amount of time for data collection.

Schedules

Generalized Schedule

Successfully designing an experiment and building the equipment needed to carry it out may seem like a daunting task, especially in the academic year format of NSSSC. Your team may review this suggested timeline of project milestones, and plan a more detailed timeline according to your team's specific objectives and member availability. Required documents are due in accordance with this schedule.

2012

September: Make sure registration is in order. Be underway with research into spectroscopy and possible science goals. Get used to frequent (at least weekly) team meetings in order to keep progress underway. Assign members individual roles in the build process, as well as administrative tasks. Begin your Project Logbook now, and consider assigning one member the task of keeping it complete and well-organized.

October: Science goal should be clearly stated. Based on your team's specific goal, figure out the capabilities (e.g. wavelength resolution, intensity at detector) that will be required of your spectrograph. With these in mind, begin designing your spectrograph and choosing optics. Secure needed laboratory space and resources that you will need on your home campus.

November: Finalize design; calculate theoretical performance capabilities (resolution, intensity, etc.). If design needs are met, order parts. (Plan on some parts taking several weeks to arrive.)

December: Test parts as they arrive. Make your own intensive schedule for January-May that includes necessary tasks such as fabrication, layout, testing, troubleshooting, calibration, data collection, all items on Team Checklist, etc.

2013

February: Have instrument built and fully operational. Perform in-lab testing. Troubleshoot any problems and begin calibration.

March: Finalize plans for travel/ shipping to Montana. Ensure that all items on the Team Checklist have been completed.

April: Present your work and the scope of your science goal in an Educational Outreach event. In addition consider giving a practice presentation at home, especially for those taking science communication or capstone classes.

May: Wrap up your coursework and head to Montana!

Schedule On-Site in Bozeman, MT

Groups represent a maximum of five teams. Group designations and a finalized scheduled will be provided leading up to the competition.

	Wednesday, May 15	
	Spectrograph Demonstration And Poster Presentation	Design and Build Talk
AM	Groups A and B	Groups C, D, and E
PM	Groups C, D, and E	Groups A and B

Thursday, May 16	
Spectrograph Demonstration And Poster Presentation	Outreach Talk
Groups C, D and E	Groups A and B
Groups A and B	Groups C, D and E
Thursday Evening: Open House at MSU	

	Friday, May 17
AM	Results Talk: All Teams
PM	Results Talk: All Teams Open Time
	Friday Evening: Awards and Banquet

Saturday, May 18
Fun In the Sun!
All teams participate.

Summary of Important Dates

2012	September 30	Registration Deadline for teams requesting Build Awards
	September 30	Teams announced and Build Awards Notification
	September 30	Registration Deadline for all team
	October 30	Late Registration Deadline for all teams
	November 15	W-9 Form Deadline for teams accepting Build Award Funds Deadline for Statement of Science Objective – Submitted via email
	November 30	Team Photos/ Bios Deadline. Medical Consent Agreement and Media Release Form
2013	February 28	Deadline for Preliminary Status Report – submitted as PDF via email
	March 30	Deadline for Project Report – submitted as PDF via email
	May 14	Teams travel to Bozeman, Montana
	May 15	Competition Day 1: On-site data collection, Design and Build Talks
	May 16	Competition Day 2: On-site data collection, Outreach Talks
	May 17	Competition Day 3: Results Talks, Open House, Banquet and Awards
	May 18	Fun in the Sun: Rafting, hiking, and other activities in the Gallatin Canyon
	May 19	Teams return home
	June	Scholarship Awards distributed
		Travel awards will be distributed to winning teams when arrangements have been made for the students to go to a NASA launch.

Competition Deliverables

Items 2, 3, and 5 (below) should be submitted to Randy Larmier via email to rlarimer@ece.montana.edu) by midnight on the stated due date. Items 4-6 will be reviewed at the competition.

1. Project Logbook/Engineering Notebook

Teams are expected to keep Project Logbooks throughout the year. These are mostly for your team's own benefit during the design and build process, but will be reviewed during your period of On-site Data Collection. Logbooks should be bound and include regular, dated meeting notes, design sketches, and other relevant entries. Taken with your team's Project Report described below, every step of your design and build should be documented. Judges will be looking for completeness, clarity, and neatness in order to augment the grading criteria described in the Rubric below.

2. Science Objective Report – Due November 15, 2012

A 1-3 page paper describing your team's science objective. Describe the question(s) you are trying to answer and the data you will be collecting. Also, provide a summary of spectrograph capabilities that will be required to accomplish your science goal**. These will be taken as your unique design criteria during later evaluation.** Judging of this report will contribute to the Best Spectrograph Design Award

In the case that your team decides to change your science objective significantly after the November 15th due date, please submit a revised version of this report.

3. Preliminary Status Report – Due February 28, 2013

Submit a 2-3 paragraph description of your team's status to date. Also, provide 3-5 photos with short captions that highlight your progress on your spectrograph**.** Judging of this report will contribute to the Best Spectrograph Build Award

4. Educational Outreach

Teams are to organize, deliver and document an educational outreach event that may include an informative lecture or demonstration given to an elementary, middle or high school audience or the general public. Be creative! Content should be tailored for audience comprehension and engagement. Audience participation activities or interactive media should be used. Make sure to adequately promote and document your event. Judging of this outreach event will contribute to the Best Presentation of Results Award.

(Competition Deliverables – continued)

5. Project Report – Due April 27, 2013

The Project Report is a 15- 20 page document detailing your team's work leading up to the competition. All progress made towards designing, building, and calibrating your spectrograph should be covered. If your science objective has changed at all through the year, you are encouraged to resubmit a revised Science Objective Report. The following sections should be included in the report:

- Annotated CAD images or other final-stage design documentation
- Optical layout schematic showing all optical elements and indicating any mechanically-driven elements (e.g. a rotating grating stage or movable detector)
- A block diagram systems schematic that indicates how data are sent to and from the spectrograph
- Theoretical performance calculations demonstrating that the required performance capabilities stated in your Science Objective Report are met
- Parts inventory: List all optical/ electronic/ mechanical components, cost, and source. Include any materials or hardware that went into construction.
- Project management notes: schedules, team member duties, etc.
- Software interface: describe any software used, and include a description of how your team adapted/ coded your software to interface with your spectrograph
- Calibration documentation. Provide data on reference spectra taken (vapor lamps, LED's, etc.) and document the formulation of a calibration profile
- Sensitivity/ Resolution measurements: These are optional as performance measurements are heavily dependent on available lab equipment
- Data Analysis: Describe how your data is handled once it is obtained. Is calibration applied automatically? Is data displayed in a useful way during/ immediately after scans?
- Operation Procedure: 1-2 pages describing the basic operation of your team's device
- Images should be included where appropriate.
- Sources: Include a references/ works cited page for any outside sources used

Judging of this report will contribute to the Best Spectrograph Design Award and the Best Spectrograph Build Award.

(Competition Deliverables – continued)

6. Poster

Your team should bring a large-format poster to present at the Competition on May 16th, 17th and18th. There are no requirements as to size or the content included, but it should be of a quality typically seen at research conferences. The poster will contribute to the Best Presentation of Results Award.

7. Talks

Each team will give three ten-minute talks during the Competition that highlight their work in the following topics: Design and Build, Educational Outreach, and Scientific Results. Appropriate media should be used to supplement these talks, and all members are expected to participate. The talks will contribute to the Best Presentation of Results Award.

Due to time constraints, teams running over the ten minute limit will be cut off.

- Design and Build Talk (May 16): Highlight the major design features and unique components of your spectrograph. Also, describe the critical moments that your team faced during the build process.
- Outreach Talk (May 17): Showcase the educational outreach your team has participated in.
- Scientific Results Talk (May 18): Present the results that you have gathered during the competition, in the context of your science goal.

Competition Checklist

Submit all materials to Randy Larimer via email at rlarimer@ece.montana.edu

- ☐ **W-9 Form:** Must be filled out and sent in by November 15, 2012 in order to receive Build Award funding.

- ☐ **Statement of Science Objective:** A 1-3 page paper describing your team's science objective. Describe the question(s) you are trying to answer and the data you will be collecting. Also, provide a short summary of required spectrograph capabilities. Submit a PDF file by November 15, 2012.

- ☐ **Team Photos/ Member Biographies:** Please provide a photograph of your team (with your advisor) to be included on the NSSSC website. Also, each team member should submit a personal biography with an individual photo. Please submit by November 30th.

- ☐ **Medical Consent Agreement and Media Release Form** for every participant and advisor; submit by November 30, 2012. These forms are found on pages 21, 22 and 23 of this *Handbook,* respectively.

- ☐ **Preliminary Status Report:** Submit a 2-3 paragraph description of your team's status to date. Also, provide 3-5 photos with short captions that highlight your progress on your spectrograph. Submit by February 28, 2013.

- ☐ **Project Report:** Theoretical calculations, final-stage sketches, CAD designs (printed), parts inventory, budget, calibration data, etc. Submit by April 27, 2013. *Note that wavelength calibration of your instrument is expected.* Output of a normalized intensity is, however, optional, based on your team's needs.

- ☐ **Poster Presentation:** Presented at the Competition on May 16th,17th and 18th, 2013.

- ☐ **On-site Data Collection:** On May 15 and 16, 2013, teams will have 90 minutes on each day to collect data using provided heliostats. The goal is to demonstrate the operation of your spectrograph to the competition judges and to collect data that supports your science goal.

- ☐ **Ten-minute Talks:** On May 15, 16 and 17, 2013 each team will give three ten-minute talks. Teams will give the highlights of their work in the following topics: Design and Build, Educational Outreach, and Scientific Results. Appropriate media should be used to supplement these talks, and all members are expected to participate.
  Due to time constraints, teams running over the ten minute limit will be cut off.

  Specifics of the talks follow:

  - ***Design and Build Talk*:** Highlight the major design features and unique components

Competition Checklist (continued)

of your spectrograph. Also, describe the critical moments that your team faced during the build process.

- ***Outreach Talk**:* Showcase the educational outreach your team has participated in.
- ***Scientific Results Talk:*** Present the results that you have gathered during the competition, in the context of your science goal.

Logistics

Travel, Lodging and Food

All travel, accommodation and food costs are the team's responsibility. Arrangements for inexpensive accommodations on the MSU campus are being planned.

Teams must pay their own travel costs to the competition.

Approximate Cost per person: Total= $785.00 (no options) to $1100.00 (all options) (See note below)

Cost Breakdown:

Airfare	$500.00 (typical)
Hotel	$105 (dorm style housing double occupancy 5 nights)

Competition Housing Options:

- Montana State University Dorm Style Housing Info

Room rate for a single room is $26.00 per night.
Room rate for a double room shared by two occupants is $21.00 per person per night.

- Best Western Plus Grantree Inn

Room rates are $82.00 per night for single or double occupancy
Phone: 800-624-5865 Group Code: TBD

Travel, Lodging and Food (continued)

Food	$180.00 ($30.00 per day for 6 days)
Local Transportation	$30 optional during competition
	($150 per team assume 5 person team)

*******Transportation to and from the airport will be provided by MSGC staff

*******All competition events are within walking distance of the dorm

Fun Day	$150 optional (depending on activity $10 to $150)
Misc.	$135 optional

Note: These prices are budgetary only and may change depending on your unique arrangements.

Please contact your local Space Grant for possible travel assistance.

Shipping

You are responsible for the shipping costs of your spectrograph to and from the competition. If your spectrograph is not traveling with your team, shipping arrangements should be made to have it delivered to:

Montana Space Grant Consortium
Attn: Randy Larimer
264 EPS
Montana State University
Bozeman, MT 59717

Phone: (406) 994-6085

Ensure that all fragile elements are protected during transport!

FAQ

What is a ground-based solar spectrograph?

A spectrograph, often used interchangeably with "spectrometer" or "spectroscope," is an instrument that gathers incoming light and analyzes it by separating out its constituent wavelengths. There are innumerable scientific and technical applications of spectroscopy; most instruments are built for a very specific purpose. Your job will be to decide on a purpose – a scientific goal – and then design and build a spectrograph to meet your own needs. To learn more, visit our IRIS tutorial page.

What type of science can be done with a spectrograph?

The Sun is our closest stellar neighbor, making it an ideal object of study to learn more about the complicated physical processes that take place inside of stars. Each new endeavor in solar science – such as NASA's IRIS mission – brings a wealth of new information about the Sun. But if studying the Sun doesn't sound interesting enough, the possible applications of a spectrograph are limited only to your imagination. Currently scientists are using spectroscopy to answer questions about the Earth's atmosphere, the health of pine trees, and the location of meth houses - and that's just in Montana!

Do we have to study the Sun?

No! While many teams will choose science objectives related to solar science, the Sun may also be used as a light source for whatever science questions you see fit to answer!

Does our spectrograph have to operate in the visible range of wavelengths?

Due mainly to cost constraints, we expect to see observations made in the visible and near-IR/UV ranges. Efficiency information on the diffraction gratings provided by Richardson Gratings can be found at http://spacegrant.montana.edu/iris/gratings.html.

How will we collect light during the competition?

During the competition, multiple heliostats will be set up for teams to interface with. These are equatorial wedge clock drives modified to hold precision aluminum mirrors. These heliostats will provide a fixed beam of light at an angle of 45 degrees from normal.
Please see http://spacegrant.montana.edu/iris/resources.html for more information.

How do we test and use our instrument without access to a heliostat?

Short scans – sufficient for intensity adjustments – may be performed by simply directing your heliostat at the Sun. We expect teams to be collecting their first scientific data at the competition, as this will likely require longer scans than possible without solar tracking hardware.

(FAQ – continued)

What if the light is too powerful?

An aperture of the maximum allowed size of 4" would collect enough light to generate quite a lot of power at the focal point. Teams must consider the operational limits of their optics and other materials used. Aperture size, shutters, neutral density filters, and variable gain detectors are all options when controlling for the intensity of incoming light.

Can we use a light source other than the Sun?

No! No lasers or other artificial light sources may be used in a spectrograph design. The exception to this rule would be an integrated light source used only to verify/adjust calibration. Note that disabling such a light source during collection of scientific should not affect the spectrograph's performance.

Is there a time limit for data collection?

On the day of the competition, each team will have ninety minutes to setup and collect data. Before the competition, we encourage teams to collect as much relevant data as possible.

How do we order our complimentary diffraction grating from Richardson Gratings?

Once your team has decided on a grating, please send your selection and shipping instructions to Randy Larimer. Thank you to competition judge Chris Palmer and Richardson Gratings for their ongoing support.

Where can we get additional optics?

Besides Richardson Gratings, Newport Corporation, ThorLabs, Edmund's Optics and other online retailers supply optical equipment at reasonable costs. Other companies specialize in liquidating surplus optics (such as Surplus Shed), and may be a cost effective option for certain items.

What type of lenses/ detector/ other optics/ mounts/ etc. should our team use?

Figure it out! Each optical element has an efficiency that is dependent on wavelength, and will affect your usable signal. Also, think carefully during the design process about the need to align optics as the device is built. Pay close attention to all tech specs to make sure all of your optics will perform as needed. It will be up to your team to review the return policy of any store you order from.

Our team does not have access to a machine shop. Is that a problem?

No! With some creativity and ingenuity plywood, PVC, and other low-cost items can be used to form a light-proof and stable optics platform.

Does our spectrometer have to be weather-proof?

The extent of weather-proofing applied is up to individual teams. We recommend that your instrument can withstand at least brief exposure to light showers.

(FAQ – continued)

What type of calibration are we expected to perform?

Wavelength calibration is expected in order for your team to present spectral data in a standardized fashion. Calibrating your instrument to output a normalized intensity (radiometric calibration) is optional based on your team's specific needs.

What are the optical specifications of the mirror used in the heliostats?

The heliostat mirrors were chosen for their high quality of surface flatness. This feature ensures that light will be reflected uniformly before entering your spectrometer. The mirrors are aluminum coated, so their efficiency closely matches the reflectance of aluminum curves plotted on the grating reflectance curves found at http:/spacegrant.montana.edu/gratings.html.

Does our team have to be comprised of different majors?

While we encourage a multidisciplinary approach to the competition, there is no requirement to have multiple majors on a team.

Are international teams allowed?

Unfortunately, due to the rules regarding build and awards funds provided by NASA, we are currently unable to accept international teams.

What if it is cloudy or raining during the competition?

In the event that the weather is uncooperative during the competition, artificial light sources (such as vapor lamps) will be provided to test spectrograph performance. The goal should be to have presentable scientific data BEFORE the competition; think of the competition days as an opportunity to demonstrate your design and share science ideas.

Will there be access to power outlets at the competition?

Yes, standard 120V wall outlets and extension cords will be available.

Can graduate students participate in the competition?

Graduate students may aid teams in an advisor/ mentor role, but may not be active team members.

Scoring Rubrics and Awards

Awards will be given for the following activities:

- **Best spectrograph design,**
- **best spectrograph build,**
- **best science observation, and**
- **Best presentation of results.**

Samples of the scoring rubrics are found on the following four pages.

NSSSC Award Rubric 2012-2013

Best Spectrograph Design Award

Points Breakdown: Team_____

0 - No elements of the grading criteria are present
1 - Criteria incomplete, some elements are present
2 - Criteria are mostly satisfied in an acceptable manner
3 - Grading criteria are fully satisfied in an acceptable manner
4 - Grading criteria are fully satisfied in an exceptional manner
5 - Criteria are fully satisfied in an exceptional manner, and additional efforts are clearly demonstrated

Science Objective: (Due November 15 – Science Objective Report used to Evaluate) (Revisions after this date will not be scored in this category) • Relevant; is there potential to learn something new? • Clearly defined; is there a well-stated question or hypothesis? • Spectroscopy is employed in an effective manner • Spectrograph performance requirements are defined • Goal is within the scope of a one-year project	__ / 5
Design Documentation: (Due April 27 – Project Report used to Evaluate) • Complete • Well-organized • Budget met • Project management demonstrated	__ / 5
Design Merit: (Due April 27 – Project Report used to Evaluate) • Design contains an effective optical layout • Component selection is effective based on stated requirements • Theoretical calculations (ie, resolution and sensitivity) • Performance requirements satisfied	__ / 5
Creativity and Resourcefulness • Clever solutions to design challenges • Materials selection • Fabrication technique • User interface is present in design	__ / 5
Total Points	

In the case of a tie, the judges will choose the winning team and the judges' decision is final.

NSSSC Award Rubric 2012-2013

Best Spectrograph Build Award

Points Breakdown: Team_____

0 - No elements of the grading criteria are present
1 - Criteria incomplete, some elements are present
2 - Criteria are mostly satisfied in an acceptable manner
3 - Grading criteria are fully satisfied in an acceptable manner
4 - Grading criteria are fully satisfied in an exceptional manner
5 - Criteria are fully satisfied in an exceptional manner, and additional efforts are clearly demonstrated

Preliminary Status Report and Spectrograph Photo: Due February 28 • Send a photo of your spectrograph (as is on this date) and a paragraph describing where you are in your build process	__ / 5
Build Documentation: (Due April 27 – Project Report used to Evaluate) • Parts and materials inventory tabulated • All parts and materials are within budget • Component tests are performed and documented • Troubleshooting is documented in logbook	__ / 5
Craftsmanship • Optical platform is stable • Ease of setup • Ease of operation • Built and operates as designed	__ / 5
Scope of Use • Can the spectrograph interface with the NSSSC heliostat? • Is there sufficient adjustability to work with our contest heliostat? • Is the device adaptable in the data it can collect • Were optical elements treated carefully and in good condition?	__ / 5
Functionality (does it function as designed?) • Electronics are properly wired and grounded where needed • Mechanical elements operate with required precision • Optical elements properly aligned and easily adjustable if needed • Software interface is intuitive and functions smoothly • Performance at or near theoretical limit	__ / 5
Total Points	

In the case of a tie, the judges will choose the winning team and the judges' decision is final.

NSSSC Award Rubric 2012-2013

Best Science Observation Award

Points Breakdown: Team_____

0 - No elements of the grading criteria are present
1 - Criteria incomplete, some elements are present
2 - Criteria are mostly satisfied in an acceptable manner
3 - Grading criteria are fully satisfied in an acceptable manner
4 - Grading criteria are fully satisfied in an exceptional manner
5 - Criteria are fully satisfied in an exceptional manner, and additional efforts are clearly demonstrated

Data collection • On-site data collection is efficient • Observations are repeatable and accurate • Data collected supports science goal • Is data displayed live in an informative way? • Can all members operate spectrograph/ collect data?	__ / 5
Data Analysis • Tests performed with known light source(s) and documented • Wavelength calibration is formulated and verified • Intensity calibration is formulated and verified • Data calibration/ normalization applied automatically?	__ / 5
Error Analysis • Theoretical limitations calculated • Actual performance determined experimentally • Sources of noise are controlled or considered carefully	__ / 5
Documentation • Logbook is used for instrument testing and data collection • All data is archived properly • Supporting data (time of day, weather, etc.) are included • Sufficient observations are collected to support science goal	__ / 5
Total Points	

In the case of a tie, the judges will choose the winning team and the judges' decision is final.

NSSSC Award Rubric 2012-2013

Best Presentation of Results Award

Points Breakdown: Team_____

0 - No elements of the grading criteria are present
1 - Criteria incomplete, some elements are present
2 - Criteria are mostly satisfied in an acceptable manner
3 - Grading criteria are fully satisfied in an acceptable manner
4 - Grading criteria are fully satisfied in an exceptional manner
5 - Criteria are fully satisfied in an exceptional manner, and additional efforts are clearly demonstrated

Poster Presentation (at competition) • Science objective is clearly explained • Spectrograph design is clearly explained • Data is presented clearly and in a way that supports science goal • Emphasis is given to original work done by team	__ / 5
Design and Build (ten-minute talks at competition) • Content is engaging and informative • Media used effectively • Team member participation • Talk is polished (rehearsed) and professional	__ / 5
Science Results (ten-minute talks at competition) • Scientific statements are clear, concise, and in line with observation • Results are aligned with original science goal • Error analysis is present in results • Critical troubleshooting is highlighted	__ / 5
Outreach (ten minute talks at competition) • An informative lecture or demonstration is given for an elementary or high school audience • Content is tailored for audience comprehension and engagement • Audience participation activities or interactive media is used • The event is adequately promoted and documented	__ / 5
Total Points	

In the case of a tie, the judges will choose the winning team and the judges' decision is final.

REQUIRED FORMS

The following forms *must* be filled out, scanned as PDF's and returned to Randy Larimer at:

rlarimer@ece.montana.edu by **November 30, 2012**

MEDICAL CONSENT AGREEMENT - Student

If I should require medical treatment because of injury or illness during the National Student Solar Spectrograph Competition, I understand that every effort will be made to contact the parent for whom I have provided information below. I consent to such treatment in an emergency or if I am unable to consent to such treatment.

A copy of my medical insurance card from _____ is attached.

I acknowledge that Montana State University (MSU) or Montana Space Grant Consortium (MSGC) does not provide health and accident insurance for National Student Solar Spectrograph participants and I agree to be financially responsible for any medical bills incurred as a result of emergency or other medical treatment. I will notify the competition organizer in writing if I have medical conditions about which emergency medical personnel should be informed.

I acknowledge that I have read the foregoing MEDICAL CONSENT, understand it and sign it voluntarily. I am at least eighteen (18) years of age and fully competent and I fully intend to be bound by the terms of this agreement.

Printed Name of Student: _____

_____ _____
Signature of Student Date

_____ _____
Name of Parent for emergency contact Parent Phone No.

MEDICAL CONSENT AGREEMENT - Advisor

If I should require medical treatment because of injury or illness during the National Student Solar Spectrograph Competition, I understand that every effort will be made to contact the emergency contact for whom I have provided information below. I consent to such treatment in an emergency or if I am unable to consent to such treatment.

A copy of my medical insurance card from _____ is attached.

I acknowledge that Montana State University (MSU) or Montana Space Grant Consortium (MSGC) does not provide health and accident insurance for National Student Solar Spectrograph participants and I agree to be financially responsible for any medical bills incurred as a result of emergency or other medical treatment. I will notify the competition organizer in writing if I have medical conditions about which emergency medical personnel should be informed.

I acknowledge that I have read the foregoing MEDICAL CONSENT, understand it and sign it voluntarily. I am at least eighteen (18) years of age and fully competent and I fully intend to be bound by the terms of this agreement.

Printed Name of Advisor: _____

_____ _____
Signature of Advisor Date

_____ _____
Name of Emergency Contact Emergency Contact Phone No.

MEDIA USE PERMISSION FORM – All Participants

During the National Student Solar Spectrograph Competition photographs and videotape footage may be obtained to document the competition's activities. This material will be used to document and publicize various aspects of the National Student Solar Spectrograph Competition.

I grant permission for photos, slides, and videotape footage of myself to be used in presenting the activities and results of the National Student Solar Spectrograph Competition.

Printed Name: _____

Signature of Participant: _____ Date:_____