



SOCIETY OF PHYSICS STUDENTS

An organization of the American Institute of Physics

Marsh White Award Report Template

Instructions: Please complete each section after reading the purple text describing what should be in that section. Then delete the purple text.

Project Proposal Title	Scoping Out Astronomy!
Name of School	US Air Force Academy!
SPS Chapter Number	7502
Project Lead (name then email address)	Cadet Thomas Dickinson C14Thomas.Dickinson@usafa.edu
Additional Project Leads (two lists: names then emails)	Major Matthew Spidell, Matthew.Spidell@usafa.edu Dr. Devin Della-Rose, Devin.Della-Rose@usafa.edu
SPS Chapter Advisor	Dr. Devin Della-Rose
Total Amount Received from SPS	\$300.00
Total Amount Expended from SPS	\$300.00

Summary of Award Activities

USAFA SPS currently hosts hundreds of young students each year at our observatory tours. This semester we augmented these tours by adding a station where students built simple refracting telescopes from two convex lenses and a cardboard tube that they may keep at the end of the evening. The students were excited about the project and they learned a lot!

Statement of Activity

Overview of Award Activity

and

Impact Assessment: How the Project/Activity/Event Promoted Interest in Physics

In the fall of 2013, the United States Air Force Academy's Chapter of Society of Physics Students (USAFA SPS, #7502) proposed a project to build enthusiasm for physics and astronomy among young students in the Colorado Springs area. USAFA SPS currently hosts hundreds of students each year at our observatory tours and our "Physics is Phun" shows. It was proposed that interest in physics would be generated by giving students hands-on experience building a rudimentary refracting telescope with which they could observe the night sky. Additionally, because of the low cost of each telescope, it would be something the students could take back and share with friends and family, hopefully explaining how the device works and further spreading interest and awareness.

Due to the complexity of managing funds in a government bureaucracy, though we received the \$300 check for the Marsh White Award by February, we were unable to use the funds to purchase materials until mid-March. All purchases were made through the online wholesale supplier Enasco. With the Marsh White Award funding we ordered approximately 100 un-mounted double convex 3.75 cm diameter lenses with a 30 cm focal length (the objectives) and approximately 100 un-mounted double convex 3.75 cm diameter lenses with a 5 cm focal length (the eyepieces). We also purchased craft foam, glue guns, and card stock with the Marsh White Award funds. The craft foam and glue guns serve to hold the lenses in place while the card stock is rolled up around the eyepiece and inserted into the paper towel tube to serve as the focusing mechanism. The cardboard paper towel roll tubes were used as the bodies of the telescopes and were provided by USAFA SPS and the visiting students.

In April 2014 when our order arrived we discovered that we had bought-out the wholesale supplier. We received only half of the eyepieces that we ordered and none of the objectives, with the rest placed on backorder. Fortunately we were able to borrow a supply of

objective lenses from elsewhere in the department that would work well for this project. In mid-April USAFA SPS built a prototype telescope to make sure that our plan would work.

Finally, on April 24th, 2014 a group of about twenty-five students visited the USAFA observatory for a tour. With ray-tracing diagrams we taught them how optics worked and then provided them with the necessary materials and instructions for the project. The full instructions can be found in our MWA project proposal. The students loved the project and were really excited about it. They were having so much fun that we doubt they even realized that they were learning principles of optics and astronomy that are often part of a high school or introductory college course! Having finished his telescope, one student asked whether his image should be inverted. We told him to look again the ray-tracing diagram on the board, and decide for himself. After a brief glance, he exclaimed “yes, it should be inverted!” This was a powerful moment—seeing a young student think independently and draw his own conclusion. At the end of the night the students were allowed to take the telescopes home with them, all for a cost of about \$3.00 per telescope!

Because we were unable to start until late in the semester USAFA SPS still has a supply of project materials that will be used up during the next year, but the first night was an awesome success! We will continue building these telescopes with young students during our observatory tours next semester until our supplies run out. We have an additional supply which will be used next spring at the 17th annual Girls in the Middle Conference. This event inspires over 200 at-risk Colorado middle school girls toward careers in the sciences!

The project turned out to be a great way to get children excited about science, and to teach them that physics and astronomy are not boring or “too hard.” Every student involved left with a big smile, and as a bonus got to keep the telescope they built to share with family and friends. We strongly encourage this project to anyone who is interested in doing something like this!

Key Metrics and Reflection

Please answer the questions below. Please indicate if a question is not applicable to your project.

Who was the target audience of your project?	Young Students
How many attendees/participants were directly impacted by your project? Please describe them (for example “50 third grade students” or “25 families”).	25 students so far, hundreds in the future!
How many students from your SPS chapter were involved in the activity, and in what capacity?	5 SPS members were involved in planning and carrying out the project.
Was the amount of money you received from SPS sufficient to carry out the activities outlined in your proposal? Could you have used additional funding? If yes, how much would you have liked and how would the additional funding have augmented your activity?	Yes, the funding was sufficient. We could use additional funding (at the cost of about \$3 per telescope) to do this project with as many students as possible!
Do you anticipate repeating this project/activity/event in the future, or having a follow-up project/activity/event? If yes, please describe.	Yes! We have additional supplies and will be reaching at least 200 students next year.
What new relationships did you build through this project?	This project helped strengthen the relationship between USAFA SPS and the community!
If you were to do your project again, what would you do differently?	Order the supplies as early as possible! The lenses can be hard to find in bulk.

Expenditures

The main cost of the project was the objective lenses and the eyepieces at a little over one dollar per lens. Everything else was pretty trivial and most SPS chapters already have some of these things (like glue guns or card stock) on hand already. The 3.75 cm diameter lenses work perfectly with a paper towel tube, but you can play around with the focal length to get a different magnification. We found this combination ($f=300\text{mm}$ for the objective and $f=50\text{mm}$ for the eyepiece) to work great!

Expenditure Table

Part #	Link	Description	# Needed	Cost/Item	Total Cost
SB10480M	http://www.enasco.com/product/SB10480M	(objective) Unmounted Optical Lenses - Double Convex 3.75 cm Diameter, 30 cm Focal Length	100	\$1.40	\$140.00
SB10476M	http://www.enasco.com/product/SB10476M	(eyepiece) Unmounted Optical Lenses - Double Convex 3.75 cm Diameter, 5 cm Focal Length	100	\$1.35	\$135.00
9729446	http://www.enasco.com/product/9729446	(craft foam to hold lenses in place) Creative Hands® - Mixed Colors Sheets Craft Foam	1	\$5.30	\$5.30
9731441	http://www.enasco.com/product/9731441	(glue gun) Dual-Temp Glue Gun	2	\$7.90	\$15.80
9716287	http://www.enasco.com/product/9716287	(card stock for focusing tube)Array® Card Stock - White	1	\$9.95	\$9.95
				Total	\$306.05

Activity Photos

Pictures of a successful project!



USAFA SPS President C1C Dickinson builds a prototype telescope to make sure that our plan will work flawlessly!



As expected the prototype telescope works great! The kids are going to love this.



Major Matthew Spidell teaches young students about the optics of a Galilean telescope before they start building them together.



Cadet First Class Rogers and Major Spidell teach students how to put their telescopes together.



Students enjoy learning some physics while building their telescopes as Major Spidell explains how friction helps hold the focusing element of the telescopes in place.



A student enjoying the view through a telescope that he built! Maxwell's laws in action!



If you have any questions, please contact the SPS National Office Staff
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