SOCIETY OF PHYSICS STUDENTS
An organization of the American Institute of Physics

Marsh White Award Report Template

Project Proposal Title	Renewing Physics Demonstrations for Community Outreach
Name of School	University of Maine
SPS Chapter Number	4043
Project Lead (name then email address)	Graham Van Goffrier, graham.van@maine.edu Greg Buotte, gregory.buotte@maine.edu
Total Amount Received from SPS	$500.00
Total Amount Expended from SPS	$500.00

Summary of Award Activities

Our chapter members, all part of the University of Maine Physics Department community, actively involve themselves in promoting study of physics to pre-university students in our local area and across the state of Maine. The funding provided for our Marsh White project enabled the refurbishment of existing physics demonstrations, targeted towards children of all ages, as well as the purchase and setup of new demonstrations filling certain topical needs. Some of these portable demonstrations were first employed at an inter-university Engineering Expo in March, at which most of our active members volunteered, as well as other statewide events continuing into the summer.

Statement of Activity

Overview of Award Activity

The intent of this project was to update the demonstrations available to our SPS Chapter and physics department for use at the annual Engineering Expo, as well as other traveling events and school visits through the year. SPS student members were most heavily involved in the setup, operation, and takedown of these demonstrations at the events mentioned, but also participated in the evaluation of demonstration performance and selection of new additions to the collection. These events could be said to be the context of this project: our chapter members have long participated in such events as part of our service to the department and the community. The University of Maine, as the state's foremost land-grant public research university, takes its responsibility to the education of the state's youth citizenry very seriously, and our department has played a large role in advancing pre-university physics awareness.

The tangible project outcome is five updated or new demonstrations; two of which are completed and have been deployed at events, and three of which will be completed this summer once remaining part orders are fulfilled. The outlined plan for division of SPS member volunteers into demo development teams was not followed; limited availability of members and officers required a more improvisational approach, with the wide majority of volunteer hours centered around the Engineering Expo. Therefore, although volunteers did not benefit from educational design experience as much as hoped, they gained significant experience with scientific outreach to youth in public settings. The funds provided by Marsh White allowed for the updating of a demonstration repertoire in constant need of modernization, and will thereby continue to ensure this productive learning for volunteers and attendees alike for years to come. Overall, we estimate that around 8000 total people have been reached by our SPS volunteers and/or updated demonstrations since the award was granted.

There is no higher highlight in this kind of community service than when a visiting child turns to their guardian as they walk away, and the conversation about physics continues. Our member volunteers in one voice describe the pleasure of knowing they have given a child some small boost along the path to knowledge.

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

The three key goals of this project and their fulfillment or remaining work are as follows:

1. Renovate existing demonstrations

First, obtaining replacement belts and thereby repairing our Van de Graaff generator was a key task. The UMaine SPS chapter finds that upper elementary and middle school students enjoy seeing and experiencing a Van de Graaff generator; it is one of the few demonstrations which immerses a student beyond just sight and sound.

Second, the long-used Newton's cradle which we had hoped to refurbish was determined to be beyond repair, and the purchase of a new model helps to replenish the mechanical aspect of our demonstrations.

2. Create new demonstrations

Many students in the state of Maine are likely to participate in our demonstrations more than once, whether through a school event, a visit to a public expo event, or a trip to UMaine. Therefore in order to capture their attention, it is critical that the students experience something new each time, and so our demonstrations must evolve from year to year.

First, the purchase of a large stock of diffraction-grating glasses (most easily explained via the two attached images) has a dramatic impact upon student enjoyment of our optical demonstrations. Previously students had taken turns observing colored lights through one permanently fixed set of diffraction goggles; now they are able to participate at the same time and are encouraged to compare their observations with one another. Even more significantly, the unit cost of these glasses is low enough that we are able to give students their own pair to keep, along with a level-appropriate explanation of “home experiments” by which they might continue their exploration.

Second, we are still in the process of purchasing and then outfitting both a hand-crank generator demonstration and handspun helicopter demonstration for use at outreach events. Their setup, use at demonstrations, and continued fine-tuning will involve SPS student member volunteers at every stage.

3. Deploy demonstrations at Engineering Expo and other events

Time limitations and availability of student volunteers had a significant bearing on this project. We had outlined in our proposal a goal of aligning student teams towards the creation of particular new demos, as semi-independent projects; however, ultimately far more volunteer hours were devoted towards setup, student interaction, and takedown at demonstration events. Awareness itself of the Marsh White award allowed us to recruit member volunteers in large quantities, managing both existing and new demos. These events were numerous and represented a great benefit to the local community as well as to the enrichment of those SPS member volunteers who participated, and are listed

below. Also listed is one scheduled future events at which our SPS members will volunteer, and at which the new demonstrations mentioned which are still being ordered will first be deployed and tested before use in the Fall.

February: 2018 UMaine Engineering Expo – ~10 volunteers, ~1700 visitors
May: STEM Days at Funtown Splashtown USA – 3 volunteers, ~3000 visitors
(additional 3700 visitors reached by demos both on campus and on the road, but without student volunteers)
July: UMaine 4H Days at Windsor Fairgrounds

The proposed assessment plan was as follows:

“The direct success of this project may be measured simply by evaluating the functionality of the demonstrations developed. However, much more meaningful is the subsequent indirect effects of benefits conferred to area students whose exploration of physics is enabled.

The primary available metric at public STEM-awareness events such as our university’s Engineering Expo is the quantity of visitors/participants. By comparing number of total participants who visit the physics demonstrations with that of previous years, the total improvement resulting from this project can be assessed. This evaluation can also help to identify which demonstrations are more popular with students and therefore more effective than others, allowing for continued refinement of the products.“

We did not collect numerical data on visitors/participants to individual demonstrations at the Expo and other demonstration events. A more heuristic and gradual approach was followed, where the many SPS member volunteers combine their observations of the popularity of various demonstrations to evaluate their usefulness. Yet oftentimes, popularity by itself is not a good enough metric for usefulness; for example the Van de Graaff generator can only allow one focused participant at a time, compared perhaps with the diffraction glasses which are intended for multiple participants discussing what they are seeing with one another.

Therefore we claim success of this project based upon the continued enjoyment and learning which our volunteering members observed in the faces of youth attendees. Many of our volunteers are at the junior year or below, and so will be able to carry these observations with them as they take the helm of our SPS chapter in the year or two to come, and continue to make improvements to demonstrations.

Key Metrics and Reflection

Who was the target audience of your project?	Pre-university students in Maine
How many attendees/participants were directly impacted by your project? Please describe them (for example “50 third grade students” or “25 families”).	~8000 attendees of expos, STEM days, roadshow and visit demonstrations (so far)
How many students from your SPS chapter were involved in the activity, and in what capacity?	3 involved in updating demonstrations, 10 involved in volunteering
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 provided was more than sufficient, and provided us with the flexibility to adapt our plans as needs became more clear.
Do you anticipate repeating this project/activity/event in the future, or having a follow-up project/activity/event? If yes, please describe.	Our volunteering at events of this kind will continue regularly each year, and specifically this summer.
What new relationships did you build through this project?	None in particular by name, but each attendee of our demos who enjoyed themselves could be considered a new relationship in some small way!
If you were to do your project again, what would you do differently?	We would have started the project in the Fall, giving student volunteers more time to truly develop their own demonstrations.

Press Coverage (if applicable)

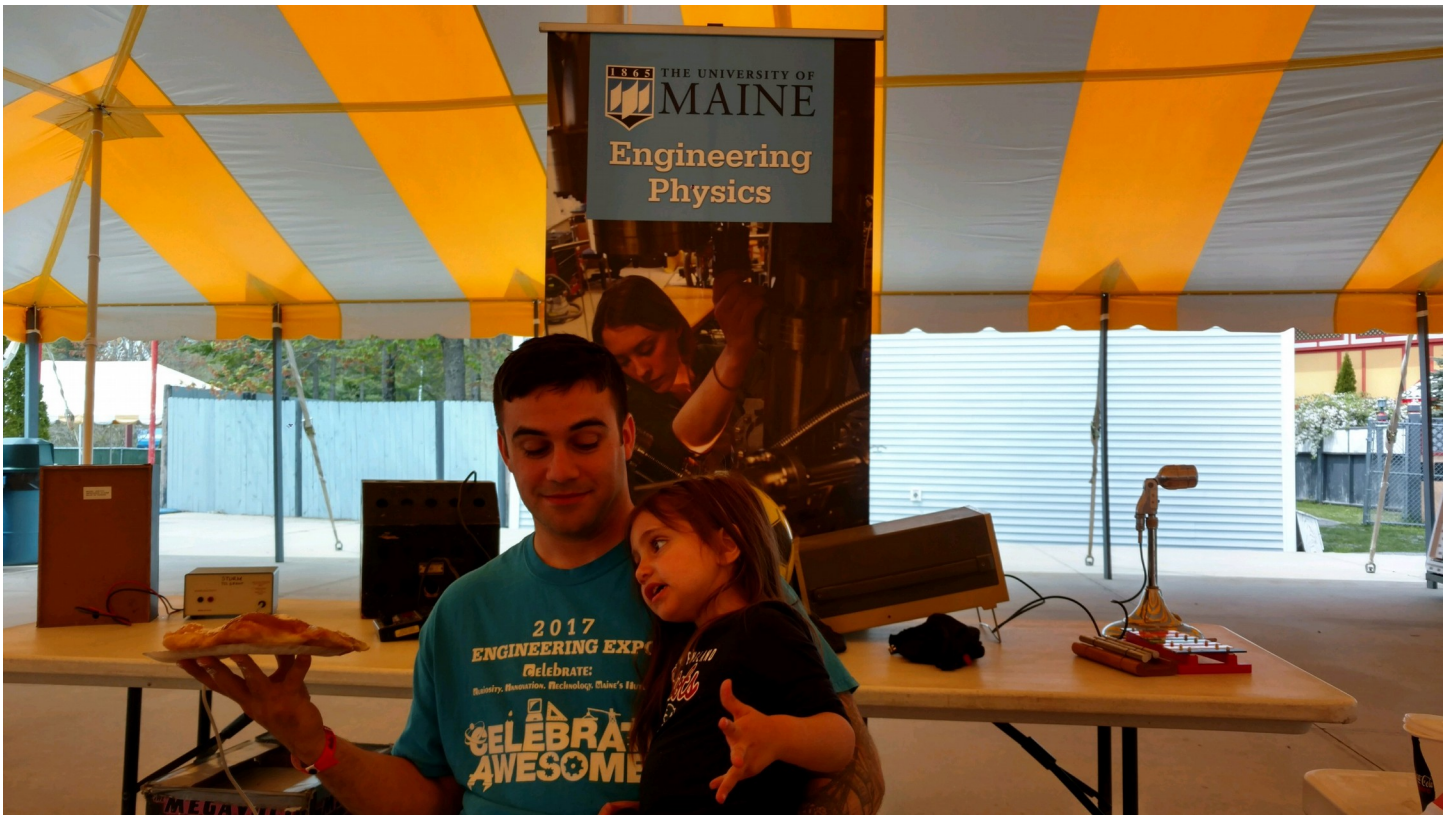
Expenditures

Our purchases for updating demonstrations were carefully chosen to match the funding amount available from Marsh White. All funds are allocated towards demonstrations or demonstration components, either as replacements/repairs or new additions to our repertoire of demos.

Expenditure Table

Item	*Please explain how this expense relates to your project as outlined in your proposal.*	Cost
Diff. Glasses (Rainbow Symphony)	Interfaces with existing optical demos but provides a unique take-home experiences for attendees.	500 @ $.30 = $150
Van de Graaff Belts (PASCO)	Repairs existing and popular demonstration for more effective electrical property visuals.	2 @ $29 = $58
Newton's Cradle (MAKIGO)	Replaces worn out model which has been highly popular with students.	$35
Hand-crank Generator (PASCO EM-8090)	Extends success of demonstration in the college classroom to visiting students.	$200
Handspun Helicopters (Oriental Trading)	Sample of flight which is especially relevant to drone-engaged students.	36 @$5/dozen = $15
Fresnel Lens Plastic Sheet	Important optical demonstration component with low usage-lifetime.	20 @ $1.05 = $21
Magnifying Glass	Important optical demonstration component with low usage-lifetime.	20 @ $1.05 = $21
Total of Expenses		$500.00

Activity Photos



Chapter member Justin Puckett at STEM Days, Photo by David Sturm (Umaine)

View of optical demo through diffraction glasses, Photo by David Sturm (UMaine)

Take-home diffraction glasses, Photo by David Sturm (UMaine)

Student attendee at STEM Days enjoying repaired Van de Graaff generator, Photo credit David Sturm (UMaine)

Chapter President Graham Van Goffrier and Secretary Abby McGee at Engineering Expo