

Warren J. Baker Endowment

for Excellence in Project-Based Learning

Robert D. Koob Endowment for Student Success

Proposal Cover Page

Title of Project:

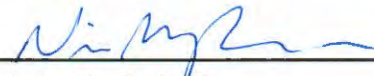
WATER FUN AT EXPLORATION STATION

Proposal Author: NICHOLAS RUNYAN

Cal Poly Email: nrnyan@CALPOLY.EDU

Student ID: 007300952

Signature (Optional):



Signature provides permission to check financial aid eligibility.

Previous Baker/Koob Endowment funding? (circle one):

Yes

No

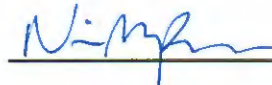
Team Member(s)

Signature

Cal Poly Email

Department

NICHOLAS RUNYAN



NRUNYAN@CALPOLY

MECHANICAL ENG.

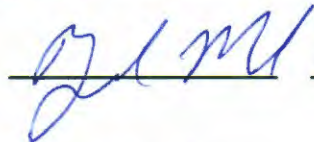
Heriberto Rodriguez



herodri02@calpoly.edu

Computer Eng.

RAYMOND MORAN



rmoran07@calpoly.edu

MECHANICAL ENG.

Faculty Advisor: SARAH HARDIN

Department: MECHANICAL ENG.

Faculty Advisor email: SHARDIN@CALPOLY.EDU

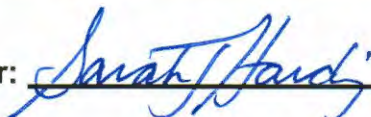
Telephone: 805-756-7994

Anticipated Start Date: SEPTEMBER 29, 2016

Anticipated End Date: JUNE 2, 2017

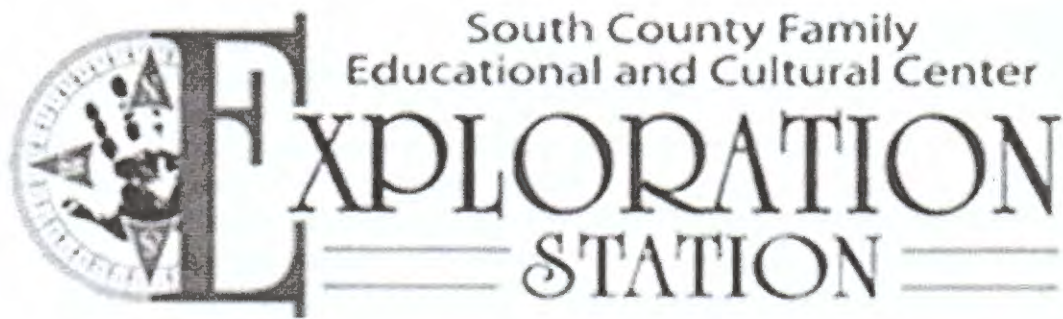
Total Funds Requested (\$): 2500.00

Signature of Faculty Advisor:



Date:

11-14-16



Water Fun at Exploration Station

Baker-Koob Endowment Funding Proposal

November 14, 2016

Submitted by:
H2O Innovations

Raymond Morales, rmoral07@calpoly.edu
Heriberto Rodriguez, hrodriguez1821@gmail.com
Nicholas Runyan, nrunyan@calpoly.edu

I. Abstract

H2O Innovations is comprised of three California Polytechnic State University (Cal Poly) engineering seniors: Nicholas Runyan (Mechanical Engineering), Raymond Morales (Mechanical Engineering), and Heriberto Rodriguez (Computer Engineering). For our senior project, we are working with the Exploration Station to bring an engaging and educational new exhibit to their visitors. The Exploration Station is a nonprofit children's science museum located in Grover Beach, California, catering to large groups of students and families during its hours of operation on Thursday through Sunday. They take much pride in the quality and quantity of fun and interactive science exhibits within their building -- once the location of the Grover Beach fire station. The Scientific Exhibit Committee at the Exploration Station would like to see the current (not in use) water exhibit on display in front of their facility either redesigned and renovated, or completely replaced with a new interactive and educational water feature exhibit. This funding proposal will include a brief snapshot of the background research completed, our work plan moving forward, important dates and deadlines during the design process, as well as a description of how funding from Baker-Koob would help us to carry out our senior project with the Exploration Station.

II. Introduction

After our first meeting with our project sponsors at the Exploration Station, we were able to better understand their needs and wants for what this new exhibit would be capable of. Among these needs include that the exhibit will be educational, fun, safe, and low cost. Additionally, they expressed dissatisfaction with the current water table on exhibit, as it was lacking educational features and simply was not engaging enough for their visitors. Our goal is to create a functioning, durable water feature that meets a number of educational standards for children ages 2-13 at the lowest possible cost. This new feature will help to bring a hands-on and engaging means of learning fluid dynamic concepts to the local visitors and hopefully inspire those who interact with it to see the wonder of science and engineering. We are fortunate to be an interdisciplinary team that has skills in the backgrounds of both mechanical engineering and computer engineering, which gives us a large advantage for optimizing the performance as well as "coolness" factor of the exhibit.

III. Objectives

A list of engineering specifications was developed so as to have a better means of meeting our sponsors' needs and wants. Engineering specifications are a set of standards that are quantifiable and measureable, used to gauge the success of a design. These are listed in **Table 1**. It is important to note that this is an abridged version of a longer list of engineering specifications, however for the purpose of this funding proposal we chose to list only a few so as to highlight key points. Funding from the Baker-Koob endowment would be very valuable in allowing us to meet these goals, as it would give us a means to use higher quality materials in our fabrication. Our sponsors have made it clear that a low maintenance frequency was something that is very important to them. Should our team be constrained to purchasing bottom line pumps and filter systems, then it will only put long-term stress on the members at the Exploration Station, and harbor dissatisfaction with the product we have given to them. Our goal is to have our sponsors be completely satisfied with the end product, and sufficient funding is a very valuable resource to have in accomplishing this.

Table 1: Engineering Specification Table

Spec	Parameter Description	Requirement or Target (units)	Tolerance
1	Sub-system/ components maintenance frequency	Once every two weeks	± 1 week
2	Number of visitors exhibit can accommodate	Min. of 8 visitors	± 2 visitors
3	Number of educational features	3 features	± 1 feature
4	Total cost of project	Under \$2500	$\pm \$300$
5	Exposed hazards	0 exposed hazards	n/a
6	Maximum water depth	3 inches	± 0.5 inch
7	Supporting weight	Min. of 250 lbf	± 50 lbf

IV. Methodology

Our team began work for the Exploration Station project during the first two weeks of the Fall 2016 quarter. Up to this point, we have completed the problem identification step that is preliminary and critical for the engineering design process. As of November 10, our team will have completed the ideation process and chosen a final design to move forward with in terms of more in depth design and fabrication. This will be presented to our sponsor in the form of the Preliminary Design Review (PDR). Following the PDR, our team will engage in more advanced design analysis using engineering tools such as SOLIDWORKS modeling and fluid dynamics analysis to make our design concept a functioning reality. After sufficient analysis, we will begin fabrication and product testing to ensure that everything is functional in time for the Final Design Review in June 2017.

V. Timeline

In terms of design reviews, there are three main deadlines to look out for: Preliminary design Review (PDR), Critical Design Review (CDR), and Final Design Review (FDR). PDR is scheduled for November 17, 2016, and will be the presentation of all basic design work completed thus far, including ideation documentation and prototyping results. CDR is scheduled for February 17, 2017. This report will be based around a functional description of our final design, including layout drawings of the main system as well as subassemblies and components. At this time, we will also have to provide a detailed cost breakdown as well as a discussion on safety considerations and material selection. Lastly, FDR is scheduled for June 2, 2017. This is the final presentation that we give to our sponsors, building off of the information presented in the critical design review. The main focus of the FDR will be on manufacturing and testing, as well as conclusions on the entirety of the water exhibit project.

VI. Final Products and Dissemination

Our goal at the end of the senior project is to develop a fully operational water exhibit for Exploration Station in Grover Beach. This exhibit will be used by the local community, including the elementary schools as well as central coast families who visit the station. We will design, prototype, and build an exhibit that can accommodate eight to ten children. This exhibit will include a base, water basin, multiple pumps, plumbing systems, water reservoirs, filtration system, engaging water features, electronic controls-microcontrollers, and many other components needed to complete each subsystem of the exhibit. The appearance of the exhibit will be visually appealing.

This project and its successful completion will be presented to our project sponsors as well as the general public. During senior project, we will be presenting our project directly to our sponsors on multiple occasions throughout the 2016-2017 school year. In June 2017, we will present our project during Senior Project Exposition at Cal Poly. The "Senior Expo" invites the community, sponsors, donors, fellow students and faculty to see the projects that the mechanical engineering seniors have completed. Following the Senior Expo, the exhibit will be delivered to Exploration Station in Grover Beach to be put on display. Exploration Station will have the opportunity to display the new exhibit on their website to attract visitors to their children's museum.

VII. Budget Justification

Our proposed budget is designed in reference to a budget analysis from a 2014 senior project team at Cal Poly tasked with fabricating an interactive water exhibit for the San Luis Obispo Children's Museum. As the scope of this project is similar to that of ours, we used the cost analysis provided in their Final Design Review as a starting place for estimating the cost distribution for the exhibit we will be designing.

A majority of funding will be allocated to the construction of the water exhibit. The past senior project team spent \$1900 on their exhibit, constructing it out of wood and thin acrylic lining that have since rotted away and warped due to exposure to the elements. In order to produce a durable and longer-lasting exhibit, higher quality materials must be utilized. While this would potentially increase the cost of our construction (estimated at \$2500, most of this being for construction of the frame itself), it would also lead to a far more successful and longer lasting end product for our sponsor.

As our team wants to implement microcontroller systems into the exhibit, we need to account for the money that will be spent on computer hardware supplies and materials as well. Following research online to find materials needed to perform tasks that we have brainstormed to make the exhibit more interactive, we have estimated our spending for this subsystem at \$300. Some materials that we will need to purchase include an Arduino, wide angle PIR sensor, and a water level height sensor.

There are certain tasks during the construction phase that our team will not be capable of accomplishing by ourselves, and thus may have to outsource to another company to complete. This could mean either ordering parts online instead of machining them ourselves, or paying for a service such as powder coating the frame of our exhibit so that it can withstand the elements. These are going to be necessary tasks for us to create a functional and effective exhibit, however we do not anticipate that the cost of either to be excessive, and thus we have estimated Postage/Shipping (of ordered parts) at \$200 and Contracted Services at \$500.

Student Applicant(s):	
Raymond Morales	
Heriberto Rodriguez	
Nicholas Runyan	
CENG Faculty Advisor: Sarah Harding	
Project Title:	Requested Funding
Water Fun at Exploration Station	
Travel <i>subtotal</i>	\$0
Travel: In-state	\$0
Travel: Out-of-state	\$0
Travel: International	\$0
Operating Expenses <i>subtotal</i>	\$ 2000
Non-computer Supplies & Materials	\$ 1500
Computer Supplies & Materials	\$ 300
Software/Software Licenses	\$
Printing/Duplication	\$
Postage/Shipping	\$ 200
Registration	\$0
Membership Dues & Subscriptions	\$0
Multimedia Services	\$0
Advertising	\$0
Journal Publication Costs	\$0
Contractual Services <i>subtotal</i>	\$ 500
Contracted Services	\$ 500
Equipment Rental/Lease Agreements	\$
Service/Maintenance Agreements	\$
TOTAL	\$ 2500



Mechanical Engineering Department
1 Grand Avenue
California Polytechnic State University
San Luis Obispo, CA 93407

November 9, 2016

RE: RFP – Water Fun at Exploration Station

Baker-Koob Endowment Committee:

I am the senior project advisor for the team Water Fun at Exploration Station. This project was proposed by Exploration Station in Grover Beach, California. The project involves building an interactive water exhibit for the Exploration Station, a children's museum. Community members and school groups benefit from visiting Exploration station.

In addition to engineering, the students on this project will learn about working with educators and the community. Teaching students to help their communities is a fantastic life-long skill and I hope that through this project these students will gain an appreciation for helping their own communities in the future.

The three students on this team are working on this project in fulfillment of their senior project. This team consists of two mechanical engineering students and one computer engineering student. One of the mechanical engineering students is pursuing a teaching credential for the K-12 community. The students are having the opportunity to work with another discipline just like they will in industry. They are currently enrolled in the first quarter of the three quarter mechanical engineering senior project sequence. Because of the very structured nature of the course, I have great confidence in the students' ability to design, build and test an exhibit for Exploration Station by June 2017.

The course is structured so that students have six hours a week with their team and advisor. As their advisor, I will be meeting with them weekly to check on progress, recommend steps they can take to improve performance, and break down any roadblocks. These meetings are crucial to the success of the project.

This project came to Cal Poly with no funding. Before students selected this project they were informed that they would need to conduct fundraising to build an exhibit for our community. I hope that the Baker-Koob committee will help fund this great project so Exploration Station can have a water exhibit for years to come!

Sincerely,

A handwritten signature in cursive script that reads "Sarah T. Harding".

Sarah Harding
Mechanical Engineering Lecturer

(805) 756-7994