



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

November 11, 2016

RE: RFP – Joseph’s Jogger

Baker-Koob Endowment Committee:

I am the senior project advisor for the team Joseph’s Jogger. This project was proposed by Special Olympics for Joseph, a young man with spastic quadriplegia in our community. The project will build a new jogging stroller for Joseph so he can participate in running events with his father and other members of Team Joseph.

This project will immerse the students in field where many have no experience, working with those with disabilities. This project involves service learning where they will design, build, and test a system that is designed for particular individual’s needs. My experience with service projects has shown that the students greatly benefit from working directly with a client and seeing the impact they can have as engineers. The students on Joseph’s Jogger have already been able to push their client in his current jogger and experience the benefit this type of experience gives Joseph and his family. The smiles and appreciation the students receive at the conclusion of this type project is sure to have a lifelong impact.

The four mechanical engineering students on this team are working on this project in fulfillment of their senior project. 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 confidence in the students’ ability to design, build and test a jogger for Joseph 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. The team has established a close working relationship with Joseph’s father and Michael Lara from Special Olympics and is in regular contact to review design proposals and make sure they are meeting the needs of the customer.

Since this project came to Cal Poly with no funding, I hope that the Baker-Koob committee will help the project so the students can build a quality device.

Sincerely,

A handwritten signature in black ink that reads "Sarah T. Harding". The signature is written in a cursive, flowing style.

Sarah Harding
Mechanical Engineering Lecturer

(805) 756-7994



Warren J. Baker Endowment

for Excellence in Project-Based Learning

Robert D. Koob Endowment for Student Success

Proposal Cover Page

Title of Project:

Joseph's Jigger

Proposal Author: Carolina Reyes Cal Poly Email: creyes02@calpoly.edu

Student ID: 007803168 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
<u>Luke Kraemer</u>	<u></u>	<u>likraeme@calpoly.edu</u>	<u>ME</u>
<u>Robert Trujillo</u>	<u></u>	<u>rotrujil@calpoly.edu</u>	<u>ME</u>
<u>Josh Egli</u>	<u></u>	<u>jegli@calpoly.edu</u>	<u>ME</u>

Faculty Advisor: Sarah Harding Department: Mechanical Engineering

Faculty Advisor email: sthardin@calpoly.edu Telephone: (805)756-7994

Anticipated Start Date: 01/09/2017

Anticipated End Date: 06/09/2017

Total Funds Requested (\$): 2,500.00

Signature of Faculty Advisor:  Date: 11-10-16

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Robert D. Koob Endowment *for Student Success*

I. Abstract

We are committed to design, manufacture, and test a sports jogger for Special Olympian Joseph Cornelius. Joseph actively participates in numerous marathons and triathlons. He is an inspiration to his athletic team and those who know of him. Because Joseph has spastic quadriplegia, he counts on his jogger in order to participate in races with his father and team. His jogger has crossed many finish lines; hence, it is worn out and does not provide Joseph with the comfort or safety he needs. Therefore, our engineering team is dedicated to design a new and suitable jogger that will not only allow Joseph to continue his passion for marathons but also serve his needs. Hence, we plan to design a jogger that is safe, practical, and accommodates his body. We have carried on intricate research, created a number of prototypes, and done Pugh matrices that have contributed to our design process. From the preceding techniques, we will agree on the best design. Next, we will build our design in the Cal Poly machine shops (The Hangar and Mustang '60). We will then test our device in order to optimize it. Lastly, we will deliver a completed jogger to Joseph at the senior project exposition. Through the power of engineering, it has become our priority and wish to help Joseph cross many more finish lines while simultaneously inspiring others.

II. Introduction

Joseph Cornelius is a young man who loves to be in motion. Joseph was diagnosed with cerebral palsy, spastic quadriplegia from a young age and is unable to walk. In order to allow him to experience the freedom of movement, his father and friends push Joseph on runs in a special jogging stroller. Running under the name of Team Joseph, they have competed in numerous triathlons and plan on doing many more. Currently, Joseph is being pushed through the running portions of these events in a jogger that is becoming worn down and that needs improvements. This jogger has seen a lot of use throughout the last few years, and has covered approximately 7000 miles. In his current setup, towels are being used to pad Joseph's body from constantly being supported by the metal framing of the jogger. When this jogger is used, it is often for periods lasting more than five hours. Due to this, and the fact that Joseph cannot move to adjust himself, comfortability of the jogger is a large design concern.

Our team, composed of Robert Trujillo, Carolina Reyes, Luke Kraemer, and Josh Egli, is committed to creating a new device which will allow Joseph to continue to achieve his aim of competing in marathons and triathlons through sponsorship from the Special Olympics of Southern California. We aim to create a device which allows Joseph to be easily pushed by his father and team members. A device which will safely support Joseph's body and provide a comfortable ride. A device created specifically for Joseph, that will last him a long time. We hope that through the creation of this device, we can better help Joseph, his father, and the members of Team Joseph succeed in and enjoy competing in marathons.

III. Objective(s)

Our goal and promise as a team is to create a jogger for Joseph Cornelius that will suit his needs. Thus, we aim to accomplish this through an engineering approach of design, manufacture, and test. It is in our best interest to produce a device that will accommodate Joseph and his running team in events that bring joy and relaxation to Joseph. We plan to dedicate great efforts to improving Joseph's running experience by working closely with his father John Cornelius, teacher William Walters, and the team's project sponsor Michael Lara.

IV. Methodology

The general approach to designing a new jogger are outline as follows: define problem, conceptualize, evaluate/ analyze, detail design, manufacture, and validate. This outline is not proposed to be linear as factors may cause our design team to return to a previous step such as a failure of a prototype during the validation step may cause our team to return to the detailed design step.

Before creating ideas for a new jogger, it was necessary to understand the problem first to differentiate the user's wants from needs by interviewing the father of Joseph, John, about the current jogger and Joseph, as well as going on jogs with Joseph on his jogger to access the situation. In addition, our team researched an aquatic device known as the aqua-bullet from what a previous team had done for Joseph and benchmarked other similar designs. After researching and benchmarking the jogger, we created a quality function deployment (QFD) to help define the customer needs and requirements in order to translate them into specific plans to produce designs that will meet those needs.

Our team have conceptualized possible design ideas both individually and in a team that would meet the user's needs and requirements. Simple mock-up models of those ideas have also been produce to access their feasibly in the real world.

In order to narrow the ideas to a few, we will be using a Pugh matrix which is a formatted chart that compares all of the possible designs to a baseline criterion. After narrowing the ideas to few, we would then use an Analytical Hierarchy Process that would provide a logical framework to determine the benefit of each design idea and choose a final design based on those benefits.

When designing the final jogger, many different elements will have to be considered such as traction and speed. In consideration of those elements, each component of the jogger will be designed and analyzed to meet safety requirements as well as the design specifications. It should be noted there is a possibility that we may choose to purchase an existing jogger and modify it to meet Joseph's needs. Once all components are designed and modeled on CAD, all parts necessary to construct the new jogger will be ordered.

The manufacturing of the jogger will depend on our choice whether to construct the jogger from scratch or purchase an existing jogger and modifying it to meet Joseph's needs. Despite either of the two choices, we will divide the manufacturing process into manageable parts throughout a scope of two to three months.

We will outline properties of the jogger to be tested and methods for testing those properties to evaluate whether or not they meet our engineering specifications and safety requirements. In a situation where a component has failed, we may have to return to a previous step to correct the failure.

V. Timeline

Research and benchmark project:	10/4/2016-10/18/2016
Conceptualize design ideas:	10/25/2016-11/1/2016
Select a final design:	11/3/2015-11/15/2016
Build a failure mode effect analysis plan:	11/29/2016-12/1/2016
Analyze design:	12/1/2016-12/10/2016 & 1/10/2016-1/31/2016
Create CAD models and bill of materials:	1/31/2016-2/7/2016
Order Parts:	2/24/2016-2/28/2016
Construct prototype:	4/4/2017 – 5/2/2017
Test the Prototype:	5/2/2017 – 5/23/2017
Deliver final design to user:	5/30/2017

VI. Final Products and Dissemination

The final form of the project will be a fully functioning jogger for Joseph to use. This jogger will be given to Joseph on 5/30/17 at the senior project exposition. It is our mission to provide him with a device he can reliably use for many years. We anticipate the jogger being able to meet the following customer requirements:

- 1: be lightweight in order to be easily pushed
- 2: be easily transportable via standard-sized minivan
- 3: have an adjustable handlebar to suit different size drivers
- 4: accommodate Joseph's size and weight
- 5: protect and align Joseph's body—specifically at the hips.
- 6: position Joseph in a relatively upright position.
- 7: safely secure Joseph and provide crotch support
- 8: provide a smooth ride and dampen road impacts.
- 9: require minimum maintenance, including at footrest.
- 10: have a quality braking system
- 11: protect Joseph from the sun and rain.
- 12: allow Joseph a clear view of the road.
- 13: be in Team Joseph colors

VII. Budget Justification

The cost for this project was divided between materials/supplies and contracted services. The materials/supplies needed for this project are shown below in Table 3. We do not possess the skills to complete some parts of the fabrication process. The tasks that will be outsourced are the manufacturing of the seat, welding of the frame, and powder coating the frame in Team Joseph colors. These projected costs are shown below.

Seat Manufacture Labor Cost: Estimated 6 hours at \$80/hr = \$480

Frame Welding: Estimated 6 hours at \$60/hr = \$360

Frame Powder Coating: \$260 (cost of powder coating Go Kart frame of similar size)

Table 3: Material Costs

Product	Quantity	Cost (\$)
6061 Aluminum Tubing	30 ft	200
Disc Brake System	2	175
Rear Rim	2	60
Rear Hubs	2	100
Rear Spokes	72	30
Rear Tires	2	60
Front Hub	1	50
Front Rim	1	30
Front Spokes	36	15
Front Tire	1	30
Seat Waterproof Fabric	1	100
Seat Foam	1	200
Pelvic Support Post	1	200
5 point harness	1	100
Ankle Restraints	2	50
Total Cost		1400

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PROPOSAL BUDGET

Student Applicant(s): Luke Kraemer Carolina Reyes Robert Trujillo Joshua Egli	
Faculty Advisor: Sarah Harding	
Project Title: Joseph's Jogger	Requested Endowment Funding
Travel <i>subtotal</i>	\$ 0
Travel: In-state	\$ 0
Travel: Out-of-state	\$ 0
Travel: International	\$ 0
Operating Expenses <i>subtotal</i>	\$ 1400
Non-computer Supplies & Materials	\$ 1400
Computer Supplies & Materials	\$ 0
Software/Software Licenses	\$ 0
Printing/Duplication	\$ 0
Postage/Shipping	\$ 0
Registration	\$ 0
Membership Dues & Subscriptions	\$ 0
Multimedia Services	\$ 0
Advertising	\$ 0
Journal Publication Costs	\$ 0
Contractual Services <i>subtotal</i>	\$ 1100
Contracted Services	\$ 1100
Equipment Rental/Lease Agreements	\$ 0
Service/Maintenance Agreements	\$ 0
TOTAL	\$ 2500