Posterior Beach Walker
Final Report

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Abstract

This senior design project is to design and build a walker that can be used on the beach for a twelve year old child with cerebral palsy. The client is able to walk and is receptive, and he needs no neck or back support, but due to his condition he does require additional support from a walker or quad-canes to move around. The client’s current walker is not designed for use at the beach, and the client has requested a walker that is easy to maneuver on sand.

The device is a posterior walker, which means that it supports the user from behind, requiring him to stand in a more upright posture and promoting trunk extension. The walker’s height is adjustable to allow for many years of use, and is foldable to allow for convenient transporting to and from the beach. The walker was designed and constructed to meet the needs and requests of the client. The final product is a walker designed specifically for the client to provide the support he requires to move around at the beach.

1. Introduction

1.1 Background

The client, 12 year old Matthew Davies, has spastic cerebral palsy (CP) which restricts his mobility and requires that he use a walker and leg immobilizers to help him move around. Matthew is 57 inches tall, and weighs 98 pounds. Matthew’s family vacations at the Rhode Island beaches every summer, and his current walker is not suited for use on the beach. The beach walker has large balloon wheels which will allow for its use on sand. The walker is posterior walker, which will give Matthew support from behind and promote trunk extension. It is also height adjustable, to allow for many years of use. The walker is made of lightweight aluminum and can fold for more convenient transporting.

1.2 Purpose of the Project

The purpose of this project is to provide the client with a source of mobility for use on the beach. This will allow him to move about more freely and easily on uneven terrain such as sand. The device is a posterior walker and includes a foldable seat to allow for Matthew to sit and rest anywhere. The walker height is adjustable to ensure that Matthew gets maximum use out of the walker for many years.

1.3 Previous Work Done by Others
1.3.1 Products

There are a few commercial products available that have been designed to serve the same purpose as the one in this project. Deming Designs Inc. manufactured a walker which was designed for use on the beach by persons with balance, walking, or lower extremity disabilities. The frame of the walker is made of powder-coated 316L stainless steel tubing. It has two front casters which rotate 360° and two back casters which are fixed. All four wheels are 30 cm Wheeleez wheels.

Deming Designs also has a lightweight aluminum walker for use on the beach. It has an adjustable height and uses four 22 cm Wheeleez wheels. It has front casters which rotate 360° and back casters which are fixed with push to lock brakes. This walker includes a seat and is able to fold for easier transportation.

1.3.2 Patent Search Results

There are currently a few patents for all-terrain walkers. The first is US patent #6,578,594 for a “mobile rehabilitative walker”. This walker supports the user in an upright position and has large wheels and a wide base to allow for navigation over irregular surfaces.

![Figure 1. US Patent #6,578,594 Mobile Rehabilitative Walker](image)
A second device, which has yet to be issued, is US patent application #11/164,129 for an “Assisted Walking Device”. This walker has four all-terrain wheels. The handles have an actively set and a non-actively set brake. The non-actively set brake engages automatically if the user loses control over the device or releases the handle. The actively set brake allows the user to engage the brake manually.

Figure 2. US Patent Application #11/164,129 Assisted Walking Device

1.4 Map for the Remainder of the Report

The remainder of this report will focus on the design for the project. Three alternative designs will be considered, in addition to an optimal design with a detailed description of each of the subunits. A description of the completed prototype will also be discussed. Realistic constraints and safety issues will be looked at, as well as the impact of the engineering solution and the lifelong learning that has taken place.

The budget and timeline will be reviewed, and team member contributions will be described. The appendix will include all of the purchase order requisition forms and price quotes for the parts.
2. Project Design

The project design involves three alternative designs and an optimal design. The three alternative designs will be overviewed and the optimal design will be discussed in more detail. All subunits contained in the optimal design will be discussed, supplemented by figures, pictures, and CAD drawings.

2.1 Alternative Designs

2.1.1 Alternative Design 1

This design involves purchasing a prefabricated walker, such as the Nimbo Lightweight Posterior Posture Walker, and making adjustments so it would be appropriate for the client and his specific requests. This type of posterior walker would provide the client with excellent trunk support and would help improve his balance. The purchased walker would be made from a lightweight aluminum frame and would be collapsible, making it convenient to transport.

Providing our client with a posterior walker would be beneficial to him in several ways. First, the oxygen consumption rate with a posterior walker was found to be much lower than that for an anterior walker. Also, flexion angles of the trunk, hip and knee are generally lower on a posterior walker. When tested for children with spastic diplegic cerebral palsy, gait analysis data and oxygen consumption measurements showed that the posterior walker offered the user better upright positioning and energy conservation. A study published in the Developmental Medicine & Child Neurology journal confirms this, with results indicating substantial improvements in postural alignment and gait characteristics for children when using a posterior walker rather than an anterior one.

The walker would be modified to have large polyurethane balloon wheels, to allow for use on the beach. Junior size rollators usually work well for users between 4’8” and 5’2”. The Nimbo walker has an adjustable handle bar height, but handlebar extensions would be added to customize the walker to the client, who is expected to grow to be around 6’tall. A padded seat would be fabricated and attached to the walker to allow the user to sit whenever necessary. The seat would be hinged to allow for the walker to be folded and stored. One drawback to this design is that the designers will not have a choice in the dimensions or weight of the walker since it will be purchased commercially.
2.1.2 Alternative Design 2

This design involves providing a four-wheel, anterior walker to our client. There have been several studies regarding the advantages and weaknesses of posterior walkers versus anterior walker for young adults with cerebral palsy. While many studies have shown that posterior walkers are more suitable for children with cerebral palsy, there are some interesting facts that suggest that an anterior walker for our client would be more desirable. Studies show that there is no difference between energy expenditure of the cerebral palsy patients when using posterior walkers versus anterior walkers. It was also found that posterior walkers promote faster walking speeds and longer step lengths. When considering that the client will be using this walker mainly on the beach, it must be taken into account that the client should be walking slowly and with smaller steps because the sandy terrain makes it difficult to have a normal gait.

An anterior walker frame would be purchased from an outside vendor. The Strider Walker supplied by the Cerebral Palsy League would be an ideal anterior walker to purchase and use for its frame. The frame is made of lightweight aluminum and folds easily for transport and storage. The frame is completely adjustable, allowing for the client to use the walker for
many years as he grows into an adult. The walker has a wide base, which provides stability, safety and balance. The handles adjust without tools to an infinite number of positions to provide stability and posture.

The walker will need four wheels, so the back legs will have to be removed and two wheels will be put in. Four polyurethane wheels will be added so that the client will be able to maneuver over sand and other difficult terrain. Polyurethane wheels can be commercially purchased in sizes of 24, 30, 42, and 49 cm in diameter. The front two wheels will be smaller than the back two in order to provide optimal stability and safety. Disc brakes will be added to the walker so that the client can brake and keep the walker stable whenever necessary. The brakes will be a locking loop system with handgrips underneath the handles of the walker that can be used to slow down or fully engaged to disallow movement of the front two wheels. A seat will be added to the front of the walker so that the client can engage the brakes and sit down, providing rest and comfort whenever the client needs it. The seat will lift upwards, which still allows the walker to fold for greater portability.

Figure 5. Strider Walker

Figure 6. Anterior Walker with Brakes and Seat

2.1.3 Alternative Design 3
The third alternative design consists of a posterior walker which would be completely fabricated by the design team. Posterior walkers are widely acknowledged as more suitable for children and young adults with spastic cerebral palsy. Studies have shown that posterior walkers promote better posture among the user by decreasing flexion angles of the trunk, hip and knee. The most obvious advantage to this design is that the walker can be entirely customized to meet the client’s individual needs, and can have a unique style specific to the client. This design would also be less expensive than one that involves purchasing a prefabricated walker.

The walker would be made from lightweight aluminum rods. The width between the handlebars and the range of the handlebar height adjustability would be tailored to the client’s specific requirements. The weight capacity of the device would also be specific to the needs of the client. The handlebars will be produced to have sufficient grip and flanged ends for optimal safety. The walker has to be easily transported to and from the beach, so it must be collapsible to be able to fit in the trunk along with the many other beach supplies of the client and his family.

The walker would use the same polyurethane balloon wheels mentioned in Alternative Designs 1 and 2. The front two polyurethane wheels will be larger than the back two wheels. A pelvic stabilizer will be fabricated and attached to the back of the walker. There will be a locking/braking mechanism that easily switches the two front wheels from swivel to non swivel. An anti-reverse override bracket will be installed to disengage the one directional rear wheels and allow forward & reverse mobility.

Pelvic stabilizers are recommended for users who have an asymmetrical posture when standing or walking and, therefore, cannot stay centered in the posterior walker. The pelvic stabilizer will be adjustable in width to accommodate the client as he grows. The pelvic stabilizer will also feature a support belt and pads that will offer lateral support for the client’s hips to keep them at midline. Forearm platforms can be manufactured and added to the walker per the client’s request.
2.2 Optimal Design

2.2.1 Objective

The purpose of the project is to design and build a beach walker for Matthew Davies, a twelve-year-old boy with spastic cerebral palsy (CP). Matthew is able to walk and is receptive, but due to his CP he requires additional support, such as a walker or quad canes, to move around. In order for Matthew to safely enjoy himself while on vacation with his family, he needs a walker that will allow him to travel easily across the beach’s terrain. The walker must also provide him with the support he needs, and be lightweight enough to be transported to and from the beach. It must account for Matthew’s expected growth, allowing for many years of use.

The walker frame is a Nimbo Lightweight Posterior Posture walker in size youth, purchased from Global Industrial. It will provide Matthew with excellent trunk support and will help improve his balance. The frame is made of lightweight aluminum and is collapsible. It has height adjustable handlebars, but the specific adjustability will need to be altered to meet the needs of the client.

A seat was also purchased from Global Industrial, made specifically to fit on the youth size Nimbo walker frame.

Beach wheels were purchased from Beach Carts USA. Two large polyurethane wheels were used as front wheels, and two PVC wheels were used as rear wheels. Due to the low pressure of the wheels, they are able to move smoothly over soft surfaces such as sand.

2.2.2 Subunits

Figure 7. Accessories for Posterior Walkers
The beach walker consists of several small subunits. Each subunit will perform a specific task, and will also be incorporated into the overall system, so that the product will function with maximum efficiency. The following section describes each subunit in greater detail.

**Frame**

The walker frame is a crucial component, since it is the structure to which all other subunits will be fastened. The walker that has been selected for modification is the Nimbo Lightweight Posterior Posture Walker from Global Industrial. The frame’s most important feature is that it is posterior, which is preferred over an anterior walker frame because it is more effective at supporting proper posture and will provide the user with the maximum amount of trunk support.

The walker was chosen to be prefabricated because it will save time on building a frame, which will allow for more intricate subunits. A prefabricated frame will also eliminate the risk for any potential welding or machining errors.

The walker is made of lightweight aluminum in a midnight blue color. It weighs 14 pounds and has a 200 pound weight capacity. The height of the handlebars is adjustable between 28 and 36 inches, and the width between the handlebars is 16.5 inches. The walker folds for convenient transporting and storage.

![Figure 8. Nimbo Lightweight Posterior Posture Walker, Young Adult](image)

**Seat**

The seat will also be purchased from Global Industrial, and is designed specifically for use with the Nimbo posterior posture walker.
Wheels

The wheels will be beach wheels from Beach Carts USA. The hub of the wheel is made of polypropylene and the tires are made of polyurethane. The wheels are non-corrosive, and will not puncture.

The front tires have a pressure range of 2-4 psi, and due to their low pressure they are able to move across difficult terrain. Each wheel can hold a maximum payload of 121 pounds. The front wheels will swivel, which enhances maneuverability and ease of turning.

The rear wheels have an ideal pressure of 2.5 psi. They can hold a maximum payload of 77 pounds. The rear wheels will be one directional.
**Height Adjuster Additions**

Additions will be added onto the sides of the walker in order to increase the range of height adjustability. Four metal clamps will be fabricated to attach the frame to aluminum rods, which will be attached to the front wheel swivel caster mounts.

**Miscellaneous**

**Low Pressure Tire Pressure Gauge and Hand Pump**

It is important that the beach wheels be kept at the proper pressure in order to function optimally. The tires are easy to overinflate, and it is recommended by the manufacturer that a hand pump be used to keep the tires at the proper pressure.

**Cup Holder**

A cup holder will be attached to the side of the walker frame for convenience.

**2.3 Prototype**

The prototype is based off of the optimal design, but there are several adjustments that have been made. The frame was purchased from Global Industrial.

**2.3.1 Subunits**

The prototype is composed of several subunits which work together for maximum efficiency. Each subunit is described in greater detail.

**Frame**
The frame for the prototype was a prefabricated frame purchased from Global Industrial. It is a Nimbo Lightweight Posterior Posture walker in a youth size. We chose a youth size frame for the final design because the large size of the beach wheels would have added too much height to meet the needs of our client.

The frame is made of lightweight aluminum and weighs 12.5 lbs. The handlebar height is adjustable from 23” – 30.5” with a 15” width inside the hand grip. The depth opened at the base is 34.5”, and it has a 200 lb. weight capacity. A prefabricated frame was chosen to save time and to reduce the risk of making welding errors. Figure 13 shows the completed beach walker.

![Completed Beach Walker](image)

**Figure 13. Completed Beach Walker**

**Seat**

A prefabricated seat was purchased from Global Industrial. The seat is made specifically to fit on the Nimbo youth walker and is foldable, which will provide our client with the option of sitting to rest whenever he needs to.

Velcro was attached to both the frame and the seat to ensure that it remains folded up securely when not in use.
Wheels

The wheels are Wheeleez brand, and were purchased from Beach Carts USA. The front wheels have a pressure range of 2-4 psi, and the rear wheels have an ideal pressure of 2.5 psi. Due to their low pressure they are able to move across difficult terrain. They wheels are non-corrosive, and will not puncture.

The hubs of the front wheels are made of polypropylene and the tires are made of polyurethane. The wheels are 30cm, and they have a pressure range of 2-4 psi. Each wheel can hold a maximum payload of 121 pounds. They wheels are mounted onto swivel casters, which enhances maneuverability and ease of turning.

The hubs of the rear wheels are made of polypropylene and the tires are made of PVC. The wheels are 22 cm, and they have an ideal pressure of 2.5 psi. They can hold a maximum payload of 77 pounds. The rear wheels are one directional.
Swivel Casters and Mounts

Two swivel caster mounts were fabricated using 5” x 5” metal sheets. They were welded to aluminum rods and screwed onto the swivel casters.
**Height Adjuster Additions**

Four metal clamps were fabricated to attach the walker frame to aluminum rods, which were welded to the front wheel swivel caster mounts. The additions allow for a greater range of height adjustability.

**Miscellaneous**

**Low Pressure Tire Pressure Gauge and Hand Pump**

It is important that the beach wheels be kept at the proper pressure in order to function optimally. The tires are easy to overinflate, and it is recommended by the manufacturer that a hand pump be used to keep the tires at the proper pressure. A low pressure tire gauge and hand pump were purchased for the client’s convenience.
Cup Holder

A cup holder was purchased from Global Industrial to attach to the side of the walker frame for the client’s convenience.

3. Realistic Constraints

Economic

This project had a set budget that could not be increased, so staying in line with the budget was not only ideal, but necessary. The budget was the biggest constraint in manufacturing the walker. As with any project, a larger budget would allow the purchasing of higher quality parts and materials.

Environmental
There are no major environmental concerns for manufacturing the beach walker since the project is purely mechanical. Although the beach walker will not have a major impact on the environment, the environment will impact the walker. The walker will be stored inside, but was designed to be used on sand and shallow water at the beach. In case the walker is left outside, it must have the durability to withstand the elements. The walker can be cleaned easily, and should be cleaned periodically in order to ensure optimal efficiency.

**Sustainability**

The beach walker should be of use to our client for many years. The added height adjustments should accommodate Matthew’s growth pattern so that he gets the maximal use out of the walker. If the walker is properly cared for, it should be sustainable for an extended duration.

**Manufacturability**

Manufacturing this beach walker in a large quantity should be feasible. Many of the parts are readily available for purchase, and with the correct materials list and design, the beach walker should be easy to replicate for manufacturing. The design would need to include all of the mechanical components. Although the frame was purchased, it was altered to meet the needs of the client. These alterations should be simple enough to manufacture at a large scale.

**Health and Safety**

Matthew’s safety was the most important factor to take into consideration when designing and building the beach walker. Matthew has spastic cerebral palsy, which impairs his neuromuscular mobility. The beach walker will provide him with a safe and reliable means of walking across difficult terrain.

**Social**

The beach walker will provide the client with many social advantages in that it will allow him independence while walking on the beach. As a child, the beach is seen as a place where you can relax and enjoy the pleasurable experiences that the sand and water have to offer. Matthew will be able to independently walk wherever he desires while on the beach, whether it be over difficult terrain such as sand, or along the shore. The independent nature of the project will allow the client to feel like a normal kid on the beach, going wherever he pleases.
4. Safety Issues

Safety is the main priority of the beach walker. The frame of the walker is able to support Matthew’s weight without crumbling under the pressure. Strong joints were used to secure the walker, and the material used is sturdy and durable enough to last for many years without bending or warping. The seat, wheels, and clamps are all securely attached to the frame.

5. Impact of Engineering Solutions

The main goals for the walker were to provide the client safety as well as a feeling of independence. For many physically disabled children (especially those with Cerebral Palsy), the process of growing older and more independent is altered because, while they are mentally and emotionally ready to do things on their own, their mobility impairments limits their independence. Our client, Matthew Davies, at the young age of 14 years old, desires to be independent wherever he goes, especially on family vacations to the beach. His cerebral palsy severely limits the activities he can perform when at the beach, but with the help of our project, he will be liberated to enjoy all the exciting aspects of the beach and the ocean.

This is why our beach walker is such an important project. The market has limited options for walking assistants for children with mobility and stability disabilities for use outside of normal terrain. The beach walker has balloon wheels that allow its use over multiple difficult terrains, and is especially designed for use over the sand of the beach and in shallow water.

Economically, this walker could likely be brought to market at a lower price point than existing walkers. Ultimately, however, large-scale ambitions remain firmly speculative, due to the beach designed customization features of the walker. The walker, while having the ability to be used on many terrains, is specifically designed for use over the sand and in the shallow water. The specific features of the walker make it unlikely for families to purchase that do not visit the beach all that often.

6. Life-Long Learning

Our team has learned a great deal from the design process. Determining the client’s needs and expectations will help us understand the needs of disabled children and the challenges they face in daily life. We needed to design a walking aid that adheres to the client’s specific needs, meaning we were in constant contact with the client and his family. This allowed
us to work on our people skills and give us valuable lessons in satisfying customers in the workplace.

Building and refining the CAD model was an extensive process involving constant communication with the client and gait research, as well as learning to utilize advanced Autodesk Inventor features such as force analysis. A virtual model of the client will be developed for this purpose, so biomechanical skills were also learned. Gait research and consultation with the client’s physical therapist will not only provide a scientific basis for posterior walkers, but gave us important background knowledge on gait development and pathology, and the options available to assist those with mobility impairments.

Another technique learned was simply be the art of planning and coordinating groups. Microsoft Visio will be used to produce flow charts and diagrams for easy planning. We learned Microsoft Project in order to keep track of project goals and deadlines. Substantial coordination was required within our team, as well as between our team and the client’s family. All of these skills will be important regardless of each team member’s final career or educational path.

The most important skill learned during the manufacturing phase was the process of revision. We needed to develop highly adjustable parts in order to build an optimal final product.

7. Budget and Timeline

7.1 Budget

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**Total Projected** $1,000

**Total Spent** ~$1,000

### 7.2 Timeline

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<td>5 days</td>
<td>Mon 1/24/11 Fri 1/28/11</td>
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<tr>
<td>Assemble Wheels on to Frame</td>
<td>5 days</td>
<td>Mon 1/24/11 Fri 1/28/11</td>
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<tr>
<td><strong>Alter the height range of the Walker</strong></td>
<td>5 days</td>
<td>Mon 1/31/11 Fri 2/4/11</td>
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<tr>
<td>Cut Aluminum Rods to Fit the Desired Height Range</td>
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<td>Put Holes in the Rods for Easy Height Adjustment</td>
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<tr>
<td>Assemble Walker Frame With New Rods</td>
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<td>Mon 1/31/11 Fri 2/4/11</td>
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<td>Spray Paint the Frame</td>
<td>5 days</td>
<td>Mon 2/7/11 Fri 2/11/11</td>
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<tr>
<td>Spray Paint the Seat Harness</td>
<td>5 days</td>
<td>Mon 2/7/11 Fri 2/11/11</td>
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<tr>
<td>Final Spray Paint Coat for Frame</td>
<td>5 days</td>
<td>Mon 2/14/11 Fri 2/18/11</td>
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<tr>
<td>Final Spray Paint Coat for Seat Harness</td>
<td>5 days</td>
<td>Mon 2/14/11 Fri 2/18/11</td>
<td></td>
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<tr>
<td>Waterproof Walker</td>
<td>5 days</td>
<td>Mon 2/14/11 Fri 2/18/11</td>
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<tr>
<td>Waterproof Seat</td>
<td>5 days</td>
<td>Mon 2/14/11 Fri 2/18/11</td>
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<tr>
<td>Attach Seat Cover to the Seat</td>
<td>5 days</td>
<td>Mon 2/21/11 Fri 2/25/11</td>
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<tr>
<td>Attach Seat to the Frame</td>
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<td>Mon 2/21/11 Fri 2/25/11</td>
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<tr>
<td>Adjust Brake Height Range to Fit Frame Height Range</td>
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<tr>
<td>Attach Brakes to Frame</td>
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<td>Mon 2/28/11 Fri 3/4/11</td>
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<tr>
<td>Attach Cup Holder</td>
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<td>Mon 2/28/11 Fri 3/4/11</td>
<td></td>
</tr>
<tr>
<td>Attach Umbrella Holder</td>
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<td>Mon 2/28/11 Fri 3/4/11</td>
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<tr>
<td>Design Final CAD Model</td>
<td>5 days</td>
<td>Mon 2/28/11 Fri 3/4/11</td>
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<tr>
<td>Test Walker and Make Adjustments</td>
<td>5 days</td>
<td>Mon 2/28/11 Fri 3/4/11</td>
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</tbody>
</table>
8. Team Member Contributions to the Project

Danielle was responsible for ordering parts and maintaining dealer contact. Matt was responsible for the mechanical design and modeling the design using Solidworks. They both contributed to the fabrication and construction of the beach walker and its subunits.

9. Conclusion

This project offers the client a means of transportation on soft terrain. This posterior walker will allow the client to maneuver easily over sand, and will promote an upright posture and trunk extension. It folds for easy transportation and storage, and the height is adjustable to allow for many years of use.

This walker is unlike other commercially available products because it is a posterior walker and can move easily across sand and other uneven terrain. This walker fulfills all of the requirements laid out by the client and his family. It will provide the client with a means of transportation on sand, allowing him to have fun on the beach and still be safe and supported as he moves around.

10. References


<http://www.google.com/patents?id=BfYMAAAAEBAJ&pg=PA2&dq=all-terrain+walker&source=gbs_selected_pages&cad=3#v=onepage&q&f=false>

<http://www.google.com/patents?id=R6SXAAAAEBAJ&pg=PA6&dq=all-terrain+walker&source=gbs_selected_pages&cad=2#v=onepage&q=all-terrain%20walker&f=false>


11. Acknowledgements

Team 13 would like to thank the following people for their contribution to this project:

The Davies Family
Dr. Enderle
Marek Wartenberg and Emily Jacobs
Jennifer Desrosiers and Kerrie Wenzler
Peter Glaude and Serge Doyon

12. Appendix

12.1 Updated Specification

There are currently no new specifications; all specifications are up to date.

12.2 Purchase Order Requisitions and Price Quotes
<table>
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<tr>
<th>Catalog #</th>
<th>Description</th>
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<th>Unit Price</th>
<th>Amount</th>
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**Total Expenses:** $237.33

**Ship to:** University of Connecticut
Biomedical Engineering
U-2247, 260 Glenbrook Road
Storrs, CT, 06269-2247

**Attn:** Danielle LaPointe

**Project Name:** Beach Wheelchair/Beach Walker

**Price Quote File Name:**

**Vendor:** Beach Carts USA

**Address:** beachcartsusa.com

**Phone:** 1-866-246-8787

**Contact Name:** John Corcia

**Shipping:** $32.60

**Total:** $400.00

**Authorization:**
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Comments:

Price Quote File Name: [Vendor Accepts Purchase Orders?]

Shipping: $9.76
Total: $35.76

Vendor: Wheeleez, Inc.
Address: 3890 Industrial Way
Benicia, CA
94510
Phone: 1-707-751-3999
Contact Name: 

Authorization:
**PURCHASE ORDER REQUISITION - UCONN BME SENIOR DESIGN LAB**

Instructions: Students are to fill out boxed areas with white background. Each Vendor will require a different purchase requisition.

<table>
<thead>
<tr>
<th>Date:</th>
<th>March 14, 2011</th>
<th>Team #:</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Name:</td>
<td>Danielle LaPointe</td>
<td>Total Expenses:</td>
<td>$1,272.93</td>
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| Ship to:     | University of Connecticut Biomedical Engineering  
               U-2247, 260 Glenbrook Road  
               Storrs, CT 06269-2247 | Lab Admin only: | |
| Attn:        | Marek Wartenberg | FRS #: | |
| Project Name: | Beach Wheelchair/Beach Walker | Student Initial Budget: | |
|              |                 | Student Current Budget: | |
|              |                 | Project Sponsor: | |

### ONLY ONE COMPANY PER REQUISITION

<table>
<thead>
<tr>
<th>Catalog #</th>
<th>Description</th>
<th>Unit</th>
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<th>Unit Price</th>
<th>Amount</th>
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<tr>
<td>WGB276232</td>
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**Subtotal:** $299.57  
**Shipping:** $43.42  
**Total:** $342.99

**Price Quote File Name:**  
**Vendor:** Global Industrial  
**Address:** [http://www.globalindustrial.com/](http://www.globalindustrial.com/)  
**Phone:** 1-888-978-7759  
**Contact Name:**  

**Authorization:**