Weekly Progress Report  
Week 6: 2/24/09-3/3/09 

Travel Computer Mount 

We are still waiting for the release form for the travel computer mount. I have also begun writing a user manual for the device.

Assistive Jumping Device 

I spent a lot of time this week researching a possible suspension system for the harness. We need something that will hold the weight of the harness and support Sean and provide shock absorption as Sean falls back to the trampoline from jumping. We looked into using bungee cords or using a metal spring and climbing rope. We decided that the optimal suspension system would be able to maintain loads up to 100lbs and be able to stretch up to a foot to give Sean some freedom and challenge.

I first looked into bungee cords to support the system. I figured that bungee cords would be much easier to install and would provide greater stretch than a spring. The bungee cords could attach to the strap on top of the harness and then to the crane trolley. The arrow in figure 1 points to the strap to attach the bungee cords to the harness. This strap includes a seat buckle; therefore, the harness could be easily detached from the bungee cords to prevent unnecessary loading and wear of the cords. The harness could then be left to rest on the safety stop, or taken off the rail all together.

Figure 1. Harness strap for attaching bungee cord suspension system.
We then focused our efforts into finding bungee cords with carabiner hooks on either end. The carabiners would be sufficient for load bearing, and would make attaching the bungee cords very simple. We all ended up going to Home Depot to purchase two bungee cords with carabiner attachments. Figure 2 shows the bungee cords we purchased.

I tested the bungee cords to see if they would be suitable to carry large loads. The manufacturer’s label stated that the 24 in bungee cords should not be stretched beyond 36 in. However, the carabiners were included in these lengths so it ended up working that the 16 in bungee could be stretched to 28 in. I suspended several weights from a bungee to find the maximum load one bungee could hold (i.e. the minimum load required to fully stretch the bungee cord. Table 1 and figure 3 show my results from the testing.

Table 1. Bungee Testing

<table>
<thead>
<tr>
<th>Unloaded Bungee Length (in)</th>
<th>Applied Load (lbs)</th>
<th>Loaded Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>3.6</td>
<td>16</td>
</tr>
<tr>
<td>16</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td>16</td>
<td>8</td>
<td>16.5</td>
</tr>
<tr>
<td>16</td>
<td>11.96</td>
<td>18.5</td>
</tr>
<tr>
<td>16</td>
<td>20.8</td>
<td>22.75</td>
</tr>
</tbody>
</table>

Figure 3. Bungee Testing
From the equation given by the graph in figure 3, I determined that a single bungee could safely support approximately 34 lbs. Therefore, to support a load of 100 lbs we would need to use up to four of these bungee cords, assuming that the load would be distributed evenly among them. However, upon closer inspection of the clasps we thought that the bungee to carabiner connection would not be sufficient to support high loads. Therefore, although the bungee cords themselves should work we had to look into a different mode of attachment.

Blaine and I then tried to research springs to see if we could find a spring that was both strong enough and flexible enough for our needs. However, the springs that were strong enough did not offer great enough stretch. We then thought about using multiple springs that were weaker, but had optimal stretch properties. Although, this would work, we thought it would be difficult to install, and there would be an issue of the springs getting tangled.

We settled on the use of bungee cords for suspension after weighing the positives and negatives of both bungee cords and springs. We decided that we could secure the bungee cords with the use of climbing knots that will just further tighten under tension. Climbing knots will be sufficient for high load bearing and will be easy to install.

Blaine and I decided to order 20 ft of 3/16 inch diameter bungee cord from Reef Scuba Accessories. Each cord can hold 75 lbs and can stretch up to 120%. Therefore, 2 cords will be sufficient to maintain the load. The product also offers great resistance to abrasion and fatigue. I chose a medium sized diameter because it offers good strength, and will still be relatively easy to knot.

Our main goal for next week is to test the suspension system once we receive the bungee cord. We need to figure out how many bungee cords we need to support the harness as well as the proper length. We will probably have to make the length of the bungee cords adjustable so we can customize it to Sean’s needs. Also we need to find
where to place the bungee cords to keep the harness moving up and down the vertical rail smoothly. To accomplish this, we need a crane, or otherwise sturdy structure that will support the crane trolley. Then we will be able to test the entire system thus far. We also need to finalize which contractors we will be using for the cement and crane installation, as well as preliminary dates to have the work done.

I spent approximately 11 hours working on the project this week.