Work Completed

This week, the bed frame finally arrived. With this, we laid out the jack and motor in relation to the frame. However, the bed turned out to be narrower than we had anticipated. This meant that the jack would not be able to be placed across the bed, and at the same time it would be too long to sit length wise, while still providing a desirable amount of lift height. In addition to the width issues, we also found that the placement of the cross bars would cause problems with placing the lifting system. On Monday February 26\textsuperscript{th}, we went to the machine shop to move the cross bar connections from one end of the bed, to the center of the bed. This position will provide better support of the bed at the joint, while remaining out of the way of the lifting system. By trial and error, we figured that the jack could be positioned on an angle, so that it sits at an angle of 46.57° from the side rails, as shown below in Fig 1. In this position, it will be possible to place the jack at a distance of 13.5 inches from the joint of the bed. In this position, it will be impossible to achieve a 70° lift angle, however, we will be able to lift the bed approximately 55°, which is still a significant angle.

![Figure 1: Jack Position](image-url)
With these complications out of the way, we were able to focus on connecting the motor to the jack, and beginning to test the motor properties. The initial idea was to cut a key slot into an existing ¾ inch hex drive socket, which the key from the motor drive shaft would fit into, as show below in Fig 2a. However, we found out that the key of these motors can be “easily” removed, and therefore we could just use a screw through the existing threaded hole in the socket, which would fit down into the key slot in the drive shaft as shown below in Fig 2b. For safety, we used a lock washer as both a spacer so that the screw would be tightened completely to the socket, as well as to prevent the screw from backing out due to running vibrations. Although this method was much more convenient, it also maintained the structural integrity of the socket, so that it will be able to sustain the torque applied through it by the motor.

![Figure 2: Socket Modifications](image)

This made for a very firm connection, which will easily be able to support the output of the motor. The completed motor with drive socket is shown below in Fig 3.

![Figure 3: Motor with Drive Socket](image)

This week, I drew up a simple but practical design for the bed back. This design will allow for a sturdy and light bed back, while also providing a proper structure for the rail system to be mounted on. I also researched to see the prices
of the square tube steel which would be used in the bed back construction. At 
www.metalsdepot.com, I found that 24 feet of 1X1 square tube A513 steel, with a 
wall thickness of 0.083 inches can be purchased for $30.48, and a smaller length, 
of 12 feet, would cost $18.00.

Future Work

With the motor capable of driving the scissor jack, we can now begin to see just how this system will behave. First off, we plan to test the speed with which the jack can actually be raise, and how smooth it operates. Then we can move into realistic lifting loads using 200 pounds of weight on the jack its self, while the motor raises it. Since the motor mount for the jack has not yet been built, these tests will require some coordination, to hold the motor and raise it with the jack. We also want to begin construction of the jack motor mount immediately. We also anticipate the arrival of a rolling caster, which will be used to allow the jack to slide along the bed back during motion. Once this arrives, we can finalize and build the track which it will ride in. With all of these components together, it would also be wise to begin constructing the bed back, so that initial tests of the bed movement can begin, and any problems can be found and corrected as soon as possible.

Project Review

Construction of the adjustable back angle controller is rapidly picking up steam. With the motor, jack and bed ordered, the majority of the bed can be constructed and tested. Now that we can drive the scissor jack by the motor, we can test the capabilities of the motor, and determine safe driving rates, and loads, and get an idea of how well this bed will actually perform. Also, we are getting closer to a reliable motor controller, which will allow the motor to be driven via the force sensitive handle.

Hours Worked
12 hours