Work Completed:

An interesting subject was brought up in last week’s meeting concerning the range of horizontal movement for the easel. Using a six inch stroke actuator for a canvas width of 32 or more inches does not seem sufficient. We did not want to return the actuator due to the high cost and the amount of time required to exchange the part, so our team designed a lever system to amplify the movement of the actuator from a 3 inches in each direction to around 6 inches in each direction, allowing us to cover a larger portion of the canvas. The lever is pinned 1 inch from the end acted on by the linear actuator and the easel is fastened to an arm 3 inches away from the pin. A diagram of what this piece will look like can be seen in the figure below:

![Figure 1: Simple Representation of Lever System](image)

Over the last week we ran into a problem when ordering the relays for the project. The original choice for relays was to have them rated for 3 amps. Unfortunately, they were backordered for 3 months. Further searching found similar relays but nearly twice the anticipated cost. Fortunately, our group was recently given four relays that were left over from a previous project. These relays are rated for 15 amps which is more than capable of running the actuators. In order to run all three actuators we will need 6 relays. Regardless, this has significantly reduced our expense as the remaining two relays will only cost $25-30 dollars with the mounting sockets.

Additionally, an order was placed for 2amp DC circuit breakers. These breakers will be very useful in ensuring that the actuators never draw more than 2 amps of current. They will also help to limit the amount of current that can travel through the relays, since they are capable of up to 15 amps. This will provide the ability to also reset the circuit should a short occur during testing and will also save on the cost of purchasing multiple
fuses. A picture of the circuit breakers can be seen following. They represent a large portion of the safety mechanisms built into the easel. A picture of the circuit breakers can be seen below.

![Figure 2: Two Amp DC Circuit Breakers](image1.png)

Additional parts were also cut for the easel which will handle the vertical and horizontal movements. This will be done using a channel system with two interlocking pieces of aluminum to which one of the linear actuators will be attached. A picture of how the channel pieces interconnect can be seen following.

![Figure 3: Interlocking Channel Pieces](image2.png)
Jackie also worked on designing a number of additional features for the easel. Ideas include a drawer to accommodate painting supplies such as brushes or pencils that our client might need, a water cup holder, and an easel light. These will be additional benefits of the easel and hopefully help the client to gain as much as he can from our design.

**Future Work:**

The actuators have arrived and over the next few weeks we are planning on finalizing their optimal placement in the device. We have brought up two grinders to the lab so that the material can be cleaned up, de-burred, and welds ground down if necessary. Another piece of aluminum tracking from 80/20 is also expected to arrive later in the week which is necessary to provide for the carriage and base to be joined together. Brackets must be fabricated to mount the carriage to the urethane slides used on the 80/20 extrusion.

Over the next week, plans are to complete a purchase order for the last two relays that will be needed. Also, some initial research for an acceptable power supply will begin. The project will also require a rocker switch that our client can use to ensure that accidental movement of the joystick will not cause the easel to move while he is painting.

A box will be constructed which will house the electronic components (relays, circuit breakers, etc) and this will also be mounted to the back of the easel. Finally, once the joystick arrives, we can begin designing a method for it to attach to the easel and wheelchair if desired.

**Project Review:**

So far the project seems on schedule and to be coming along well. The horizontal and vertical movement designs are nearly complete and material is being cut to assemble them. The easel has been assembled temporarily and it seems that it will work exactly as planned. We have been very careful to take all aspects into consideration when designing the easel, and hopefully our efforts will pay off. The electrical system is almost completed and as soon as the easel can be fully assembled we can begin testing it with actuators.

We have been extremely fortunate with our free supply of aluminum material, donation of a joystick from PQ-Controls, and also obtaining 4 relays that will be very useful in the electrical system.