Jim Veronick

Week 6

In the last two weeks, the Kevlar shell made of spindle cutouts was completed. It was removed from the mold in the machine shop. The shell was then cut and shaped with a jig saw. This process was very tedious and difficult considering the saw cut very slowly through the composite. The composite was about a half inch thick, and it is clearly very durable if a saw can barely cut through it. This shows that the helmet can most likely withstand a lot of forces, including sharp objects and most likely ballistics as it is intended to do so. The shell was cut based on the outline of where the mold edges were, meaning that roughly the same shape was used. However, the area around the ears where the chin guard would go were left extended about a half inch further to allow for the connection of the guard. The jigsaw was hard to angle and needed a lot of force to push it through the composite, but in the end, the shell looked well done.

After the cutting was complete, loose threads were removed and the shell was brought to the grinding wheel for sanding. Due to the size of the shell, the grinding wheel could not get to all of the areas and edges of the helmet. The grinding wheel did a fair job of sanding down rough edges, but ultimately, the composite is not intended to be sanded down. The epoxy is permanently adhered to the Kevlar fabric which prevents the ‘sanding’ of layers to really happen. Clearly, the best attempt was tried to perfect the shell.

In addition to the shell being finished, EPS blocks were ordered. It was decided that ordering blocks and shaping them ourselves would be the best idea despite the amount of labor it will take. There was no other way to send out a particular specific shape for the company to make unless we had some way of drawing it exactly to specification in CAD, which we could not do.
An EPS hotwire cutting tool, known as the freehand router, was purchased online that will be used to shape the blocks appropriately. This tool is naturally in a convex form, which will allow for the inner carving of the EPS blocks. The outer portion of the EPS can be carved by shaping the freehand router tool’s wire to the appropriate concave angle.
Additionally, this week the mold for the chinguard was started by shaping air-dry clay. This was very difficult to do because we do not know what the exact dimensions have to be for this piece. The chinguard must fit the shell we made appropriately, keeping it mind that it has to protect the soldier’s face, but not impair his range of view, and it must be able to extend to an upright position having clearance from the front of the shell. This week, I decided that the best way to start the chinguard would be to make two identical side pieces with the appropriate 2-dimensional shape, and then bend them accordingly so that they would wrap around the soldier’s face. Working with clay is very difficult and hard to make an ‘identical’ piece for symmetry. As can be seen below, the two side pieces were made as shown.

Figure 2. Flexibility of the freehand router hotwire tool to cut and shape EPS foam.
After making these, the two pieces were put on a piece of wax paper in the orientation shown above. The wax paper was then partially laid on a ramp which would induce an appropriate curvature for the left sides of the side pieces which would contour around the soldier’s face. Problems with this method include that the perfect contour is nearly impossible to make because it is not being molded around the shell and someone’s face simultaneously. The angle used was approximated by a guess and check method. The ramp can be viewed in the figure below, where the clay dried overnight into the final mold.