Group #5
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Crane/Base Plate Components
1 Square Base Plate
1 U-Bar cut at a 45deg angle
2 Vertical T-Beams
2 Rectangular I-Beam Base Plates
1 Angled T-Beam attached to U-Bar
2 I-Beams
3 I-Beam Braces
1 Motor Cradle
2 Triangular Cradle Supports

Tomahawk Lever Arm Components
2 Delran Strips
Aluminum Plated Delran Weight Cradle
1 Aluminum Spacer
1 Adjustable Counter-Weight Holder
2 Rectangular Counter Weights

Explanation of Crane
We decided to use the U-Bar as the base of our crane because it minimized torsion, bending, and deflection through out the entire mechanism. Although cutting the ends of the U-Bar at a 45° angle reduced the U-Bar's height, we found that with the benefits of extending the vertical T-Beams out into the playing field, we were able to achieve a better angle for the double I-Beams and motor to lift the weight. With a more direct angle, we reduced the torsion caused by the motor lifting the weight and lever arm. The vertical T-Beams were attached to the insides of the U-bar with the “T’s” perpendicular to the surface of the playing field because it reduced torsion and facilitated our manufacturing process. The rectangular I-Beam base plates allowed us to easily angle and attach the double I-Beams to the vertical T-Beams. The T-Beam extension on the front face of the U-Bar lessened bending in the I-Beams, which reduced the deflection of the motor and allowed the crane to lift the weight higher. The crane contains two I-Beams because it increased the moment of inertia of the I-beams therefor lessening torsion and deflection. We inserted three braces between the I-Beams to help stabilize and reduce the torsion caused by the motor. The two triangular cradle supports help steady the cradle, which held the motor in place.

Explanation of the Lever Arm
The lever arm was composed of multiple pieces of Delran and aluminum for a few reasons. With the addition of our counter weight, the lever arm tended to hit
the crane, as it was moving through its full range of motion. To fix this problem, we used an aluminum strip as a spacer so that the crane would no longer impede the motion of the lever arm. To actually lift the weight, we decided to hook the screw protruding from the side of the weight and lift it from there. There are aluminum plates covering the “hook” section of the lever arm because they allow the screw to slide more easily as the motor lifts the weight.

Most Interesting/ Most Proud
The most interesting feature of our crane is the use of the double I-Beam. There were not a whole lot of other teams we saw that used such an apparatus. We are most proud of the problem solving we used to fix our lever arm and maximize the lift height of the weight. This includes the components like the aluminum spacer, the adjustable counter-weight holder, and the counter weights themselves.

Motor Calculations Summary
Theoretically, our lever arm only needed half of the power supplied by the motor. Also, the maximum height that our lever arm could have lifted was 2¾ in. In reality we needed a counterweight and our lever arm lifted the weight to almost the maximum height.