Remote Control Rotating Hook Block

Overview
A hook block allows the actual hook and attached load to spin on a bearing. Currently, a worker must manually rotate a load to the correct orientation by direct contact with the load or using guide ropes. Instead, Manitowoc has requested an easier and safer solution that allows the operator of the crane to remotely rotate the load from the cab, where he controls everything that moves on the crane.

Objectives
The goal of this project is to design and develop a functioning, scaled prototype of a remote controlled, rotating hook block to demonstrate the mechanical design for the solution and applications of remote control usage for a 40 ton load. Along with a functioning prototype, the team is responsible for designing a model that would work in full scale for one of the Manitowoc's cranes.

Approach
- The team discussed the project requirements and specifications through weekly conference calls with the sponsor
- Three concepts were generated and a decision matrix was used to determine the final concept
- An extensive patent search was done and a very similar idea was found but the patent was expired so concepts from this patent were used
- A site visit to the sponsor was done during the first few weeks of the project so the team could meet with the entire team working with Penn State
- An analysis of the max power a reasonable electric motor could produce lead the team to determine max loads for different shapes and inertias
- A full scale CAD model was created and delivered to Manitowoc, including the motor, gear reduction, and battery source
- A final prototype was created to demonstrate the remote control usage and gear reduction for an electric motor
- Different loads were tested on the prototype to demonstrate controlled rotation of the hook

Outcomes
- Due to the high torque needed to rotate a 40 ton load, the team was able to find max loads for specific load shapes
- Once these loads are reached, workers must resort back to manual operation of the rotation of the load

Max loads:
- 10 ft beam: 145 lbs
- 2 ft sphere: 753 lbs
- 4 x 4 ft cube: 453 lbs