Rifle Stabilization System for a One-Armed Hunter

Overview
Our user, Brian Zern, had an accident at a construction site that left him without the use of his left arm. Brian had always had a passion for the outdoors, specifically hunting, but the use of only one arm kept him from enjoying his passion. Our team was approached to design an improved rifle rest that would allow Brian to hunt regardless of his injury. Further, the team was told that an existing shooting stick would serve Brian well as long as the team made a few ergonomic, retention and safety minded changes.

Objectives
The team was tasked to create a rifle stabilization which:

- Allowed the hunter to hold the rifle safely at all times
- Operated quietly and consistently
- Preserved the user’s existing joint

Approach
- The team broke down the project into the components associated with the above objectives. The list above was broken down as such to allow the team to address each issue fully and to the best of their ability.

The steps we took include:
- At our first meeting, our user discussed the product he currently used and the components that made operation difficult for him.
- Concepts were generated by each member of the team and sent to the end user in order to determine which design would best fit his needs.
- Many patents were reviewed while some designs offered rotation, none offered pivoting and the closest relevant patent pertained to the attachment of a putter head on a golf club.
- We visited our sponsor at the same time we met the end user who offered input as to what would improve his lifestyle.
- The team ran Finite Element Analysis testing to determine a material that would sustain recoil forces over time.
- The team created detailed SolidWorks models of all components such that the parts could be manufactured by referencing them.
- The team manufactured three ball prototypes, five cup prototypes, ten trigger prototypes and two pin prototype during the course of the project.
- The team tested the ball, trigger, and pin components cyclically and functionally. The Finite Element Analysis was conducted on the ball and cup to ensure safety guidelines were maintained.
- Our model was validated after FEA was complete, the forces acting on the cup and ball were tested at a value higher than actual and the factor of safety minimum of two was still maintained.

Outcomes
- Manufacturing times were reduced by twelve hours from the prototype to final design, making the system more readily suited to mass production. The number of components was kept to a minimum so as not to overcomplicate the design.
- The project resulted in a different approach to mating a user’s rifle to a shooting stick through the use of a ball and socket design wherein the ball would quickly come free through the use of a push button retention pin.
- This project gave our end user the ability to continue his passion for hunting and the ability to bond with his grandson.