The purpose of this project was to design and build a prone human powered vehicle for a paraplegic. Rick Allwein of the Central Pennsylvania Spinal Cord Injury (SCI) Support Group is the sponsor for this project, and the prone handcycle is designed to fit his needs. Mr. Allwein has a history of pressure sores and prefers to be in the prone position, lying on his chest. To ensure safety and control, Mr. Allwein expressed the need for an all-in-one steering, pedaling, and braking interface.

There are several prone cycle designs patented, including those with rotational and elliptical hand movements to power the vehicle. The One-Off Handcycle that is currently available on the market employs hand pedaling as the driving motion; however, due to its use of high performance parts, it is very expensive. In addition, this cycle utilizes chest steering and separate pedaling and braking interfaces, which Mr. Allwein deemed undesirable.

Given the customer needs and background research, Team Trike generated a concept consisting of several subsystems. The base of the handcycle is a triangular frame made of chromoly steel. Two wheels are located in the front of the vehicle on either side of the rider and one is in the rear. This triangular shape is very stable. The design is driven by a chain which connects to the back wheel. Input is provided by the rider using an elliptical motion rather than a traditional pedaling motion. The handles used for pedaling have levers mounted on them for braking, steering, and shifting. Seating for the user consists of a foam platform with raised edges to secure his legs.

Due to time constraints, the handcycle was not completed entirely; however, the team built a strong and stable frame that can be modified for Mr. Allwein’s needs. Additionally, the drive system and handles sufficiently power the cycle, with working brakes and shifting. The team manufactured a brake cable splitter for the front two wheels, but an after-market splitter has been determined to be the better option to ensure safety. The steering cable design assembly made by the team needed too much force to actuate the steering plate, and thus further development would be needed to allow for better steering. Testing of the handcycle confirm that the drive, ability to reverse and traction are within the expected limits.

The cost for the prototype was $807.17, well within the working budget of $1,000. This figure excludes the cost shipping and handling, travel, and the poster required for an end of project showcase. In comparison to the One-Off Handcycle, this is roughly 15% of the shelf price.