Roller Coaster Restraint System for Riders with Disabilities

Overview
The restraint system of a roller coaster is one of the most vital pieces of equipment used to keep riders safe throughout the duration of the ride. Its sole purpose is to keep riders securely fastened within the train as it is in motion, particularly when going through inversions. Premier Rides Inc. utilizes a shin bar in addition to a lap bar to secure the rider on their Sky Rocket roller coaster, found at Kennywood Amusement Park. While such a system has greatly improved the riding experience for riders in regards to their comfort, it certainly has its share of drawbacks, primarily with disabled riders.

Objectives
The overall objective of the project is to improve the current restraint system design to allow people with leg amputations to safely ride one of Premier Rides’ roller coasters. The design must keep a rider without full legs secure in their seat throughout the various twists, turns, and inversions of the ride. The change in design must ensure that the rider is safe and comfortable both physically and psychologically. Additionally, it must be easy to use without adding much time to the loading and unloading process.

Approach
- The customer needs were determined through a site visit with Premier Rides.
- External research was gathered on existing products, applicable patents, and ASTM codes/standards.
- A retractable nylon strap system concept was developed along with an electronic push solenoid locking system.
- CAD models for the strap and solenoid system were created and analysed.
- A working prototype was constructed on a rotating test seat provided by Premier Rides.
- Tests were conducted to ensure that each component could withstand the required amount of force determined by our safety factor.
- Pictures and videos were taken to display results to the public.

Outcomes
- The strap system was able to effectively hold in individuals ranging within the permitted height requirement zone.
- The solenoid model displayed a locking mechanism concept to be further tested in the future by the sponsor.
- The installation and set-up procedure is efficient and can be performed in less than a minute.
- The entire design only added 24 lbs. of weight onto the train seat.
- The estimated cost of implementation is approximately $186.69 excluding labor and machining costs.