Overview
The goal of this project was to design, build, and deliver a mechanism that, when paired with a full-scale sulky and virtual reality (VR) headset, allows patrons to experience a realistic simulated harness race. The mechanism needs to be easily moved from booths at events and be durable enough for an adult sitting on the mechanism for long periods of time. The team was challenged to handle problems that arose such as alignment of axles, creating enough power to lift a load of over 350 pounds, stresses of starting/stopping on the motor and gearbox, and vibrations/stresses of unbalanced loads for the final design of the cam system generating the displacement in the final project.

Objectives
The objectives for this project included:
- The creation of a concept to be a realistic motion generator for a VR sulky racing simulator.
- Create a final prototype that can be detached and durable for long periods of time handling a load over 350 pounds that will be starting/stopping repeatedly.
- A simplistic, stout design that contains interchangeable components that can be easily maintained and replaced if needed.

Approach
- PA HRA provided customer needs and aided in the gathering of data to create a realistic, durable mechanism.
- Research was conducted of relevant patents and existing products, but no existing product could exactly fit the needs requested by the PA HRA.
- Based off other simulators in the market, the team created various concepts to solve the task at hand.
- CAD renderings were created of each concept where the team performed an in-depth analysis of the advantages and disadvantages of each. This included the same concepts with different materials being used.
- Alpha and Beta Prototypes were created to allow the team to observe problems that arose with a certain concept.
- After many iterations, the team selected the final concept that resembles car components such as a cam system to create the motion, receiving its power from a motor via a gearbox, couplings, and axles.
- The sponsor was included in each concept and aided in the selection of the final concept.
- An engineering thought process was conducted on each subsystem to allow for the success of the final prototype.
- After each component was evaluated, assembly of the final prototype was conducted.

Outcomes
- The team created a functioning prototype that could endure a 350-pound load for an immense amount of constant use for long periods of time.
- The mechanism created included a simplistic design with minimal components that could be interchanged and maintained.
- The mechanism included features such as easily changing the vertical motion of each sulky wheel so that they could travel in a unison, alternating, or 60° phase interval with respect to each other.
- A mechanism that is cost effective to produce and can be replicated easily.