Inertial Dynamometer for Low Horsepower Vehicles

Overview
Develop a dynamometer that can be used for vehicles ranging from .5 HP to 5 HP. The dynamometer must be safe up to 25 mph. The dynamometer should be able to output speed graphs, HP graphs, and torque graphs. This system will be used to tune future small vehicles in the Penn State Mechanical Engineering Department.

Objectives
Design an inertial dynamometer with a variable mass system to allow for a range of low HP vehicles. Also, create an easy to use computer package for the end user. The entire project should cost under $1000.

Approach
- Extensive patent search for commercial low horsepower dynamometers yielded little results
- Used concept selection to choose between an inertial dynamometer and a steady state, absorbing dynamometer
- Met with several relevant professors to determine best method of approach and for idea generation
- Inertial dynamometer works by gathering acceleration data on a known inertial mass to yield the system torque
- Hand calculations yielded the size of the inertia needed for various horsepower vehicles
- A very detailed SolidWorks model was created to determine dimensions of the dynamometer
- A full scale prototype was developed. This process involved the welding and cutting of steel tube
- Performed tests to determine the inherent frictional torque in the system
- Using vehicles where the horsepower was roughly known allowed us to validate our output graphs
- Our software is able to generate velocity, horsepower, and torque graphs

Outcomes
- The project cost was ~$800, which is about $2,500 cheaper than the cheapest current commercial solution
- Project will allow future Shell Eco-Marathon teams to tune their vehicles
- The power and torque graphs are very clear and precise, allowing for repeatable results and comparison among multiple runs
- Produced a dynamometer rarely seen with most commercial solutions, which utilize some sort of braking method to test vehicles at constant speed