# Human Hydraulic Powered Bike

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## Design Challenge:

Parker Hannifin Corporation is sponsoring this competition between several schools to design and build a hydraulic powered bike.

- The final drive must be completely hydraulic powered
- The bike can only have one rider
- The bike must be sufficiently stable, maintain good visibility, and have a capable braking system
- Must complete a 4 mile circuit that has a change in elevation of 400ft
- Bike will be judged on manufacturability, cost, and marketability
- To be completed in August 2005

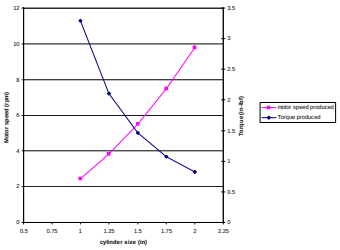
## Our Mission Statement:

Design and build a hydraulic powered bicycle that meets performance demands and design specifications set forth by Parker Hannifin Corporation. By utilizing all available resources and previous experience, complete this project within the deadlines provided.

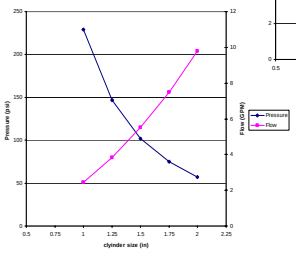
## Design Targets

- Average speed of 10 mph
- Use a low speed high torque hydraulic system
- Design a frame capable of supporting a rider and all hydraulic components while maintaining visibility rider comfort and safety
- Use a brake system capable of stopping the bike easily and safely when needed.
- Be capable of climbing hills of slopes existing on the course

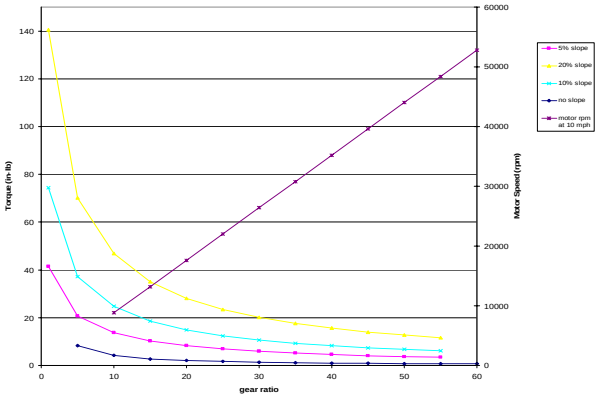
Torque and Motor Speed vs. Cylinder Size




Pressure and flow vs. cylinder size




Torque required vs. Gear ratio




The graph shows the torque and motor speed required for our vehicle to travel 10 mph on different road slopes.

## Design Procedure:

1. Researched the most efficient means of transferring power from a human to a hydraulic system
2. Designed the hydraulic system and frame around the rowing concept
   - -Hydraulic design: performed iterations with MathCad until we found the best design and modeled in Easy5
   - -Frame design: preformed FE analysis and completed drawing in Pro E
3. Frame Fabrication and Hydraulic Assembly
4. Perform Testing and Analysis of finished design

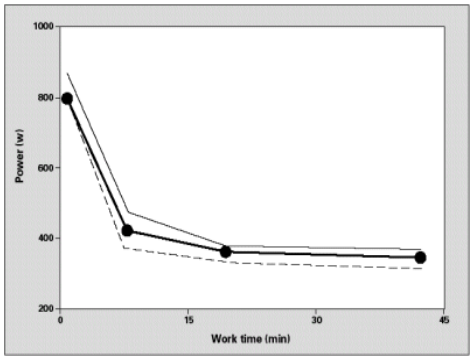
## Power Concept

-Our means of transferring human power into a hydraulic system utilizes a rowing action

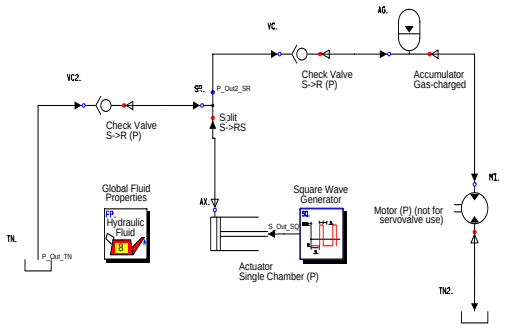
-Advantages of using this type of system include:

1. Use of a power bar amplifies input power through the torque arm
2. Literature review, and stationary bench tests showed results of higher output power than a conventional bike.
3. Allowed for a more simple and efficient hydraulic system

Row Concept Power Output



Easy 5 Simulation Schematic




## Structural Design

-Frame will consist of three wheels for increased stability

-Steering utilizes mechanical linkage in power bar

-Gearing achieved through simple chain and sprocket set

## Hydraulic Design

-Single acting power cylinder will be 1" in diameter with an 18" stroke

-Plumbing will utilize a tee and two low pressure check valves on the rod end

- •One valve will be between cylinder and reservoir and the second will be between cylinder and accumulator

-Fluid will flow from the cylinder into an accumulator to store energy.

- •Flow from the accumulator will keep the motor turning while the rider is retracting the stroke

-Fluid then flows to the high speed gear motor to power the rear wheels

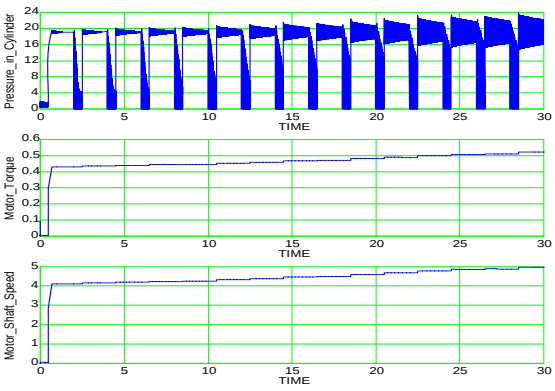
## Results

-From our analysis, we should be able to attain speeds approaching 10 mph

-The frame is capable of supporting the rider and the hydraulic components

-Hydraulics should be able to produce the torque required to propel the bike

Hydraulic Simulation Results From Easy 5
(Pressure in Bars, Torque in Nm,
Motor speed in RPM, and Time in seconds)




## Potential Impacts From Project

-Help us to understand low input hydraulic systems that may be used in applications ranging from medical equipment to outer space research.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