Design Proposal Packet

New Richmond High School SMV Team

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Log Book

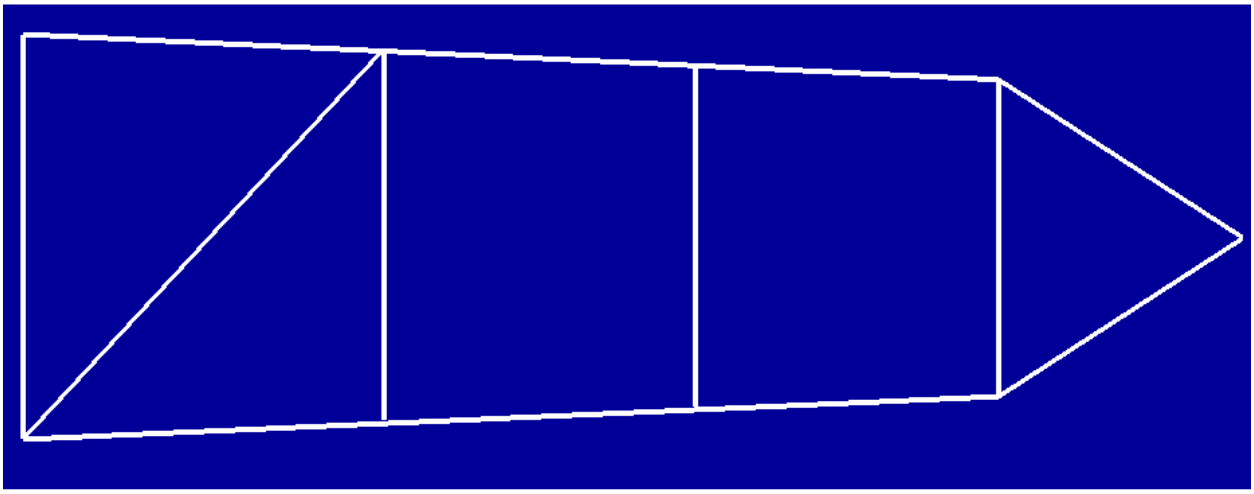
9.2007 – We discussed sponsorship today and chose places we would go to for sponsorship.

- I have received $100 from the Public Library and $500 from Fusion Metals.

-- We discussed basic design concepts.

- Removable Back end for ease of work on motor
- 3 – wheeled to minimize friction
- 1 – rear tire is propelled by the engine in a rear compartment
- 2 front tires used for steering
- Angular design for aerodynamics
- Engine to be removed with the back end
- Use similar design concepts from Andy Svenningson's car last year.
- Use WITC's superior machines to create axles and brake caliper mounts to minimize weight.
- Use airplane fabric instead of mono-coat for strength and durability while still remaining light.
- Hatch on the back for easy access to the fuel line, engine, and fuel bottle.
- Use one tie rod to connect the steering to the right tire. Use another tie rod to connect the right tire to the left tire to ensure the same turning radius with both tires.

Bottom front frame thumbnail



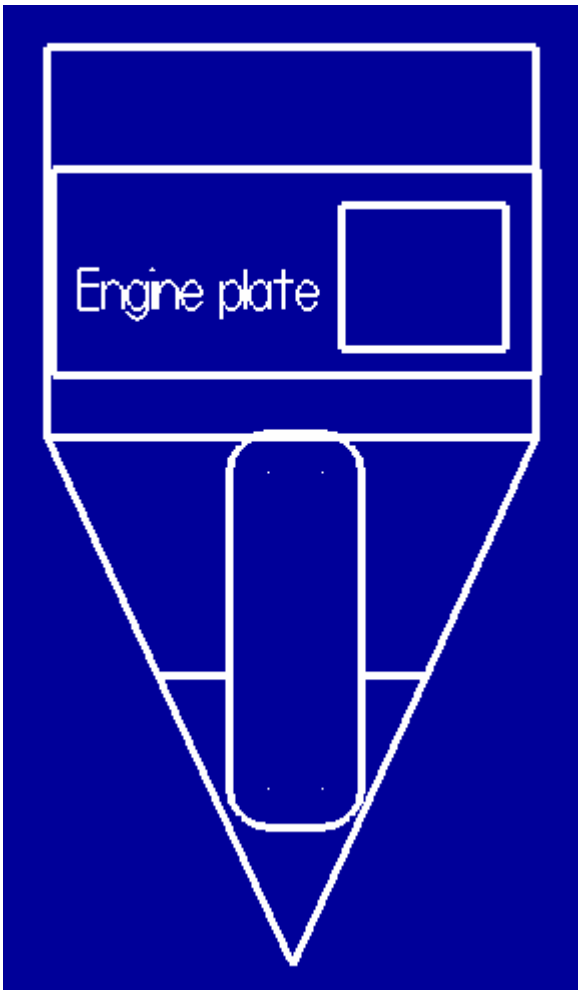
10.2007 – We discussed possible steering options

- Joystick steering
- Rack and pinion steering
- Normal tie rod steering ** Chosen

- We approximated the total length of the car to be 8 feet 6 inches from tip to tip.
- Wheel base will be approximately 5 feet.
- We approximated the amount of 1 inch aluminum tubing needed to create car.
  - 3 lengths of 20' tubing.
- Wheel attachment is discussed and final design finished.
  - wheel will be attached by a spindle which is bolted in between two eye-bolts that will be attached to a plate, welded onto the ends of the straight axle between the tires.

- Axle between the tires will be straight and welded to the top of the nose piece of the car and supported by two plates fitted to be welded to the axle and the supporting tubes for structural soundness.

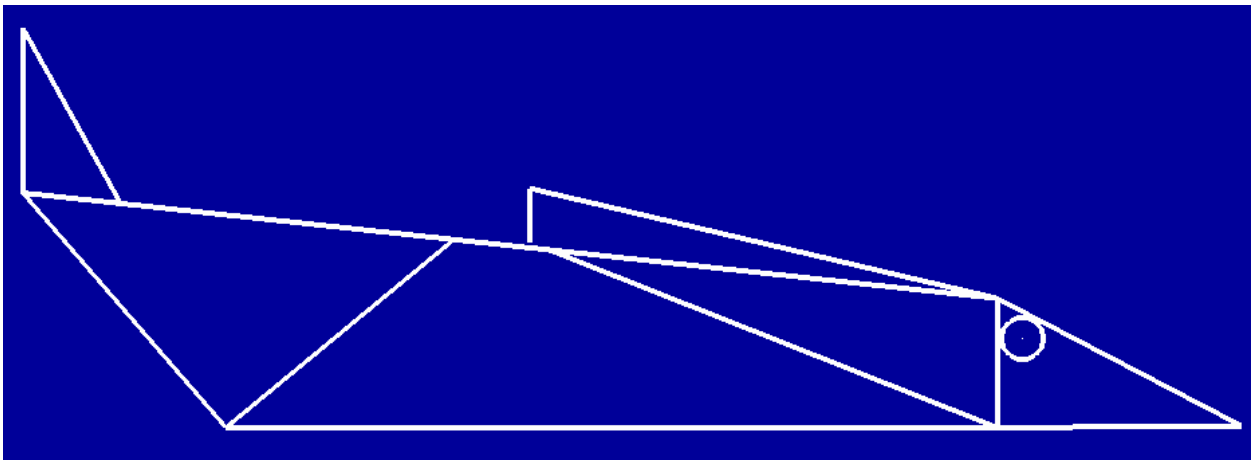
Bottom frame back half thumbnail



11.2008 – We created a quarter scale model of the car using wooden dowels. This model enables us to move more quickly in the production of parts for the front end of the car.

- Base of car has been begun.
- We cut 2 x 44”, 1 x 26”, 1 x 19”, 1 x 21.5”, and we cupped or angled these pieces to aid in better joining during the welding process.
- Axle is decided to be 2.5” round aluminum tubing instead of two square tubes.
- 70cc engine is what we will use for the car. It is Andy’s engine from last year.
- Removed wheels, brakes, engine, and seatbelts from former SMV car.

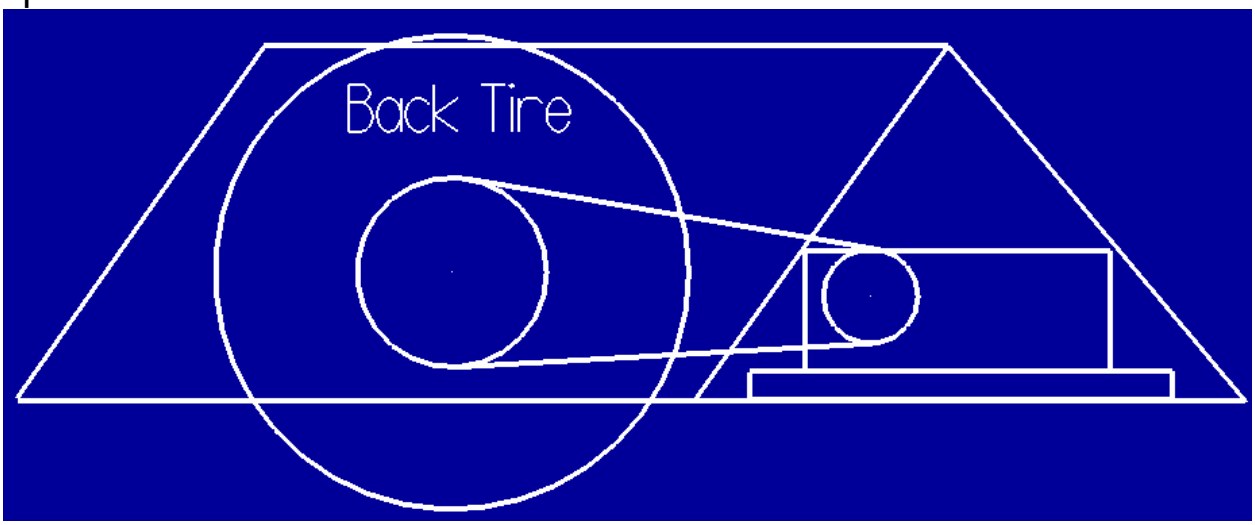
Side view front frame
Thumbnail



12.2008 – Base of car is finish welded.

- Back rest/firewall is begun.
- Obtained permission to use airplane fabric and paint sponsored by the Svenningson's.
-Color scheme decided. Flat black and baby Blue.
- Aluminum for firewall and bottom of the car has been obtained.
- Finished the tire spindles and obtained the eye-bolts.
- Shifting linkage for the engine will be copied from Andy's car. New shifter handle will need to be made to accommodate the electric start.
- Removable back is discussed and planned to begin after xmas break.
- Backrest/firewall is created. 5 x 22" are cut and cupped/angled and welded into place.
- Nose of car is created using 2 x 22", 2 x 21", 2 x 12", 1 x 6".
- Tubes spanning from the nose to the backrest of the car have been cut. 2 x 57". Also we have added a peak to accommodate steering linkage and to make the canopy smaller. 1 x 20", 2 x 8".
- Front supports for the roll bar have been added.
- Flat stock has been cut and drilled for seatbelt mounts.
- Axle between tires has been cut, faced, fitted and welded into the nose of the car. 2 plates have been created to support the axle and those have been welded to the axle and surrounding support tubes.
- Axle is 32" long.
- Face plate has been angled to fit into the peak. This plate will hold the bearing for the steering column and the kill switch.
- Canopy has been mapped out. 2 x 22.25", 2 x 27.5", 2 x 8".
- Flat mounts for the tire spindles have been begun.
- Seatbelt mounts have been roughly placed, cut, and drilled.
- Purchased 2 bearings for the steering column.

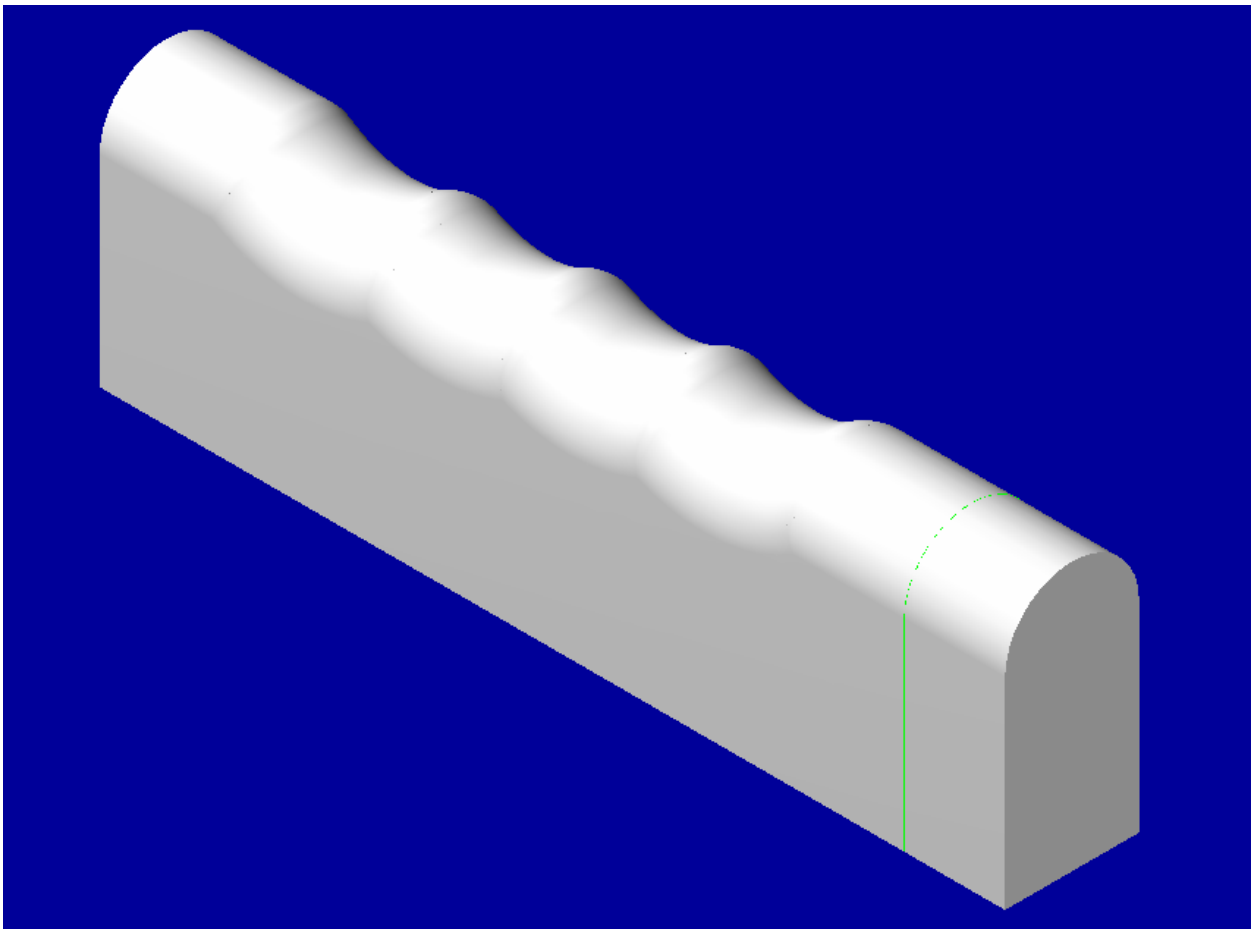
Back side view thumbnail with engine, tire, and sprocket



1.2008 – Sheet metal for the bottom of the car has been acquired and cut to shape.

- Sheet metal for the firewall has been acquired and cut to shape.
- Back end connecters have been sized and drilled.
- We taped out the back end on the floor to size.
- We cut 2 x 27”, 2 x 24” to encase the engine and be the frame supports to the coming engine plate.
- Frame box for the engine in the back end has been finish welded. Is large enough for shift linkage, engine, and battery(from electric start).
- We made 2 x 40”, 2 x 22”, and 1 x 24”. The large tubes will be the bottom of the back end that encases the tire.

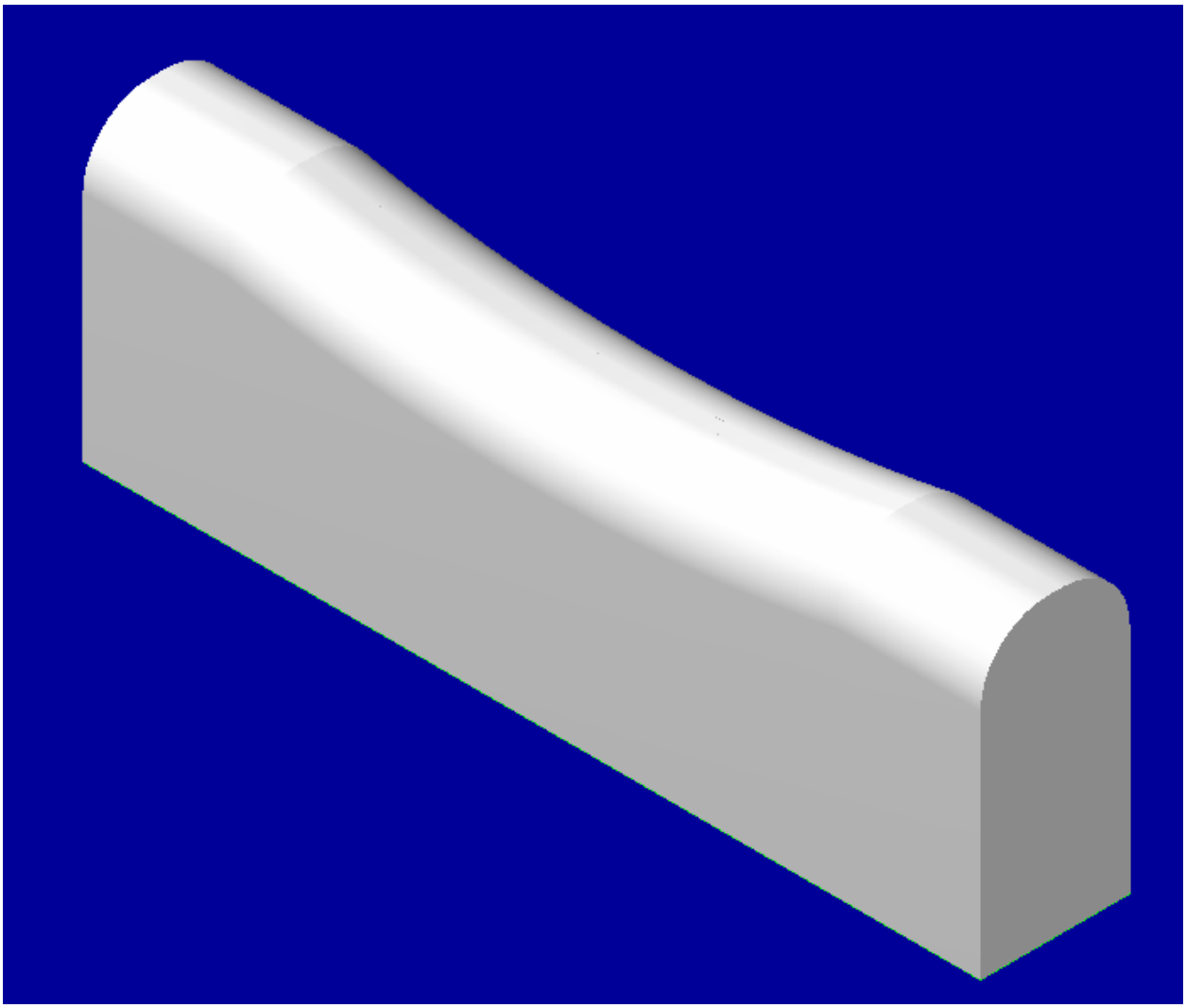
Shifter – Machine finger side thumbnail



2.2008 – Front bearing was bought along with the plates, bolts and washers to attach the bearings to the car solidly.

- Changed back end length by 2” to allow for more tire clearance.
- The back end box, angled back, and angled attachment tubes are welded together.
- The back canopy has been begun.
- Back end bottom frame is mostly finished.
- Needs tire and engine mount welded into place.
- Plans for fabric-ing are made for the 1st weekend in April.
- We have begun enclosing the back end where the tire will be.
- Horizontal upper supports and angled back pieces have been cupped and welded into place.

Shifter – Machined Palm
Side



3.2008- Back end outer frame has been finished.
-Engine plate material needs to be found and final design decided on.
- 8 attachment tubes have been made for the attachment of the back end.
- Rods to be used for the attachment of the back to the front end have been cut to size.
- Fabric has been obtained and paint has been ordered.
- Pins for the attachment are out of 7/16 steel rods.
- We created a washer to weld to the pins to remove them.
- Decided that a cotter pin will be used the secure the rods to the tubes.
- Worked on the log book.
- Obtained information on safety items, tire specifics, and engine.
-Attached bearings and cut steering shaft.
-Made tie rods and plate to be welded on the steering shaft.
-Seat belt mounts welded in.
-Engine plate cut and fitted.

-Purchased connectors for the engine.
-Shifter handle is being made at WITC.
-Finished all of design packet but the drawings.
-Shifter handle was machined
-Worked on Power train drawing and drawing of the sprocket.
-Made thumbnail simple sketches of the various frame parts.
-Inserted pictures into packet.

Basic Vehicle Configuration

Our vehicle consists of two large parts. These parts are the front and back end. The two frame ends are attached by tubes and pins on four corners to evenly distribute breaking force at that point. Our car is created from 1 inch aluminum tubing. This tubing is used throughout the frame in the front and the back. We are using sheet metal for the bottom and firewall. The front frame has a bottom, nose, driver's compartment, steering attachments, shifter linkage, and roll bar. The front axle is attached across the nose. This axle has two load bearing wheels that are attached to the steering system that allows our driver to turn. This steering system consists of a steering wheel with two handles for gas and brake. The wheel is connected to a steering shaft that is supported by the top of the frame and moves easily because of two bearing used to ease steering. This shaft is attached to a plate where the tie rods are attached. The tie rods extend out to our spindles. This system directs our car. The back end consists of the engine box and the tire supports and mounting system. The engine is located behind the firewall and behind the driver. The shifting linkage begins in the engine box attached to the engine and extends into the driver's compartment allowing for shifting to happen. The engine itself is bolted to a plate that is welded to the back frame of 1" tubing. The engine is connected by chain from its transmission to the sprocket on the wheel. The tire itself is supported by 2" aluminum flat stock that is integrated into the frame. The front of the car with the exception of the nose and the canopy is covered with airplane fabric for durability, strength, and weight. The canopy, nose, and back end are covered with poly carbonate for strength, durability, and removability.

Costs

Aluminum- $400.00

Fire Extinguisher- $20.00

Fuel Bottle- $51.00

Poly carbonate- $49.00

Sprocket- $45.00

Tires- $184.00

Primary sprocket- $23.00

Engine- $266.00

Miscellaneous, bolts, washers, switches, hoses- $75.00

Chain- $15.00

Machined parts- Donated (brake mounts & spindles)

Air cylinders- $90.00

Other paint- $36.75

Stitz Fabric- Donated by Sveninngson's Aviation

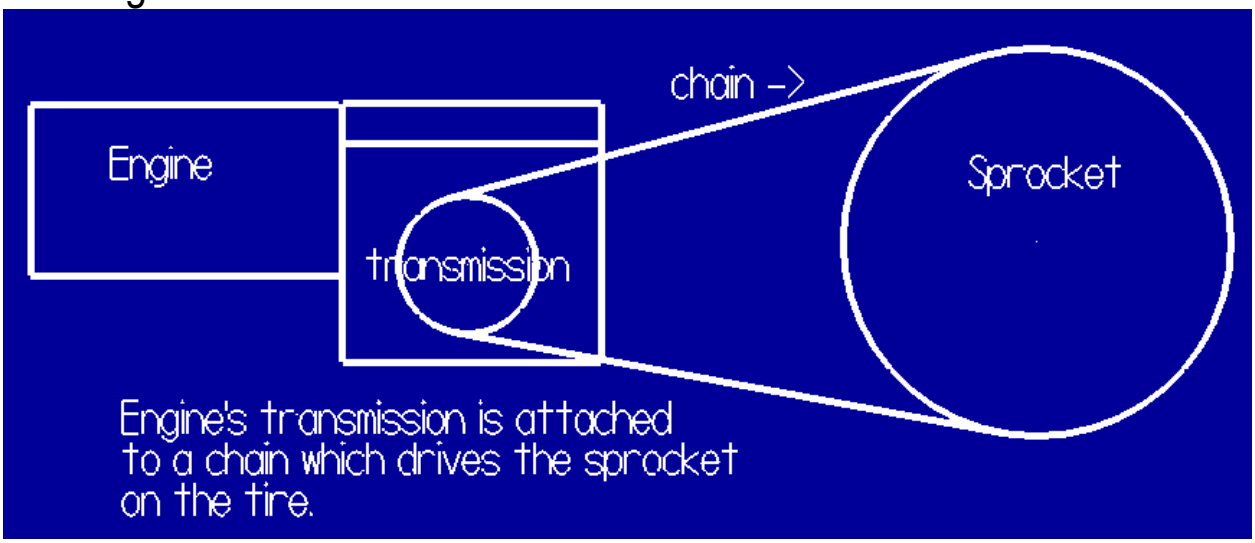
Foam- $16.00

Power Train Configuration

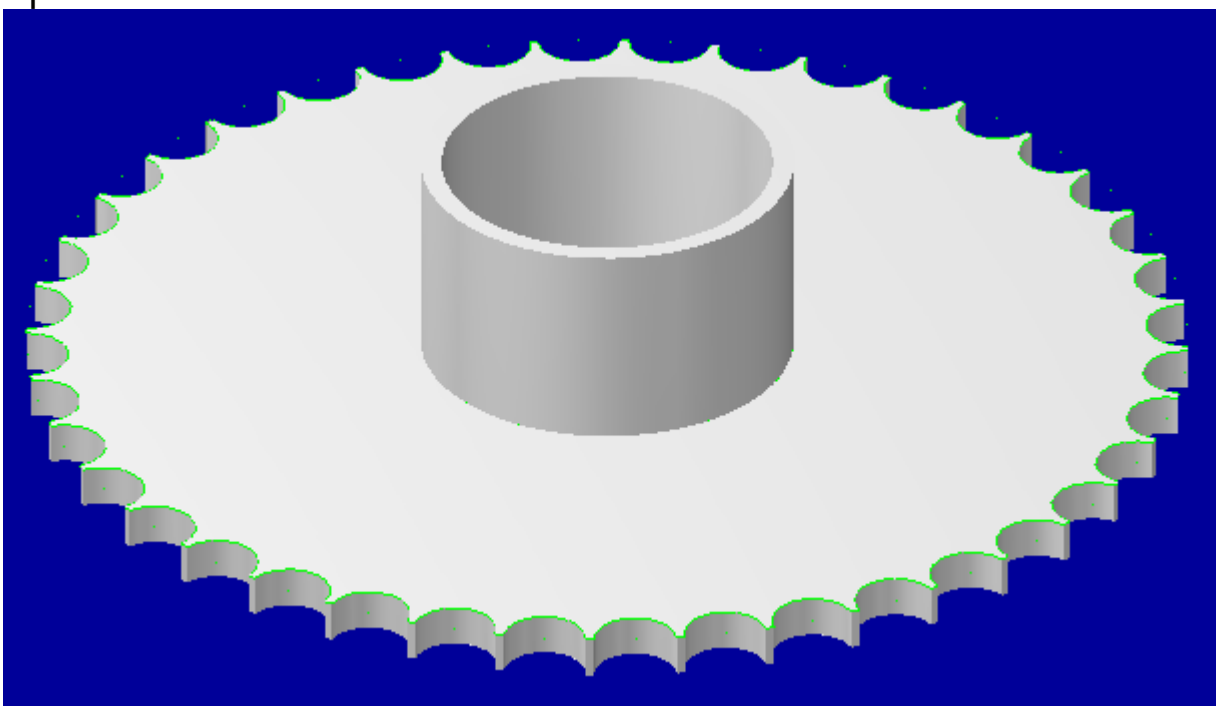
Lifan 70cc Engine
*4-stroke single cylinder, OHC air-cooled
*Max HP @ 9,500 rpm
*Max Torque 3.75ftlbs @ 6,000 rpm
*Semi-automatic clutch
*Max HP 5.3

A 70cc Lifan Honda remake engine that is a 4-speed manual with a semi automatic clutch propels our vehicle. The clutch assembly extends towards the front of the car and into the driver's compartment. The gas control and shifter are both within reach of the driver. When a gear is chosen the engine transfers the power to the clutch sprocket. This sprocket is connected to a chain that runs between the clutch sprocket and the sprocket on the wheel. The chain is 40 pitch and the primary driving wheel is a Velocity deep V rim with a Turo-c-jet tire, which is 24" in diameter.

Basic Power train
Drawing



Tire
Sprocket



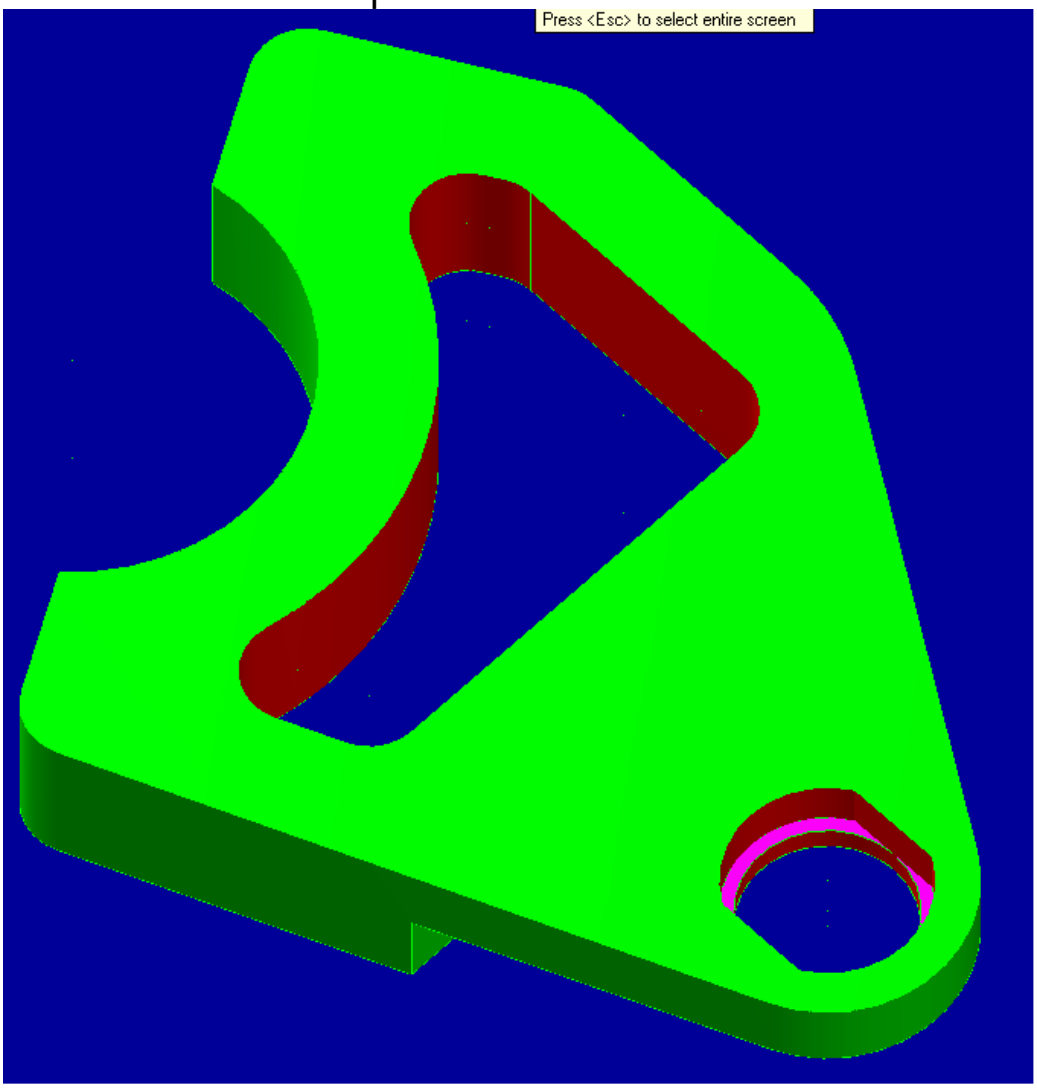
Performance

Before beginning building on the car we decided to create a ¼ scale model of the finished design. We built the model out of wooden dowels. This model process helped us in the building process. The model helped us find flaws in the design before we built the real thing.
We have done running tests to see what conditions the engine runs best in. Using just 8" of fuel line filled we ran the engine until it ran out. We found through about 5 tests that the engine runs best at warm temperatures with cool air being drawn into the engine.

Brake System

Our brake system consists of discs and calipers. The discs are stainless steel and are mounted to the front two wheels. The calipers are mounted to the tire spindles with brake caliper mounts redesign to have the brake sit at an angle allowing for greater surface area used during stopping. This modification aids the car in stopping quickly and much more effectively. Cables run from the calipers through the car and into the driver's compartment where they are attached to a handle. The manufacturer of the brakes and calipers is Hayes. This complete braking system will ensure maximum safety to our driver and other cars around us.

Aluminum Brake Caliper Mount



Safety Items

Helmet – Our driver wears a DOT approved helmet. Our driver will wear her helmet whenever they are operating the vehicle during challenges.

Roll Bar – The roll bar is at least 6" higher than our driver's helmet. The roll bar withstands a 350lb static load. It has supports on each side that extent frontward in a triangular shape for strength in between 25 and 45 degrees.

Kill Switches – There are 2 kill switches ground the engine ignition system. One is mounted in the vehicle within reach of the driver; the other is on the outside of the vehicle. They are a toggle-type switch and both kill switches are marked with a tag that is a 2" solid bright orange square and labeled on and off.

Vehicle Enclosure – The driver's body, arms and legs are enclosed inside the vehicle body. The driver's body does not come in contact with the ground. The driver's body is also not the first opint of contact in the event of an accident.

Guards and Shields – All moving parts such as the clutch, chain, and shafts or pinch points that are exposed beyond the engine enclosure are guarded.

Engine Compartment – The engine compartment of the car, with the exception of the bottom, is completely enclosed. The top canopy is fastened down and an exhaust pipe is used to get the exhaust out of the compartment.

Brakes – The brake system is adequate for stopping the car in a straight line within 25 feet from a minimum speed of 15MPH with engine running.

Fire Extinguisher – A multi-purpose ABC dry chemical fire extinguisher is located in the car. The extinguisher is within reach of the driver.

Fire Wall – A wall of aluminum at least 0.032 inches thick completely separates the driver from the engine. The firewall is higher than any part of the driver's body. The firewall provides total protection from the front half of the car to the removable back end.

Floor Pan – A floor pan of aluminum at least 0.032 inches thick covers the bottom of the car to keep the driver from road hazards. It begins at the base of the firewall and extents past the driver's feet. This pan prevents debris from entering the driver compartment.

Evacuation – The driver can exit the vehicle, unassisted, in 7 seconds or less.

Rear View Mirrors and Visibility – Driver has visibility to the front and both sides of the car and the vehicle has 2 rear view mirrors that the driver can successfully use to see behind them.

Seat Belt – Our vehicles is equipped with a 4-point racing seat belt mounted to the vehicles frame.

Problem Solving Essay

Entering this SMV season I expected things to go relatively easily because it is my fourth year in SMV. As usual things became complicated as I lost team members to other activities, time became scarce and was, in the end, ultimately on my own. To offset this loss I decided to plan. This whole car has been exactly what I designed in the beginning. In the beginning of the design process I discussed car ideas with former members of SMV that had participated for a few years during high school. They gave me some insight to flaws in my own plans and helped me work out the kinks. After I decided on a final design I made a ¼ scale model of my car with wooden dowels. This model helped me put together my car much faster than if I didn't know the exact lengths of the pieces to make it. The model I felt was an important aspect of my design process and helped me get over the loss of the team members. With the help of a couple of friends who were former SMV members I have put this car together through out the year, working around busy schedules and activities. Overall this year has been just as good a year for me as it has ever been. I believe I have built an amazing SMV car with loads of potential despite the obvious lack of time and help. In the end the awesome thing about this club is that all the time and effort in the beginning can really pay off at the competitions.