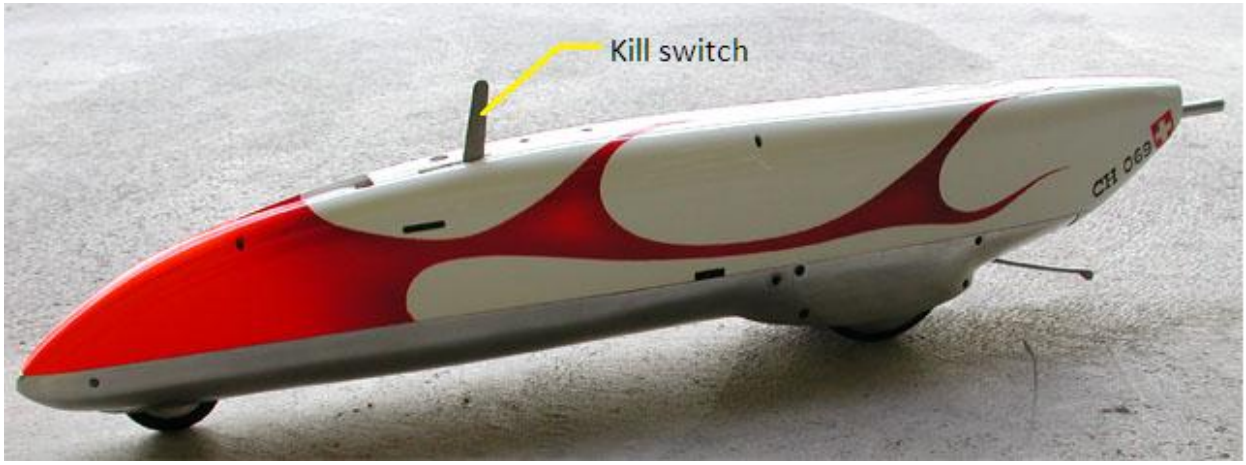
# NITRO BLITZ -3, the tether car event

## General specifications:

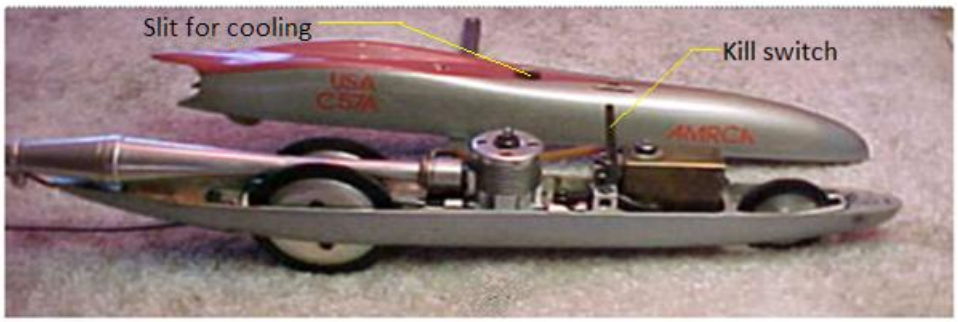


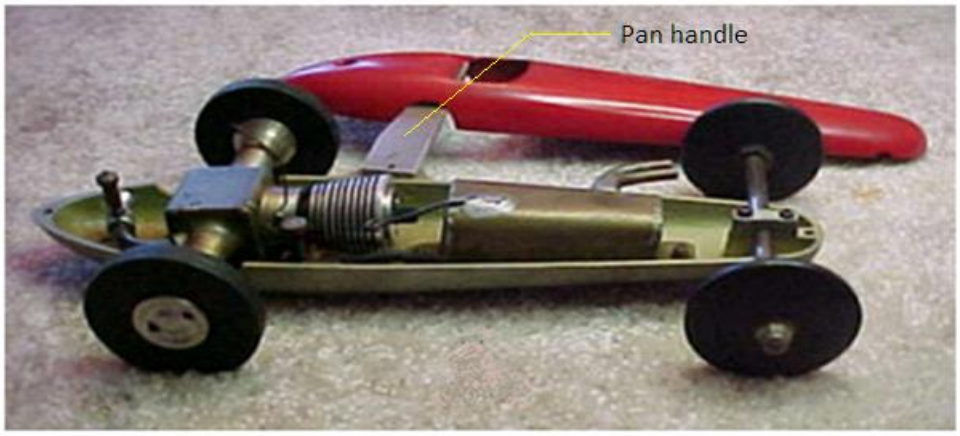

From the outside, tether cars look a lot like the vehicles that break land-speed records. The cars are narrow and most of the engine parts are enclosed inside the body of the racer. They're comprised of parts similar to a full-size car, including a combustion engine, exhaust pipe, air intake, flywheel, gearbox, driveshaft and wheels. The racers also have a tailskid, located in the back that stabilizes the vehicles at top speeds. The cars are typically about one to two feet (30.5 to 61 centimeters) long, and weigh anywhere from two to six pounds (0.9 to 2.7 kilograms). In our competition, we have fixed the max length as 60 cm and weight as 2.0 kg.

In the international competitions, there are five different engine sizes that compete. The smallest is the 1.5 cubic centimeter (cc) engine, which has a top speed over 65 miles per hour (104.6 kilometers per hour). The other engine sizes are the 2.5cc, 3.5cc, 5cc and 10cc classes. The 10cc engine class cars are capable of producing speeds over 200 miles per hour (321.9 kilometers per hour) [source: Macropoulos]. These two-cylinder engines typically run on a fuel mixture of 80 percent methanol and 20 percent castor oil and are capable of producing engine speeds up to 45,000 revolutions per minute.

Enthusiasts spend hours modifying the cars to squeeze out a little more speed -- perhaps a half a mile per hour more -- out of the engines. In fact, making adjustments and changes to the engine are a huge and laborious part of the hobby. One of the main components contributing to the car's speed is the tuning pipe. The tuning pipe not only acts as the exhaust pipe, but it also helps to propel the car. The pipe's design sucks out any unspent fuel in the engine, shoots it to the back of the pipe where it becomes vaporized, and then forces part of it back into the engine. The vaporized fuel gives more power to the engine and helps it reach its top speed, but this effect only kicks in after the car reaches 100 miles per hour (160.9 kilometers per hour).

## Chassis:




The chassis of the car houses the most integral parts of the car. Thereby it defines the fitness and the sturdiness of the car. One can think of innumerably different possible chassis designs.

In addition to the primary objective, the chassis also aids in generating down-force, by varying the air pressure at the underside of the car. **It all lies in striking a balance between the strength of the chassis and its weight**. Any material, which withstands the tremendous heat generated by the engine and still retains the strength, can be used as the chassis material. Usually metal alloys, extruded aluminiun, or even carbon fiber are used for this purpose.

For the event, you may need to these in your car

1) **Front (or rear) drive shaft**, depending on which wheels the power is sent to. Commonly known as the dog bone

2) **Fuel tank**: Since the car will run for just 150sec, the fuel tank need not be very big. While placing the fuel tank in the car, you might not prefer to have them at places where heat can build up pretty fast.

3) **Panhandle:** This is the part where the tether is latched on into your car, so it should be strong enough to hold the car, resisting sideways forces generated by it, at all speeds. Go for either a tough metal strip with holes for bolting, or simply a short piece of steel rope or tough wire (easier to attach to tether, so more recommended), fixed firmly at both ends on

to the right hand side of your car, so as to form a small loop, for the end of the tether to get connected via a loose hooking/bolting.

[Ps: The hooking/bolting mechanism is a part of the tether rope; do not bring in any pre integrated bolts and stuff- design the panhandle only!!]

4) **Kill switch:** The kill switch shuts off the throttle to the car, on the carburetor. This is the only way to stop the car after completion of the full run or in between, case of emergency. The switch, as we had mentioned twice earlier, should come out 5 cm clear from the topmost part of the body frame. It should be designed such that the car could be stopped by placing an obstacle from top, high enough to touch only the kill switch, thereby shutting off the fuel supply, and thus stopping the vehicle. A simple lever mechanism connecting the throttle would do.

5) **Shaft mount:** To hold the shaft in position while allowing it to rotate. Make sure the shaft does not sway, and permits free frictionless rotation of the shaft.

6) **Wheel shafts**: These will have the wheel hubs on its ends for fixing the wheels.

7) **Wheels:** Choose the appropriate wheels for your car, either three or four in number, preferably slick as shown it the photographs. Slimmer wheels make the car even slimmer, which aids for the streamlining too.

## Engine:

Tether cars are generally powered by 2- stroke engines, tailored down to suit the dimensions of the car. As we have already specified, use only glow plug ignition systems only. Usually, glow plug engines have a simple ignition system that uses a glow plug instead of the usual spark plugs used in real life cars, so there's no coil, magneto or points. The glow plug is heated by a battery-operated glow starter. When fuel enters the combustion chamber, it's ignited by the heated glow plug and with that, the engine springs to life, instantly gaining the momentum to continue running after all the starter accessories are removed.


**Carburetor**: The engine's carburetor supplies the fuel and air needed for combustion. It has several adjustments. A rotating throttle arm controls the AMOUNT of fuel and air that enters the combustion chamber**.**

**High- speed needle valve:** It controls the MIX or proportions of fuel vs. air at mid- to high-speeds. The idle mixture screw is similar to the high-speed needle

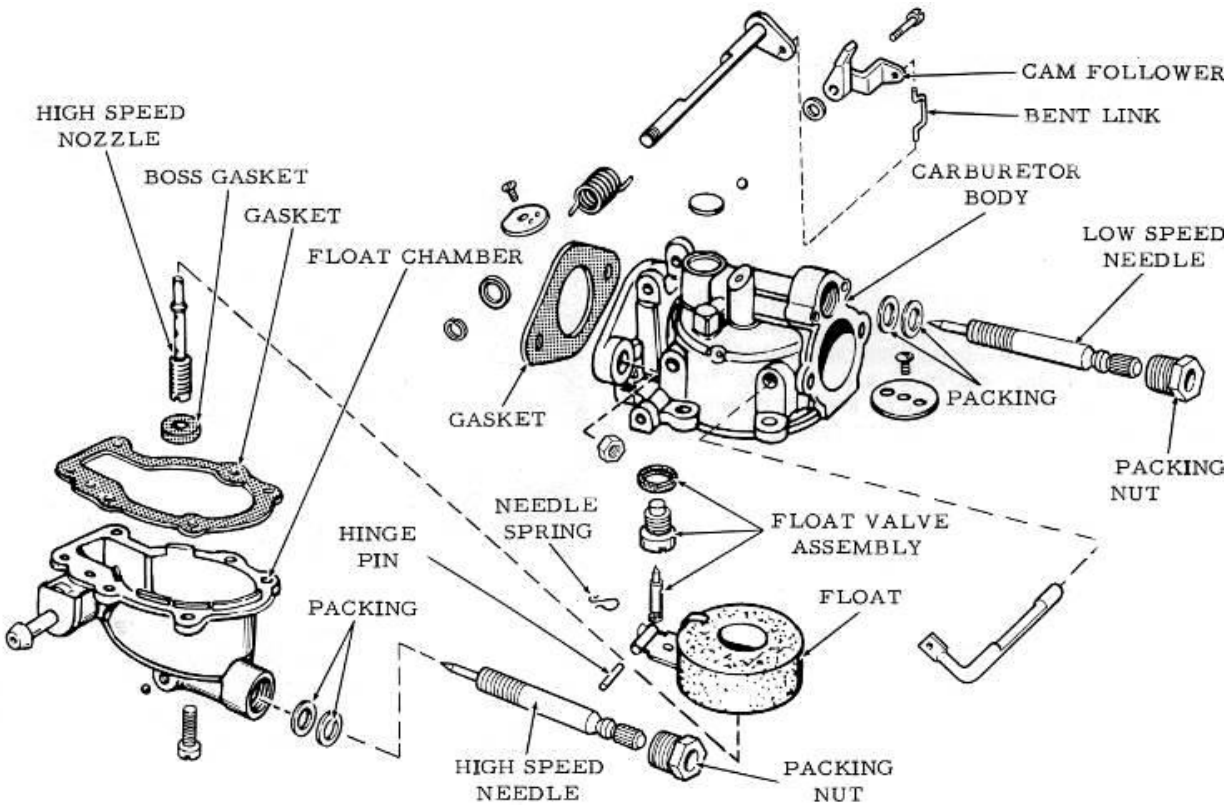
valve, except that it controls the mix of fuel and air when the engine is only idling. When you've adjusted the high-speed and idle mixtures properly, your engine should operate smooth and steady throughout its speed range.

**Glow plugs:** An internal combustion engine uses a spark plug to ignite the fuel-air mixture within the compression chamber, so a glow or nitro engine uses a small glow plug. Although the plug needs to be heated up using a glow plug igniter initially, once the engine is running, the heat generated within the combustion chamber keeps the plug glowing constantly and is thus able to ignite the fuel-air mixture on each revolution.

Precaution: Glow plugs can fail at anytime, so it's always better to have a selection of spare ones with you.

**Fuel:** Glow engines cannot be operated with the same gasoline you'd get at a filling station pump. They require a special fuel, called "glow fuel." It contains methanol as the base, with varying amounts of nitro methane to increase the energy that the fuel can provide. Oil, pre-mixed into the fuel, lubricates and protects your tiny engine as it pounds out amazing power.

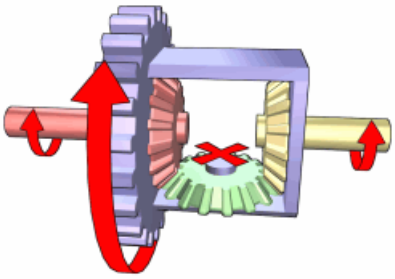
## More on carburetors:



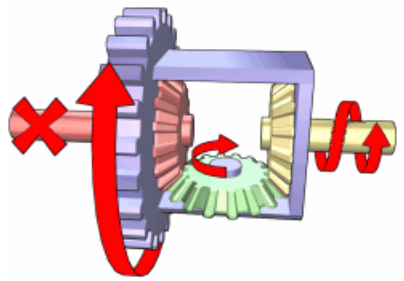

The goal of a carburetor is to mix just the right amount of gasoline with air so that the engine runs properly. If there is not enough fuel mixed with the air, the engine "runs lean" and either will not run or potentially damages the engine. If there is too much fuel mixed with the air, the engine "runs rich" and either will not run (it floods), runs very smoky, runs poorly (bogs down, stalls easily), or at the very least wastes fuel. The carburetor is in charge of getting the mixture just right. The (stoichiometric) air to gasoline ratio is 14.7:1, meaning that for each weight unit of gasoline, 14.7 units of air will be consumed. The stoichiometric mixture is different for various fuels other than gasoline.

## Differential:

These basically let the wheels fixed to a single powered axle rotate at different speeds whenever required, for example, while encountering a curve.

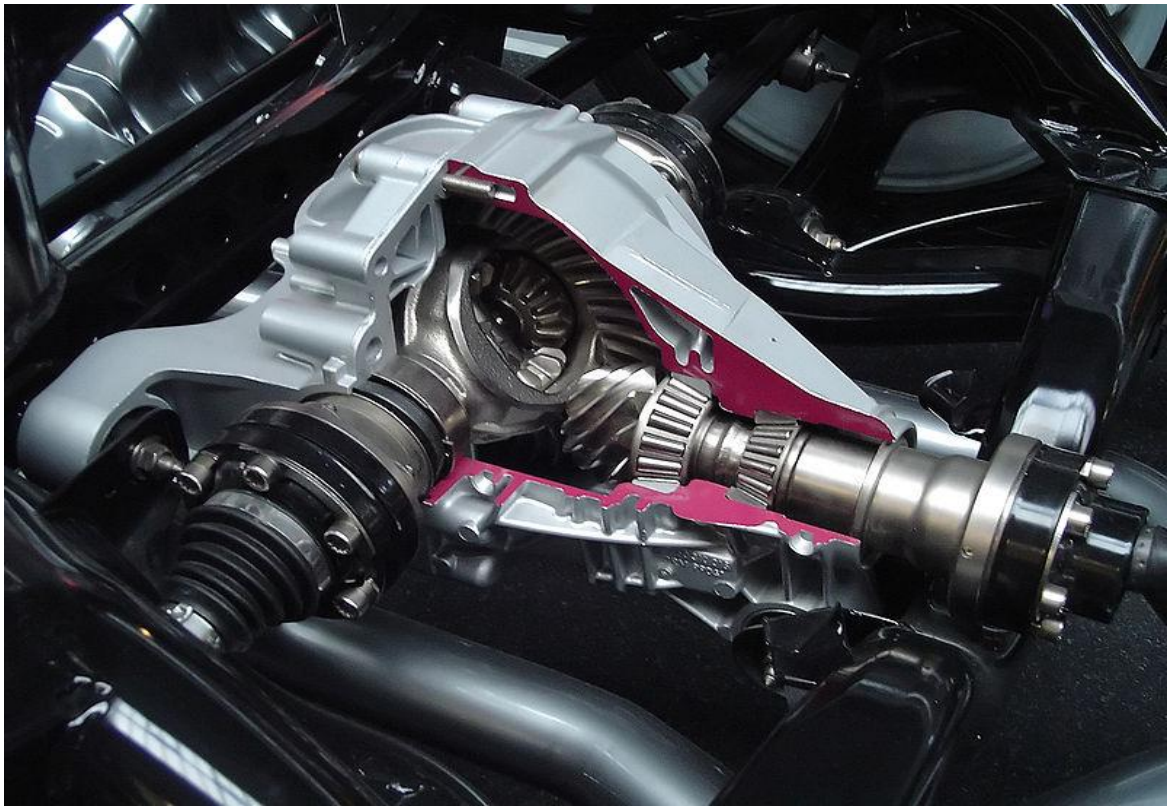


Input torque is applied to the ring gear (blue), which turns the entire carrier (blue), providing torque to both side gears (red and yellow), which in turn may drive the left and right wheels. If the resistance at both wheels is equal, the planet gear (green) does not rotate, and both wheels turn at the same rate.



If the left side gear (red) encounters resistance, the planet gear (green) rotates about the left side gear, in turn applying extra rotation to the right side gear (yellow).

The use of differentials is optional for our event. You may as well adjust the shaft at an appropriate angle to each other, keeping in mind the radius of the track.



## Stream lining:

Since tether car racing is all about speeds, and air resistance squares up with velocity, streamlining plays an important role in deciding the winners. To reduce the air resistance, the front of the object should be well rounded and the body should gradually curve back from the midsection to a tapered rear section. A section of an aerofoil is given alongside, showing the streamlines.

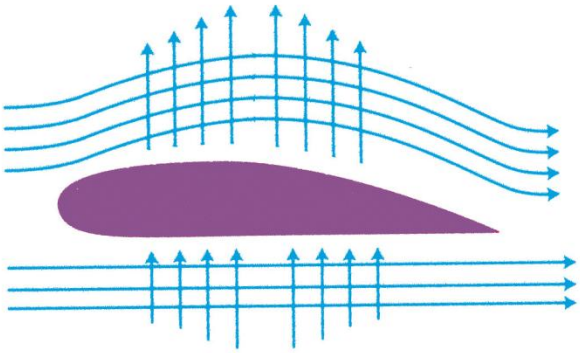


Fig : S1

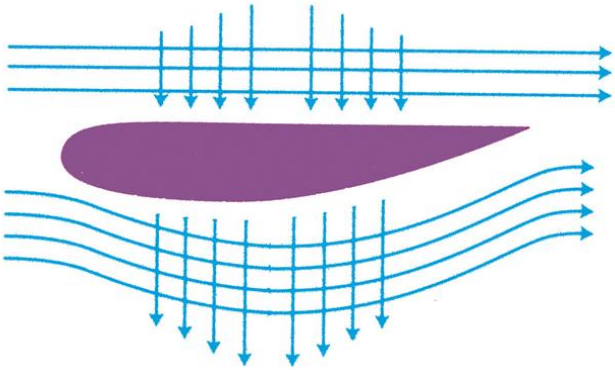
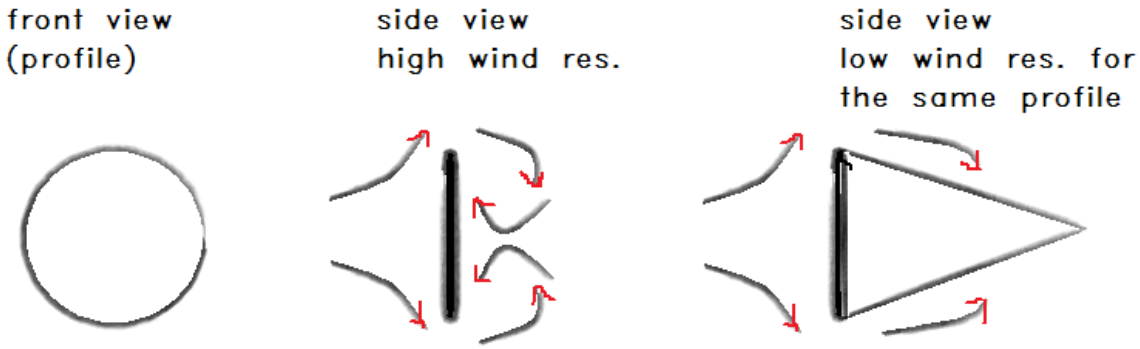


Fig: S2

As is shown here, S1 is suited for an aircraft wing, so that enough lift is generated and S2 is for a spoiler, where down force is generated, by the same principle.

There is a lot to speak of streamlining. Keep this basic concept while designing




Follow this link for details on aerodynamics and streamlining

http://videos.howstuffworks.com/auto/aerodynamics-videos-playlist.htm