HOW TO DESIGN

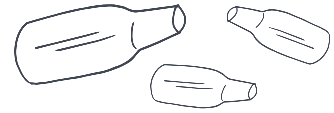
In the blink of an eye, a CO_2 race car does its work. The press of a button, the blast of compressed gas escaping a cartridge, a second of wheels tearing up the track, and it's over. The excitement is still hanging in the air and the adrenaline pumping, but the race is over.

While the race is gone in a flash, the work that went into a car to achieve that kind of speed can take weeks or even months to do! Producing a CO_2 race car is a process with many steps, and each step requires a good deal of planning and effort.

First comes the design and planning stage, including the evaluation of your available tools and materials and what you can do with them, researching and drawing your dream car, making your dream a reality from a block of wood, seeing if your design cuts the mustard through testing, and perfecting your car. Hopefully, at the end of the project, you'll have a sense of accomplishment for a job well done.

PITSCO EDUCATION

DESIGNING YOUR DREAM CO_2 DRAGSTER

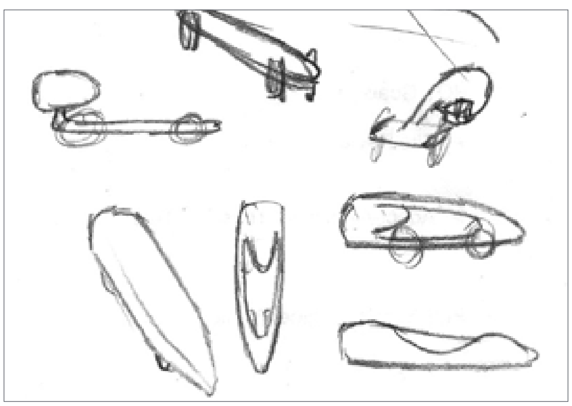


Before putting pencil to paper, consider these important points:

- Are you required to follow a set of specifications?
- Is your grade on this project dependent on the car's performance or appearance?
- What is most important to you: speed at any price, show-stopping appearance, or some combination of the two?
- What tools and materials are available to you? What kind of kit and body blank do you have? What tools can you use: hand tools, power tools, or even digital tools?

If you're in it for the speed, know that the following design factors have an enormous impact on performance: **weight** – the lighter, the better; **aerodynamics** – you want your car to cheat the wind; and **rolling resistance** – less is more.

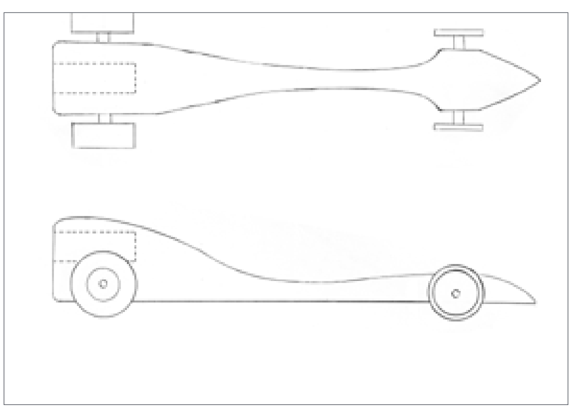
After you consider the design possibilities, it's time to get some of those race car design ideas undoubtedly floating around in your head on paper.



THUMBNAIL SKETCHING

The best way to start is with concept sketches, also known as thumbnail sketches. Thumbnails are small, quick sketches used by engineers and designers to rapidly communicate ideas. They should not be detailed or even carefully done – you're just getting the rough concepts out of your head and onto paper.

Be sure to experiment with different ideas and be as creative as possible.



DESIGN SKETCHING

On a clean sheet of paper, sketch your favorite design from the thumbnail sketches on a larger scale and with more detail. Draw the top and side views.

Make light projection lines from one view to the other to help you locate axle holes and other features of your design. Show the location of hidden details (such as the cartridge hole) by using dashed lines.

Are you required to follow a set of specifications? Teachers can issue their own specifications for students to follow, but if the goal is to compete in an organization's event – such as TSA's Dragster Design event – the event might have specifications that must be met to compete. If so, obtain the list of specs and read it. Look at your design sketch to see how each spec applies to your design. You might find it necessary to take notes or change your design.

WORKING DRAWING

The working drawing is a precise, 1:1 scale drawing that exactly describes your car and its features. Working drawings should have top and side, or profile, views.

An accurate working drawing is important for two reasons:

1. A copy of the working drawing serves as a template for rough-cutting your car blank.
2. You might be required to submit your working drawing. It could be part of your grade or even be scored for competition points.

Many car kits include a large sheet of grid paper intended for the working drawing. Start by measuring and drawing the top and side views of the car blank and then accurately locate the power plant housing on your drawing.

USING CAD

Depending on the computer programs available in your school, you may opt to draw the working drawing using a computer-aided drafting (CAD) program such as SolidWorks, AutoCAD, or Inventor. Though there is a learning curve involved, CAD software enables you to draw very precise and symmetrical designs that will make for faster dragsters. Further, CAD enables you to use computational fluid dynamics (CFD) for testing and CNC milling for building the car.

Whether you're hand drawing or using CAD, be sure to refer to the specifications sheet as you work.

When your drawing is complete, make at least two copies. This enables you to make templates for your prototype and production race car and have an extra copy for the teacher if necessary.

For a detailed curriculum about building dragsters and learning related STEM concepts, check out Pitsco's The Science of Speed 2 curriculum units.

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