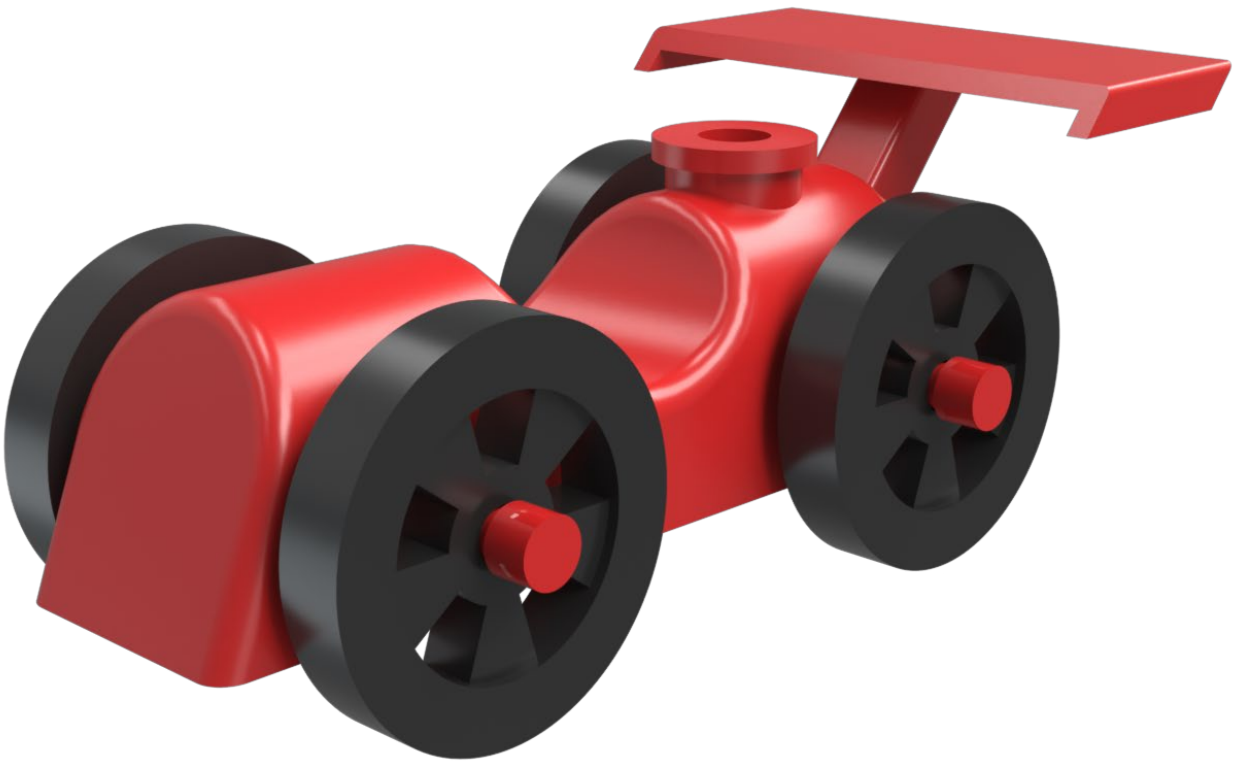
SOLIDWORKS

DESIGN PROJECTS

STUDENT GUIDE

3DEXPERIENCE



BALLOON-POWERED RACERS

DASSAULT SYSTEMES

DESCRIPTION

Welcome to the Design Projects Student Guide for the Balloon Powered Racers! Inspired by iconic racecars like the Alfa Romeo 158, Cooper T43, and Lotus 49, this project blends classic design with hands-on engineering. (Look them up to see the style!)

This guide contains information regarding Design Intent, DFAM (Design for Additive Manufacturing) and Design Tips to keep in mind for each part.

You will use CAD to design each part, print the parts on a 3D printer and assemble them to complete the bridge.

For a video demonstrating the design approach, detailed dimensions and step by step instructions, see the links in the **Additional Resources** section below.

PROJECT TASKS

1. Create the following racer components in CAD:
    - Main body
    - Wheels
    - Axle Caps
    - Spoiler
2. Create an assembly of the car in CAD.
3. Print the physical components on a 3D printer.
4. Assemble the Balloon-Powered Racer.
5. Race against other students in a drag racing style competition.
6. Iterate on the design—Experiment in CAD or utilize external household items enhance the model.

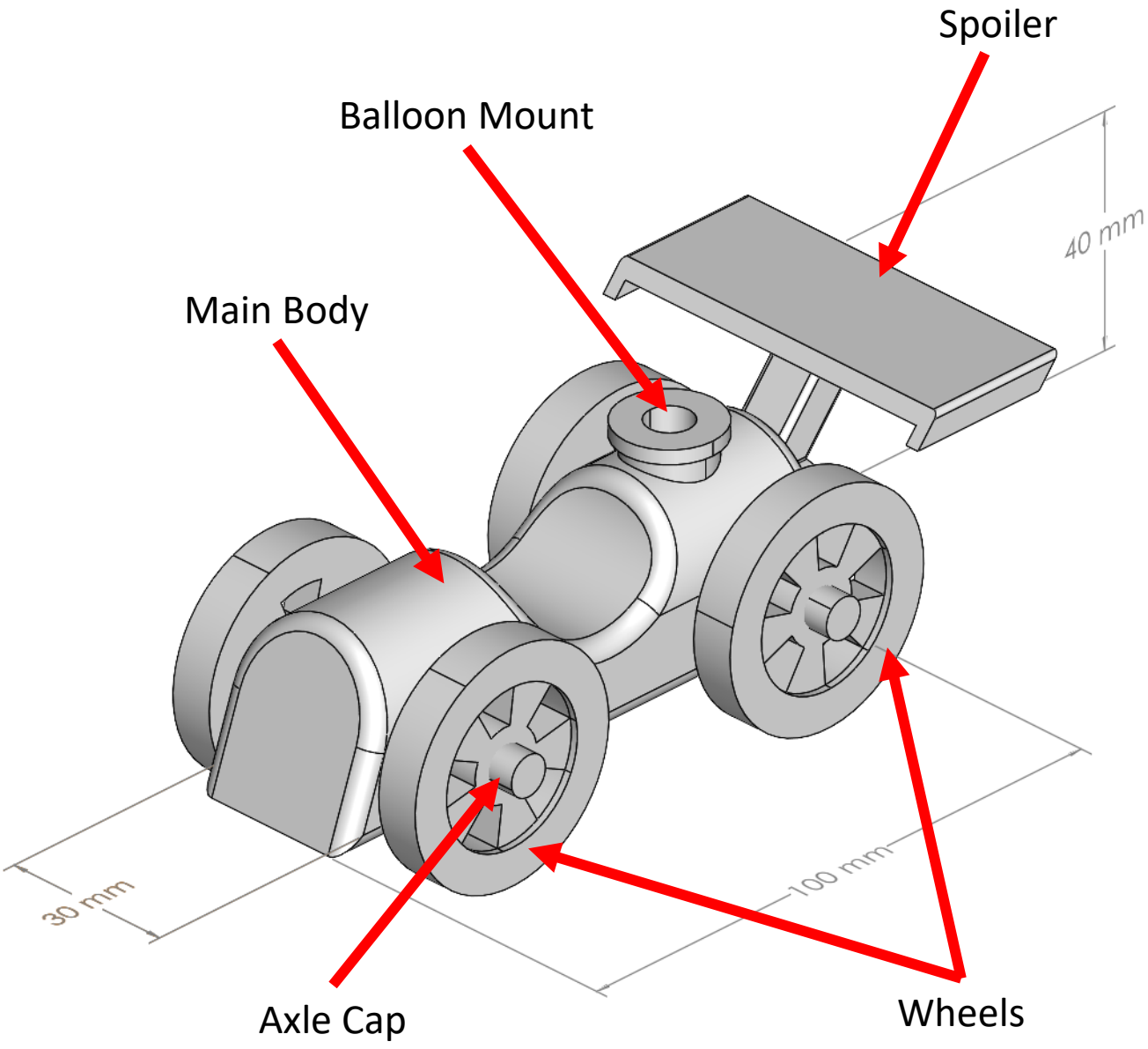
ADDITIONAL RESOURCES

LINK TO DOCUMENTS

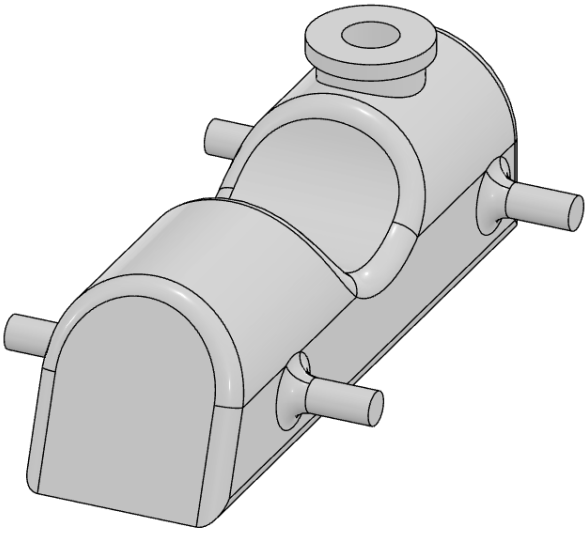
LINK TO YOUTUBE VIDEO

LINK TO STEP-BY-STEP

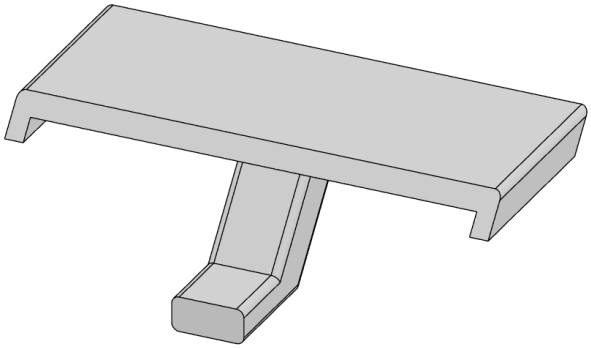
RACER COMPONENTS



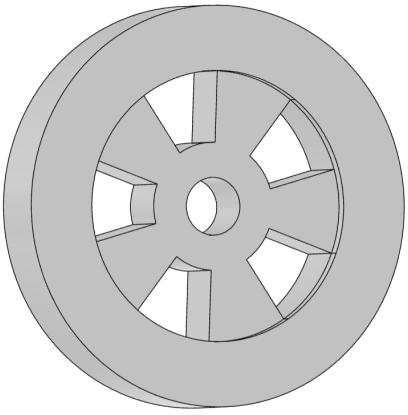
RACER COMPONENTS



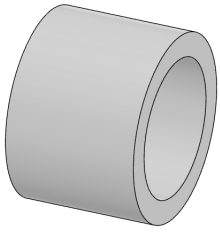
Main Body
QTY = 1



Spoiler
QTY = 1



Wheel
QTY = 4



Axle Cap
QTY = 4

MAIN BODY

DESIGN INTENT

- Acts as the main frame, holding all of the racer components together.
- Axles extend directly off the sides of the body, keeping the design simple and fully 3D printable.
- Balloon mount begins at the top, curves through the interior, and exits at the rear, providing a clean and functional airflow path for propulsion.
- Rear Spoiler Mount is a simple cut out from the rear.

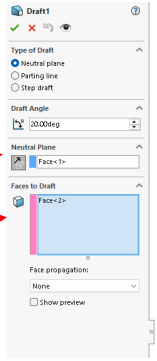
DFAM

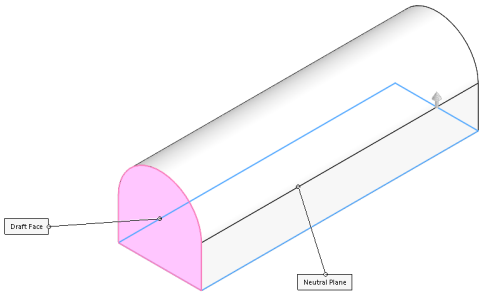
- Designed with a fully flat bottom to print directly on the build plate.
- Only minimal support material will be needed under the axles and exhaust.

DESIGN TIPS:

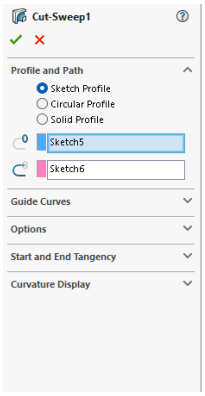
- This part uses more advanced CAD features, like **Draft** and **Swept Cut.**

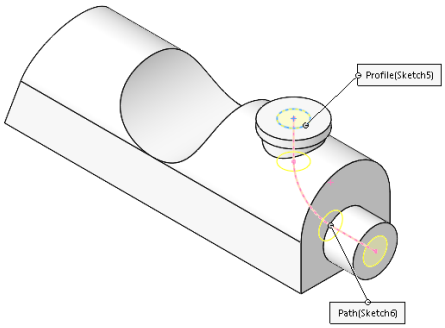
- For the **Draft:**
  - Select the bottom face as the "Neutral Plane."
  - Select the front face as "Faces to Draft."





- For the **Swept Cut:**
  - Be sure your sketch of the cut path starts at the top of the mount, and ends at the end of the exhaust.





WHEELS

DESIGN INTENT

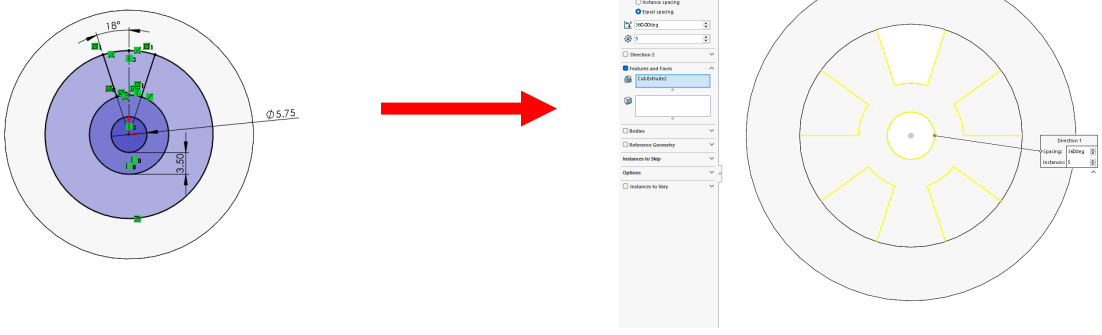
- Rotates freely on the axles while keeping the car stable and moving straight.
- Diameter must be large enough to keep the racer from scraping the ground.

DFAM

- Uses Flat-Pack Design, no support material necessary.
- Components can be nested to print several at one time.

DESIGN TIPS:

- Start by creating the total wheel shape, and then cutting away the rim elements and other details.
- Dimension the inner hole diameter with enough clearance to spin freely on the axle.
- Use the **Circular Pattern** feature to complete the inner rim after modelling one cutout.



AXLE CAPS

DESIGN INTENT

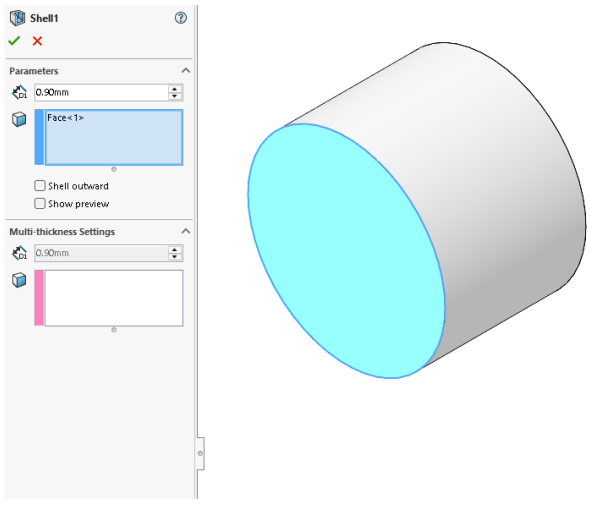
- Snap-fits onto the end of the axle to secure the wheel while still allowing for easy removal.

DFAM

- Uses Flat-Pack Design, no support material necessary.
- Components can be nested to print several at one time.

DESIGN TIPS:

- Use the **Shell** feature on the initial cylinder to create a cavity for the axle to snap-fit into.
- Adjust shell dimensions based on the accuracy of your 3D printer:
    1. First, print the main body with your chosen axle diameter.
    2. Then, print several axle caps with slightly different shell diameters (within a few tenths of a millimeter).
    3. Test to determine which provides the most reliable snap-fit—this becomes your ideal tolerance for snap-fits.



SPOILER

DESIGN INTENT

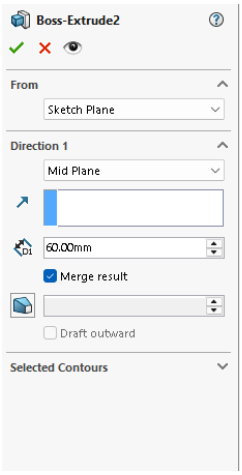
- Snap-fit into the rear mount cutout for easy removal and redesigning.
- Prevents the balloon from tipping backward.

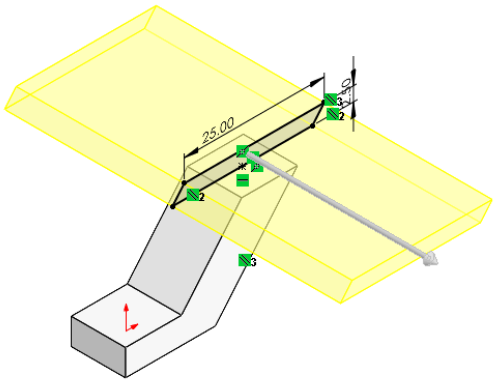
DFAM

- Orient the part so that the flat, top face is on the build plate.
- Only minimal support material will be needed under the connector.

DESIGN TIPS:

- Sketch profiles on the midplane (ZX) and use M**idplane** extrusions for symmetry.
- Size the connector slightly smaller than the mount for a snap-fit.
- Adjust dimensions based on the accuracy of your 3D printer.



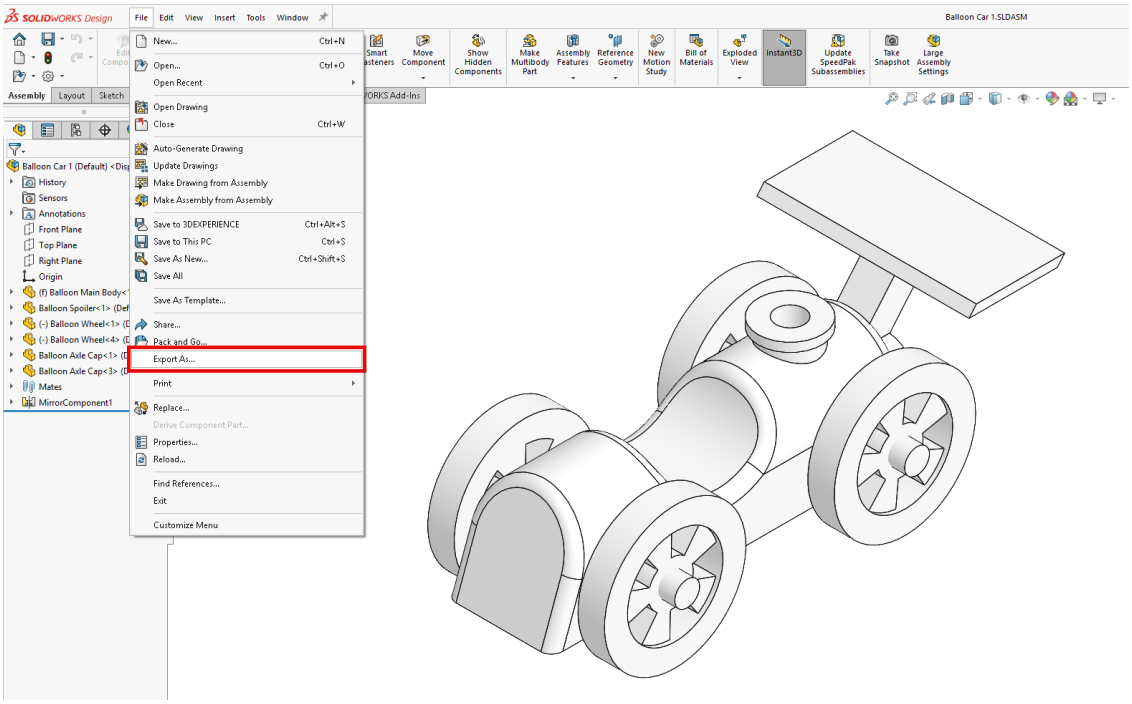


DESIGN CHALLENGE:

- Use your CAD knowledge to design your own spoiler—get creative!
- Take advantage of the removable mount to personalize your racer with a unique aerodynamic flair!

3D PRINTING

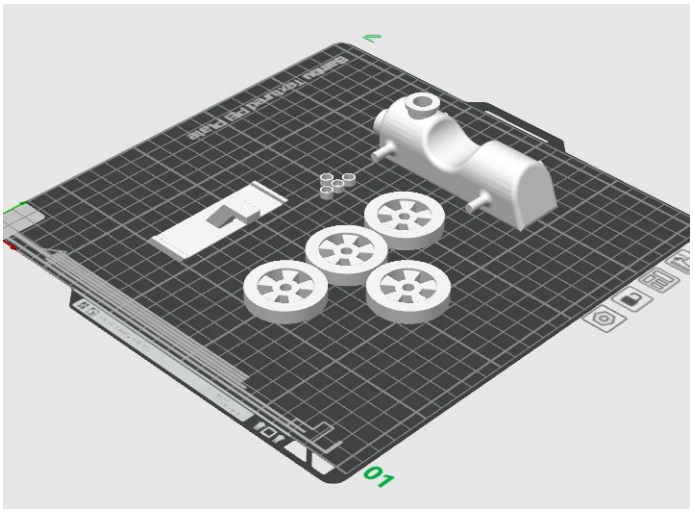
1. Click File
2. Click **Export As...**
3. Select **File On Disk**, check the File name, and set the File Format to **STL**.

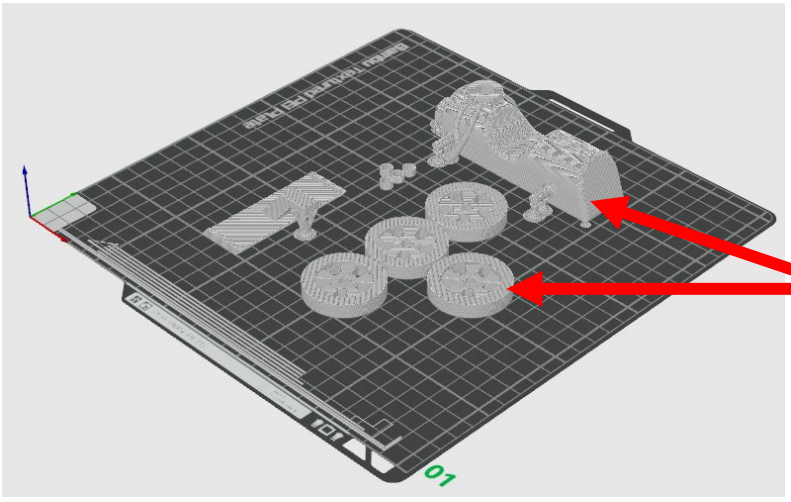


3D PRINTING

Import your .stl files into your slicing software.

Nest your parts to print many at one time—Every part necessary to assemble one car can be printed together on most printer beds.





Orient the parts to minimize the use of support material by placing each one on their main flat face. Be sure to include supports for overhanging geometries.

When prototyping or printing with classmates, consider printing multiple parts at the same time.

