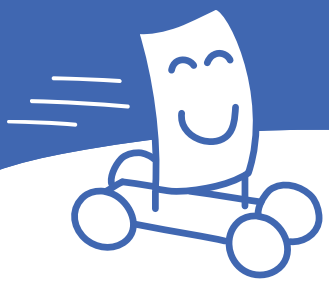
Sail Car Overview

THINKING AHEAD

What happens when you change the shape, angle or size of your sail?

Download Documents and get your supplies at **teachergeek.com**
Single: *SKU 1823-77*, 10 pack: *SKU 1823-67*



Sail Car Overview

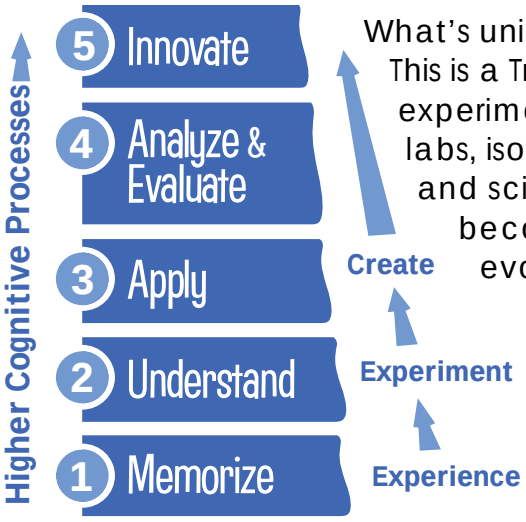
Recommended Age Level:

Activity Age Level: 5-7
Lab Age Level: 5-7 (grades K-2)
Recommended Group Size: 1-3 Students/Sail Car

Note: This overview, and corresponding Build Guide and Lab documents, are intended for educational use. If you are looking to build a Sail Car "just for fun", then download our All-in-One document at **teachergeek.com/learn**.

Overview

Engineer a Sail Car that can go the furthest distance, travel the fastest, or carry the most weight. Start by building the car base. Learn about forces and motion by completing the optional Sail Car labs. Then, design and build your own Sail Car to compete in a challenge.

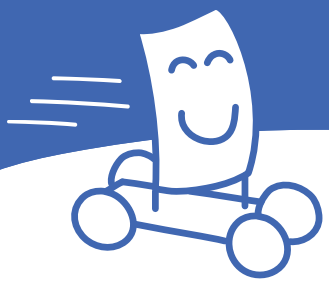


Adapted from Bloom's Taxonomy

What's unique about this, and other TeacherGeek activities? This is a True STEM/Engineering activity; It allows kids to… tinker and experiment, grow understanding through experimentation and labs, isolate variable and use the scientific method, apply math and science concepts, create their own unique designs, and become innovators. Every project turns out different, and evolves with their understanding.

When you create a project using TeacherGeek, the data works (it's usable). This allows kids to apply the math and science, see the results, and experience "I-get-it" moments (understanding why they need the math/science and what it does).

Make It Your Own: The documents for this activity are available in PDF and Microsoft Word format. If you wish to edit a document, simply download the Microsoft Word format.



Sail Car Overview

Standards

Next Generation Science Standards:

Forces & Interactions

- **K-PS2-1:** Plan & conduct an investigation to compare the effects of different strengths or different directions of pushes & pulls on the motion of an object.
- **K-PS2-2:** Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

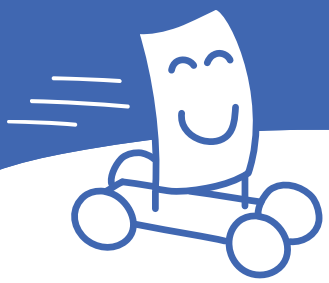
Engineering Design

- **K-2-ETS1-1:** Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- **K-2-ETS1-2:** Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Concepts & Vocabulary

When you push a friend on a swing, you are using a force. Pushing moves something in the direction of the push. The harder the push, the further the item goes. Pulling something has a similar action. The harder you pull, the faster something moves along.

- Push: To use force to move (someone or something) forward or away from you
- Pull: To hold onto and move (someone or something) in a particular direction and especially toward yourself
- Wind: a natural movement of air outside
- The Sail: A large cloth, that is connected to a boat (or car, in this activity), that is used to catch the wind that moves the boat (car) through the water (or over the land).



Sail Car Overview

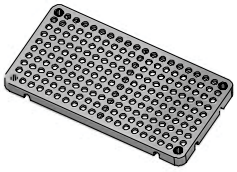
TeacherGeek Components

For One Sail Car

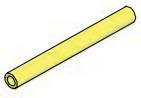
Here are the TeacherGeek components you'll need to make each Sail Car.
They are part of the TeacherGeek Sail Car Kit single: *SKU 1823-77* or 10 pack: *SKU 1823-67*, Maker Cart, or available individually at **teachergeek.com**.

4 Wheels

3 Dowels



2 Hole Plates



Slide Stop
(enough to cut two 1cm (3/8in) sections)

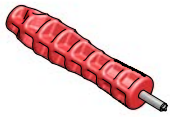
4 Screws
(1in #10 Screws)

TeacherGeek Tools You'll Need

Easy to Share in Groups

These are the tools you will need for the Sail Car *Body Build*.
You will not need them for the labs or engineering challenges. These tools are part of the TeacherGeek Maker Cart, or available at teachergeek.com. *Caution: Tools are to be used by ages 13+, or with close adult supervision.*

Multi-Cutter
SKU 1823-81
Or anything else that can cut dowels & slide stop



Reamer
SKU 1823-87

Phillips Screwdriver
SKU 1823-90

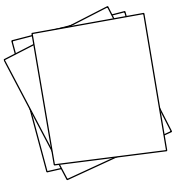
Hammer (optional)
SKU 1824-41

Other Materials

Here are some other things you will need for the *Labs* and *Challenges*.

A few rolls of **Masking Tape**

One **Desk Fan** or Hair Dryer



A stack of **Card Stock, Chipboard, or paper** (for sail)

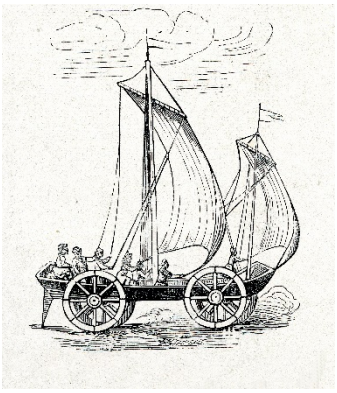
Recycled Materials
What else could you use for a sail?

Sail Car Overview

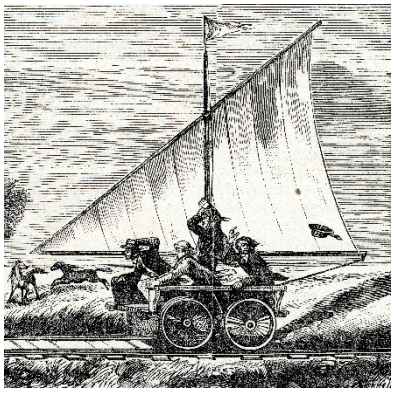
Background

When you think of sailing, you probably think of a boat that is propelled by the wind, like the one over here.

Did you know that sailing isn't just for the water? Cars can be powered by the wind. You can see from the pictures below that people have been sailing on land for a long time.



Sail driven Dutch Cart 17 century

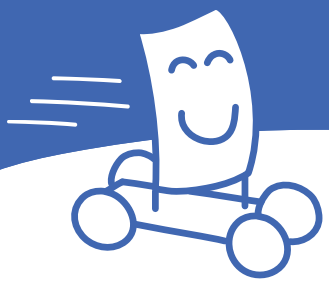


Sail driven vehicle on Kansas Pacific Railway (ca. 1890)

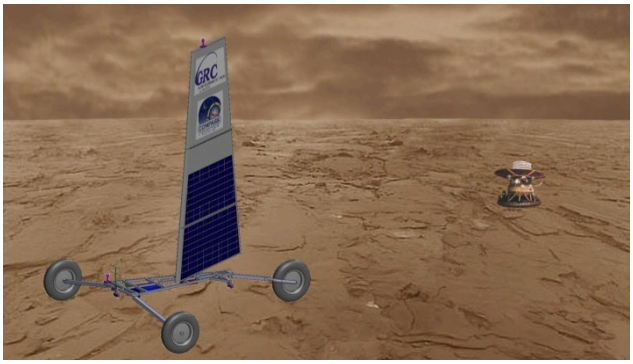
Brooklyn Sail Car

Land Sail Car: A vehicle with wheels that uses a sail and is powered by the wind. Sail Cars, also known as land yachts, used to be used as a mode of transportation. Nowadays, they are mainly used for recreation (just for fun).

Here's what todays Sail Cars look like. The "Greenbird" is a Sail Car that can go 126 miles per hour. That's faster than most gas powered cars!



Sail Car Overview



NASA is thinking about using a Sail Car to travel on the surface of the planet Venus.

Zephyr Land Sailing Rover
Image from NASA John Glenn Research Center

Resources

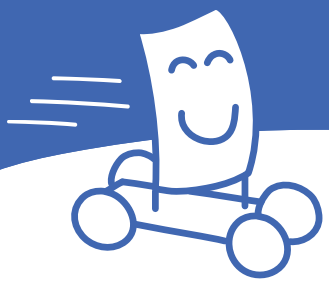
There are "a ton" of resources to help you complete this activity. Pick and choose the ones that will work for you. They are available as links below, or at **teachergeek.com/learn**.

Sail Documents

- Overview—This is it (you're reading it).
- Sail Car LS Build Guide and Labs—Grades K-2
  - Sail Car LS Build Guide—Required
    - This is the beginning of your Sail Car construction. During this step you will make the wheeled platform and masts.
  - Push-Pull Lab—Optional
    - Students investigate the relationship between forces (pushing & pulling) and distance traveled.
  - Wind Lab—Optional
    - Students investigate how sail shape and size effect the distance they are blown by the wind.
- Sail Car Engineering Challenges
  - Distance Challenge (sail the longest distance)
  - Speedway (Sail Car Races)

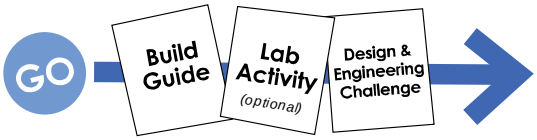
Land Sailing Videos

- Land Sailing at 126 mph, Greenbird—Youtube Video
- Land Sailing in Nevada—Youtube Video



Sail Car Overview

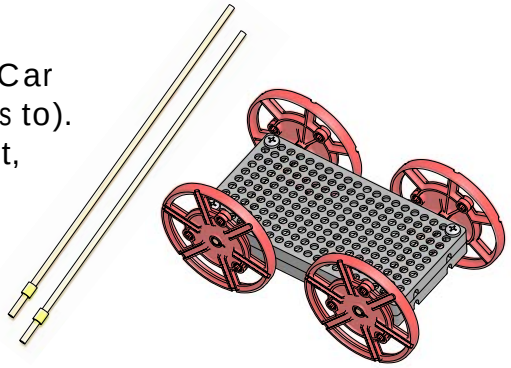
Procedure



There are many optional Labs for Sail Cars, download them (and the LS Build Guide) as part of the Sail Car LS Build Guide and Labs packet. You get to choose which Labs (if any) you would like to do. After you've finished, you can download the Sail Car Engineering Challenge to take your designs to the next level. Documents are available as links below or at **teachergeek.com/learn**.

1 Build Guide—Required

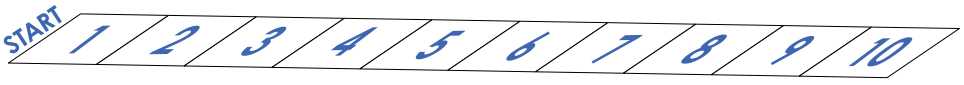
During this step you will create the body of the Sail Car (the part of the car with wheels, that the sail mounts to). It is recommended that this step is done by an adult, but it is possible for children to complete this step with the adult assistance/supervision. The cars can be kept together (for another class/student), or taken apart at the end of the activity.

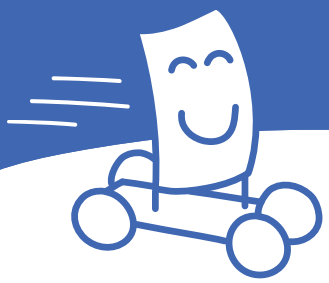


Download the Sail Car LS Build Guide and Labs

2 Track Setup for Labs & Challenges

- Find floor space for at least one Sail Car Track. It should be at least 1m by 3m (3ft by 12ft). It's best if the floor for the track is not carpeted.
- Place a desk fan where the track will start.
- Write "START" on a 30cm (12in) section of tape. Place the tape about 30cm (12in) in front of the fan.
- Use labeled sections of tape to mark out every 30cm (12in) in front of the starting line. Label the tape markers, in front of the starting line, from 1 to 10.





Sail Car Overview

3 Force & Motion Labs

The following force and motion labs are optional and included in the Sail Car LS Build Guide and Lab document.

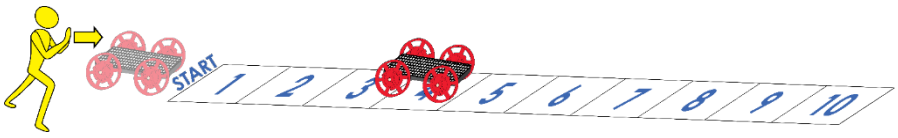
Download the Sail Car LS Build Guide and Labs

Push-Pull Lab

This lab allows students to experiment with weak and strong forces; graphing distances their car travels and learning how it relates to the force applied.

Instructions:

- Discuss the following concepts with your students. Ask them to provide examples for each.
  - Force
  - Push
  - Pull
  - Strong and Weak
  - Prediction



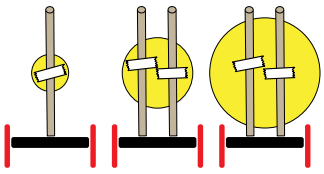
- Handout the Push-Pull Lab sheets. Explain the lab procedure and let them get to work.
- If students finish early, you may want them to start onto the Wind Lab.

Wind Lab

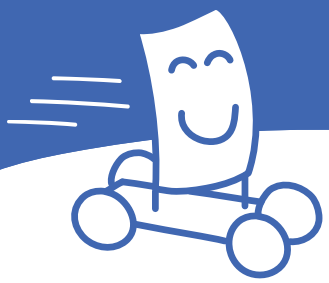
This lab allows students to experiment with sail shape and area; graphing distances and speed their car travels, and learning how it relates to the sail geometry.

Instructions:

- Prepare the sail shapes from the Sail Car Wind Lab document.
- Discuss the following concepts with your students. Ask them to provide examples for each.
  - Wind
  - Small
  - Medium
  - Large
  - Area



- Handout the Wind Lab sheets. Explain the lab procedure and let them get to work. It works best if the sails are not positioned at angles to the wind.
- If students finish early, you may want them to start an Engineering Challenge.



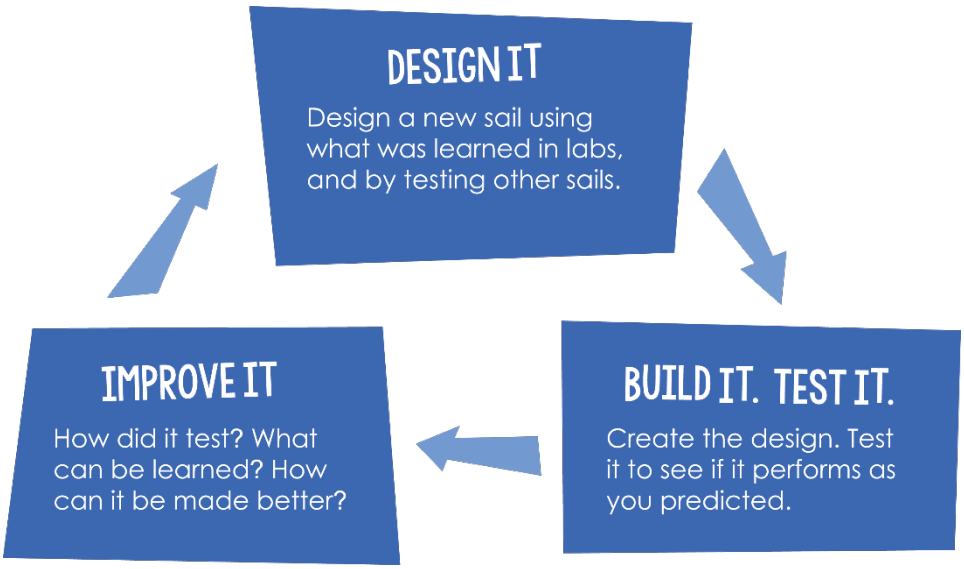
Sail Car Overview

4 Engineering Challenges

Students will design, build, test and evolve different sail configurations during these engineering challenges. They will experiment with things like sail shape, material and area.

What do you need to know about an engineering challenge? First... you are never done. Every design can be improved, so students should be working on improving their Sail Car until the very last available second.

Here's how the Engineering Design Process works.



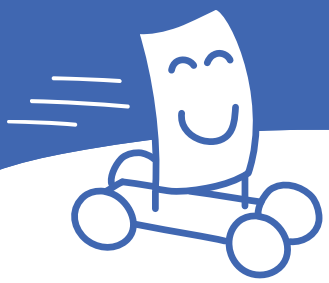
As you can see... you're not done after testing a sail design. You improve it; take what you've learned and use it to make a new, better sail.

Included are two Sail Car Engineering Challenges:

- *Speed*
- *Distance*

Download the Sail Car Engineering Challenge

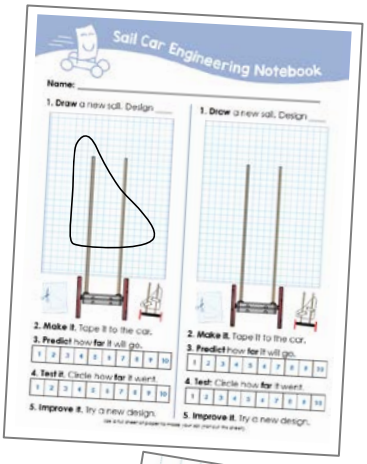
Although you may want to make up your own, unique, Sail Car challenge too.



Sail Car Overview

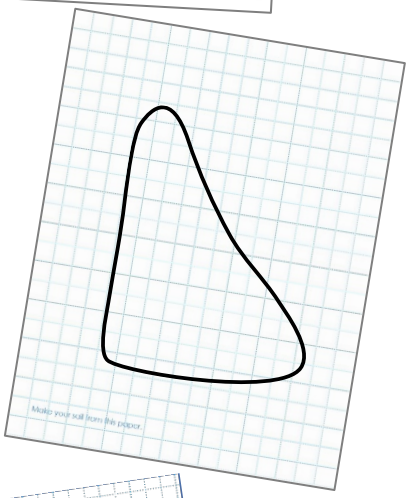
Instructions:

1. **DESIGN IT:** Provide students will the Sail Car Engineering Notebook page corresponding to the desired Challenge (distance or speed). They will use it to draw (concept) a sail design and predict how it will make their car go.
2. **BUILD IT, TEST IT:** They will then draw their design on another full sheet of graph paper (provided in the Sail Car Engineering Notebook document), cut it out, tape it to their Sail Car and test it on the track.
3. **IMPROVE IT:** Repeat and improve designs. Use an Engineering Notebook page to design a new sail.



Have a stack of extra Engineering Notebook pages handy; they can be printed front & back. Students will fill in an Engineering Notebook page (1/2 of page) for every design they create. These Engineering Notebook pages can eventually be stapled together to create a collective Engineering Notebook to document their engineering project.

- **Design a Sail using the Sail Car Engineering Notebook**
  - Predict how the sail will work
  - Make the sail
    - Draw on another sheet
    - Cut out
    - Tape to Sail Car masts
  - Test
  - Improve It



You may want to make up your own, unique, Sail Car challenge.

Like a *Sail Car Speedway*: race and compete against other groups to find the fastest Sail Car Design.