Go Guide

Advanced Sail Car

TeacherGeek

Wind power makes racing a breeze!

This guide will help you create your own wind powered sail car!

Check out our **build video** and **immersive challenge videos** by scanning the QR Code or going to **teachergeek.com/sailcar**

PRESIDENTIAL AWARDEE
PRODUCT OF EXCELLENCE

You Are Here

Choose how you would like to complete this activity.
Download documents & videos at **teachergeek.com/sailcar**

Go Guide

Start here! Build your example racer, learn sailing basics, and begin the tailwind challenge!

Optional Labs

- -Push Pull (Ages 3-6)
- -Wind (Ages 3-8)
- -Balanced Forces (Ages 8-11)
- -Forces & Motion (Ages 12+)
- -Inertia (Ages 12+)
- -Atwood's Machine (Ages 14+)
- -Momentum (Ages 14+)

Optional Challenges

- -Crosswind Challenge*
- -Headwind Challenge*

*See Page 3

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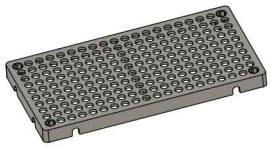
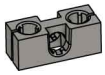
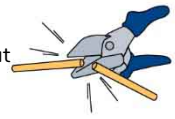
Supplies

SAIL CAR PARTS

The list includes extra parts so you can experiment and create your own designs.

NAME	QTY	PICTURE
Wheels SKU 1821-30	4	
Hole Plates SKU 1821-32	2	
Strips 30 cm (12 in) SKU 1821-31	4	
Slide Stop 8 cm (3 in) SKU 1821-49	1	
Blocks SKU 1821-34	5	
Screws 25 mm (1 in) SKU 1821-22	4	
Tire Rubber Bands SKU 1821-64	4	
Dowels various sizes SKU 1821-20	15	 Dowel Sizes 4x 7.5 cm (3") 2x 7.5 cm (5") 3x 10 cm (4") 2x 15 cm (6") 4x 30 cm (12")

Have a Maker Cart?
Use Multi-Cutters to cut your own dowels.



Do you have fewer parts than pictured?
You may have ordered the Basic Sail Car kit. Download the Basic Go Guide at teachergeek.com/sailcar

MATERIALS YOU SUPPLY

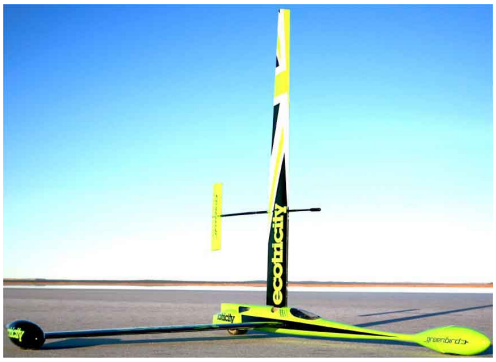
- **Screwdriver** (Phillips)
- **Scissors**
- **Fan**
- **Tape**
- **Paper** (sail material)
- **Recycling Bin Materials** (what else can you use as a sail)

OPTIONAL TOOLS

Modify materials to make even more creative designs with the **TeacherGeek / Maker Tool Set** SKU 1823-84

Can You Beat the Record?

In 2009, Richard Jenkins set the world record of 126.2 mph (202.9 km/h) for a wind-powered land vehicle.



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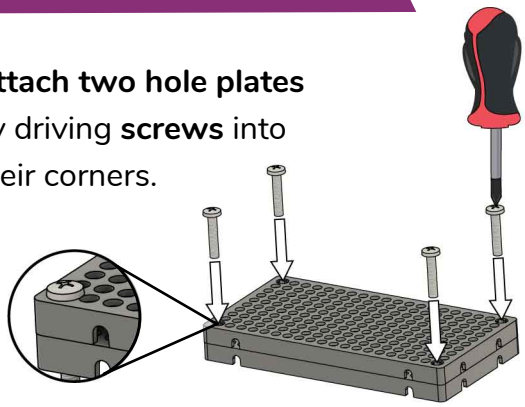
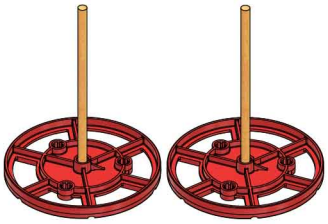
Build a Sail Car

Check out the **Build Video** scanning the QR Code or going to **teachergeek.com/sailcar**

1 **Attach two hole plates** by driving **screws** into their corners.

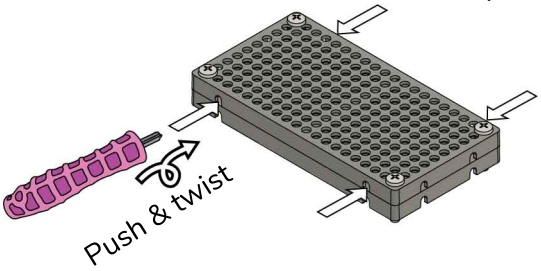


2 **Wiggle** or tap the 10 cm (4 in) **dowels into wheels.**

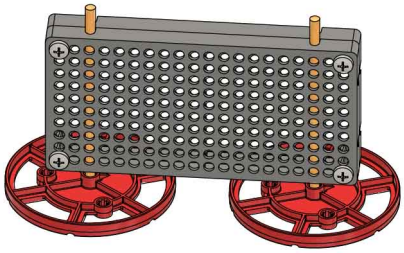


3 SKIP IF YOU'RE USING A SINGLE KIT (this step has been done for you).

Ream the holes between the hole plates.

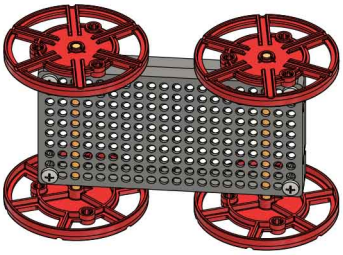


4 **Slide** the **wheels** with dowels **into the holes** between the hole plates.

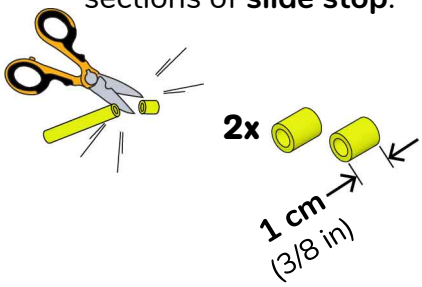


The wheels should spin freely. If they don't, repeat Step 3.

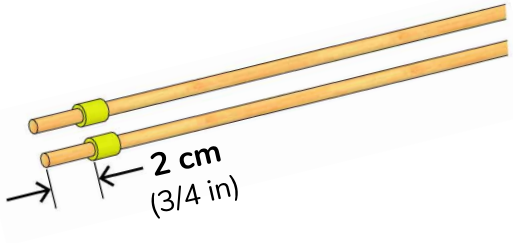
5 **Add wheels** to the other side to finish your body.



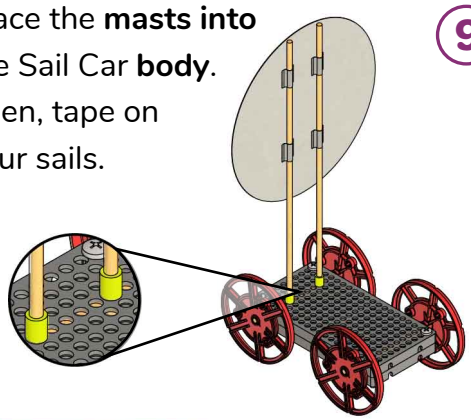
6 **Cut** two 1 cm (3/8 in) sections of **slide stop**.



7 Slide each **slide stop** section approximately 2 cm (3/4 in) **onto** each 30 cm (12 in) **dowel**.



8 Place the **masts into** the Sail Car **body**. Then, tape on your sails.



9 **It's time for labs and/or challenges!** Complete one of the optional labs below or continue on to set up for the engineering challenge!

Optional Labs: Download these labs at **teachergeek.com/sailcar**

Push/Pull Lab
(Ages 3-6)
Versions: Pre-K | K-1

Wind Lab
(Ages 3-8)
Versions: Pre-K | K-1 | Gr 2-3

Balanced Forces Lab
(Ages 8-11)

Forces & Motion Lab
(Ages 12+)

Inertia Lab
(Ages 12+)

Momentum Lab
(Ages 14+)

Atwood's Machine Lab
(Ages 14+)

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Tailwind Challenge

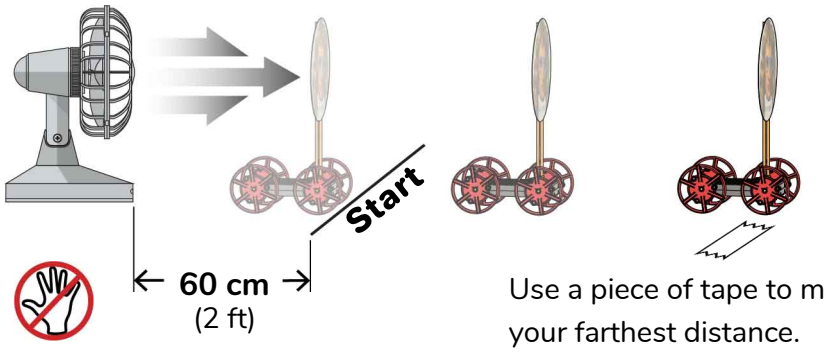
Check out **Challenge Videos** by scanning the QR Code or going to **teachergeek.com/sailcar**

How far can you make your sail car go?

Set down your fan, then mark your start line using a piece of tape.

Leave as much room as possible for your track. Sail cars can go 10 m (30 ft) on uncarpeted areas (less on carpeting).

Do not move the fan during competition.



Use a piece of tape to mark your farthest distance.

Constraints:

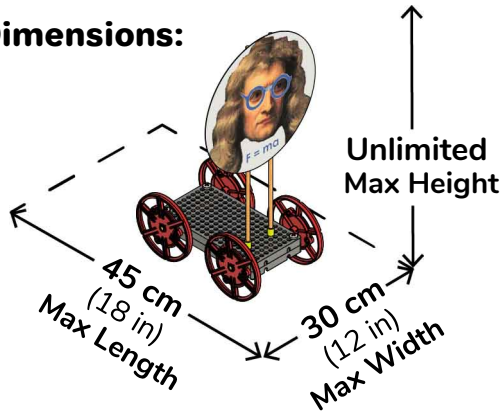
(rules and limits for your design)

Components:

You may only use the TeacherGeek components listed on Page 1.

There is no limit on recycling materials.

Dimensions:



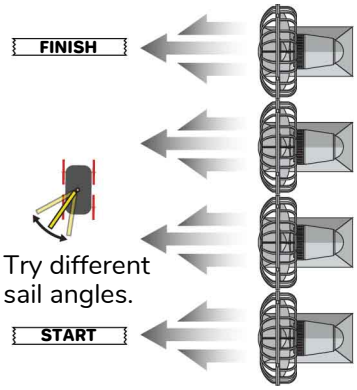
Optional Challenges:

Place fans along each side of your track to create a crosswind or headwind.

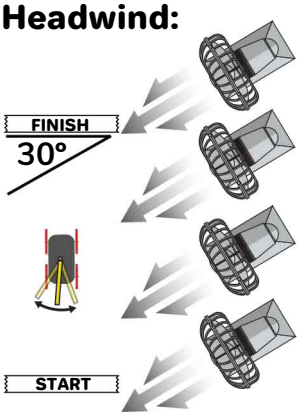
Add start and finish lines (tape). Be sure that the wind blows continuously from before the start to after the finish.

Your sail car must travel down the track in the shortest time.

Crosswind:



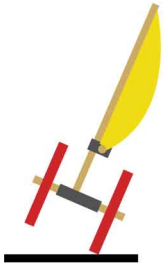
Headwind:



Variables

Experiment with your car

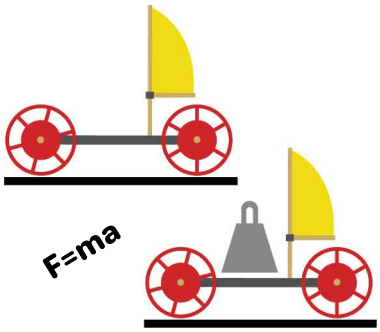
Frame
The dimensions of your frame and the location of the sail have big effects on the stability and tracking of your racer.



Stability
Does it stay up?

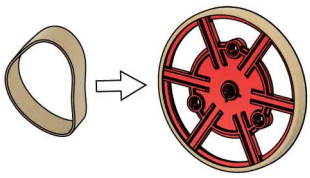
Tracking
Does it go straight?

Inertia
More mass means your racer needs more wind force to move, but also more air resistance to slow down.



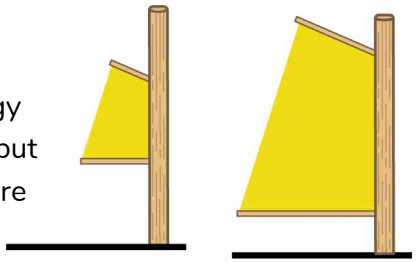
Friction
Friction can be your friend (traction) or your enemy (axle sticking). Rubber bands, wax (crayons), and graphite (pencil "lead") can be used to change friction.

Tire rubber bands can be added to wheels to give more traction.

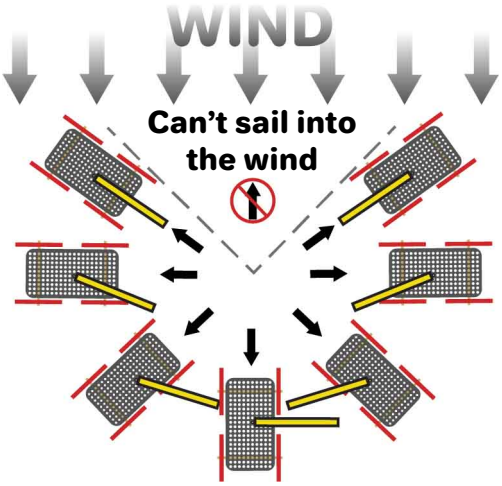


Experiment with your sail

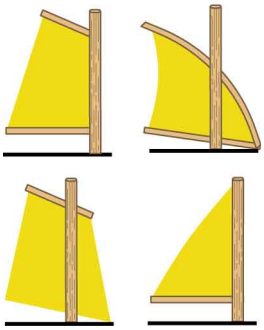
Sail Size
Bigger sails will harness more energy from the fan/wind, but they also create more air resistance.



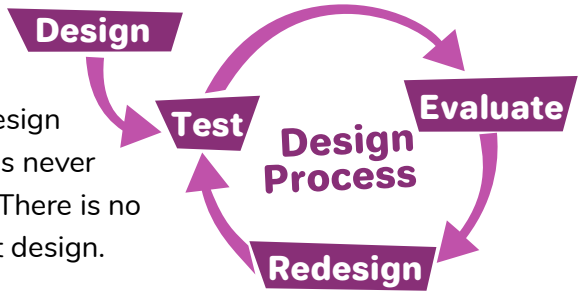
Sail Angle
Changing the sail angle also allows you to adapt to different wind directions.



Sail Shape
Different shapes interact with the wind in different ways. Each shape has its own strengths and weaknesses.



The Design Process never ends! There is no perfect design.



Historical Vessels

Dhows have been used for thousands of years as trading vessels along the coasts of Arabia, East Africa, and India, where they are believed to have originated.

Outrigger Canoes are fast and maneuverable. Developed in the islands of South East Asia, Pacific Islanders used them to settle the islands of Oceana as far as Hawaii.

Brigs were popular among Europeans in the 18th & 19th centuries due to their speed and maneuverability. They were often used by pirates, merchants, and navies.

Sail into the Future

The Zephyr Venus Landsailer was designed by NASA to explore Venus. Its main source of propulsion is its sail, which is covered in solar panels to power the steering systems and scientific equipment. The vessel folds into a protective shell for landing.