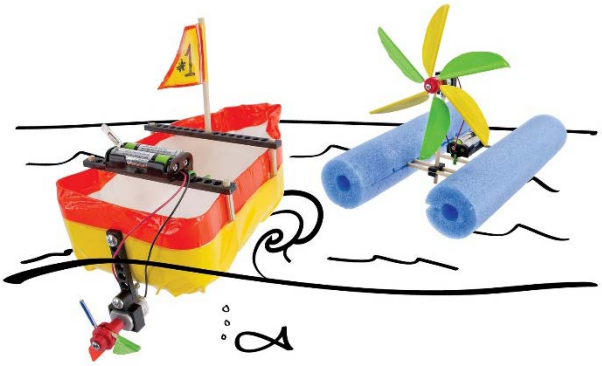
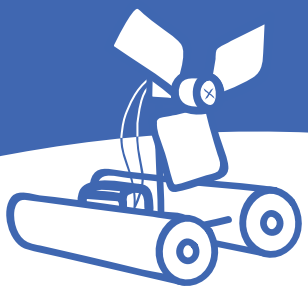
Build-a-Boat Build Guide



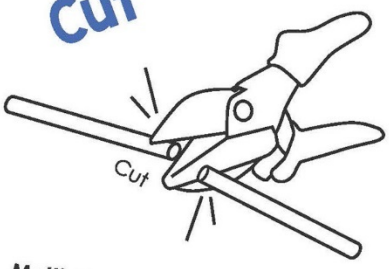
Start by building the example boat,
then turn it into your own unique design.

For use with TeacherGeek Build-a-Boat Activity, or Maker Cart. Find documents and activity materials at **teachergeek.com**.

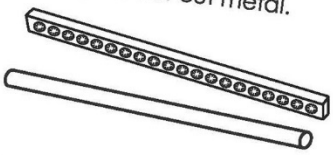


Build-a-Boat Build Guide

Cut



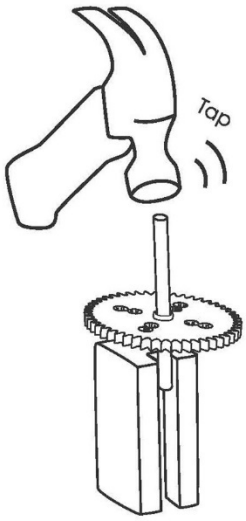
Multi-Cutters cut wood & plastic (like **dowels** and **connector strips**). They do not cut metal.



Push, Wiggle,

Push, wiggle or tap **dowels** into holes.

Tap



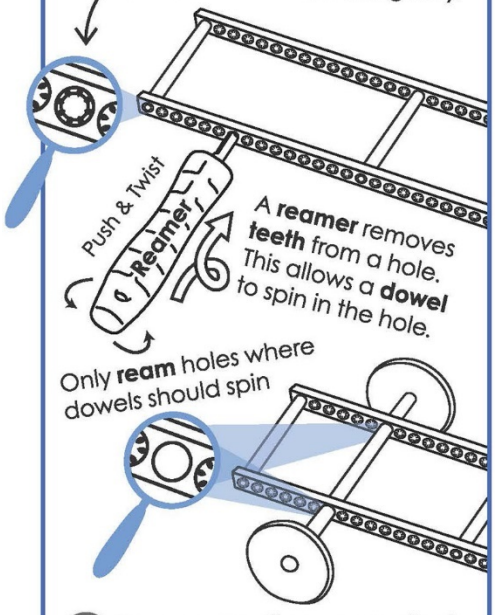
Use a **hammer** and **slider block** to tap **dowels** farther through holes.

Quick Tip!

Use a crayon, or soap on the end of a Dowel to make building easier.

Ream

Most parts have holes with **teeth**. The **teeth** hold **dowels** (keep dowels from falling out).



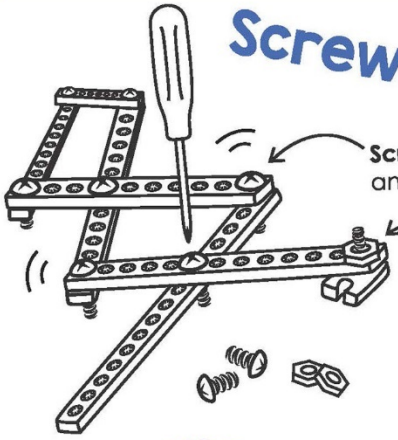
A **reamer** removes **teeth** from a hole. This allows a **dowel** to spin in the hole.

Only **ream** holes where dowels should spin

Never **ream pulleys**, **gears**, **wheels**, or any hole a **dowel** stays stuck into.

Screws & Nuts

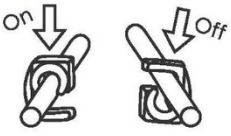
Do not **ream** holes you will put **screws** into.



Screws (without nuts) can connect parts, and allow them to rotate.

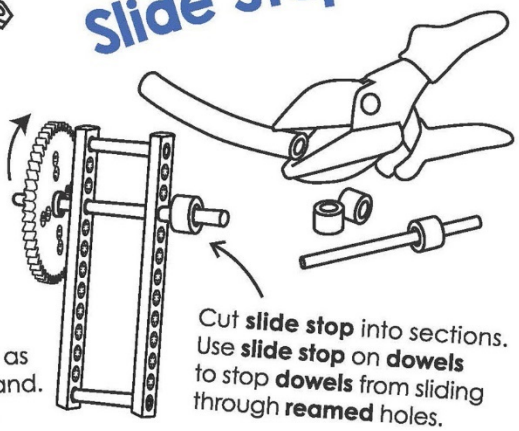
Screws (with a nut) can connect parts, and keep them from rotating.

Stop Clip

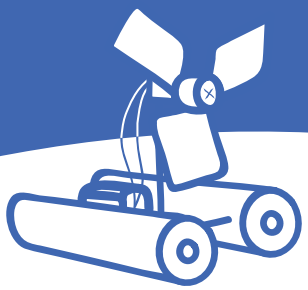


Press a **stop clip** onto a **dowel** to keep it from sliding or use it as a hook for a string / rubber band. It takes little force to get it on.

Slide Stop



Cut **slide stop** into sections. Use **slide stop** on **dowels** to stop **dowels** from sliding through **reamed** holes.

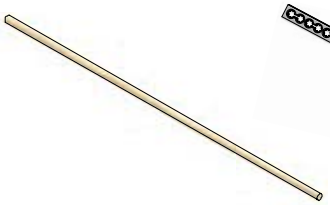


Build-a-Boat Build Guide

TeacherGeek Components

These are the TeacherGeek components for the example Boat, and extras to turn it into your own unique design.

2 - Blocks



4 - Dowels
300mm (12")

3 - Connector Strips

4 - 25mm Screws
25mm (1") #10

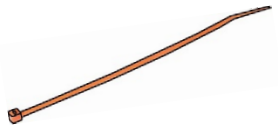
4 - Nuts
#10

10 - Toothpicks

1 - Hub Cover

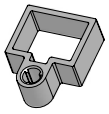
1 - Hub Base

1 - Hub Screw
⅝" #6



4 - Zip Ties

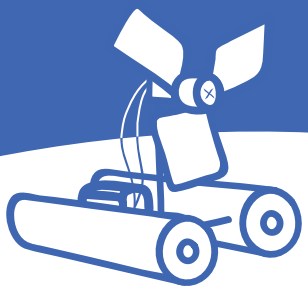
1 - Motor
1.5V-3V



1 - Motor Mount

1 - Battery Holder
w/ switch & leads

Components available in the TeacherGeek Build-a-Boat Activity, TeacherGeek Maker Cart, or at **teachergeek.com**



Build-a-Boat Build Guide

TeacherGeek Tools You'll Need

Easy to Share in Groups

Multi-Cutter
SKU 1823-81

Screwdriver
SKU 1823-90

Hammer
SKU 1824-41

Tools available at **teachergeek.com**

Materials You Supply

You will need these non-TeacherGeek supplies:

Tape
Masking, Painter's, Duct—
Any kind of tape will work.

Scissors
For cutting blade materials out of recycling materials.

Safety Goggles
Should be worn during the activity. Propeller blades spin very fast.

2 - AA Batteries

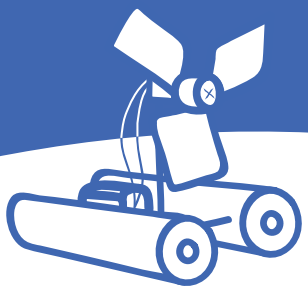
Recycling Materials

Blades can be made from cardboard, chipboard, clean food packaging, plastic, etc.

They should not be made from metal or anything sharp.

Floating Materials

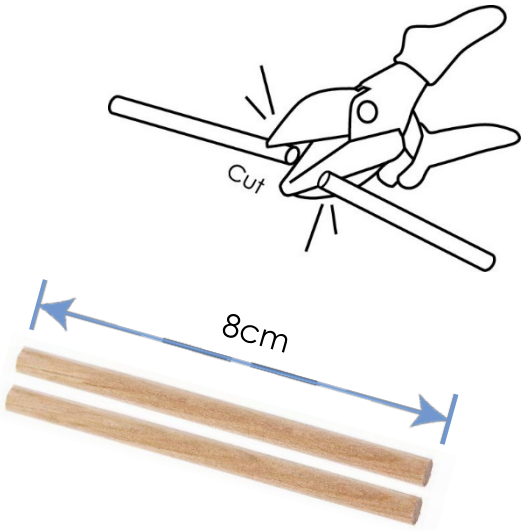
Find materials that float.
You'll get to add these to your design to create a working boat.



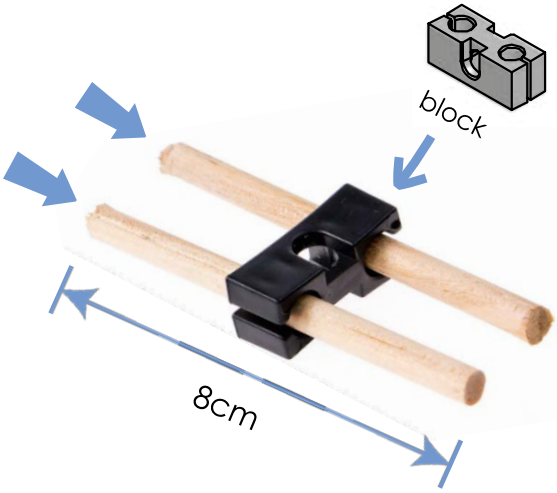
Build-a-Boat Build Guide

Frame Build

1. Cut two 8cm **dowels**.

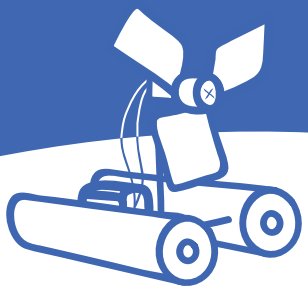


2. Push or tap the 8cm **dowels** half way through a **block**.



Quick Tip

Use a tapping block and hammer. It will things much easier.



Build-a-Boat Build Guide

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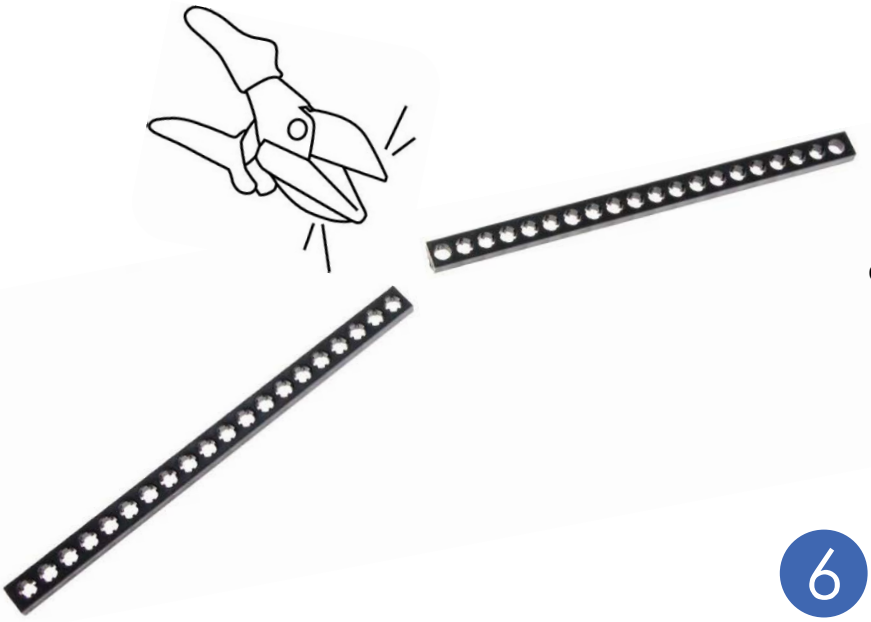
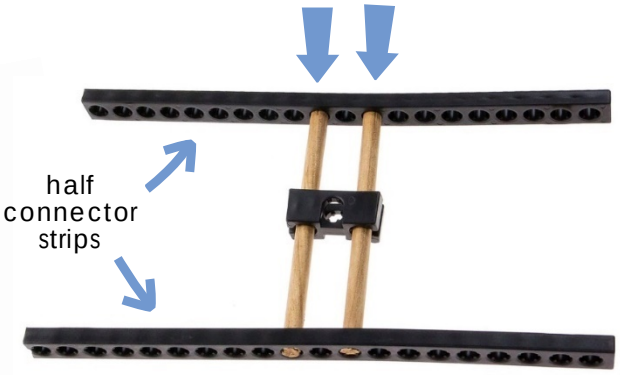
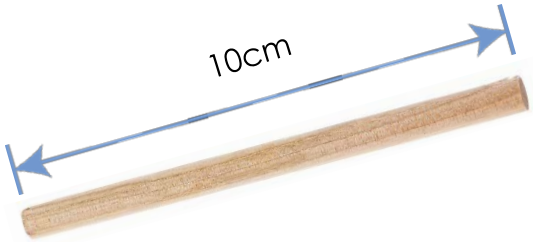
3 Cut a **connector strip** in half.



4 Push or tap the **connector strip** halves onto the dowels from Step 2.



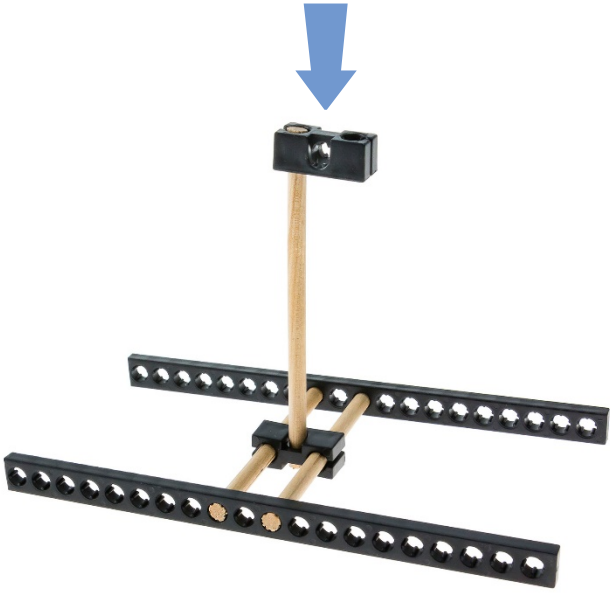
5 Cut a 10cm **dowel**.



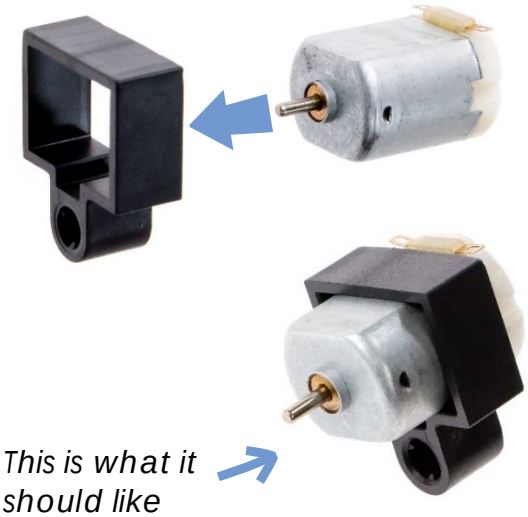
6 Push or tap the 10cm **dowel** through the center hole of the **block**.

Mount the Motor

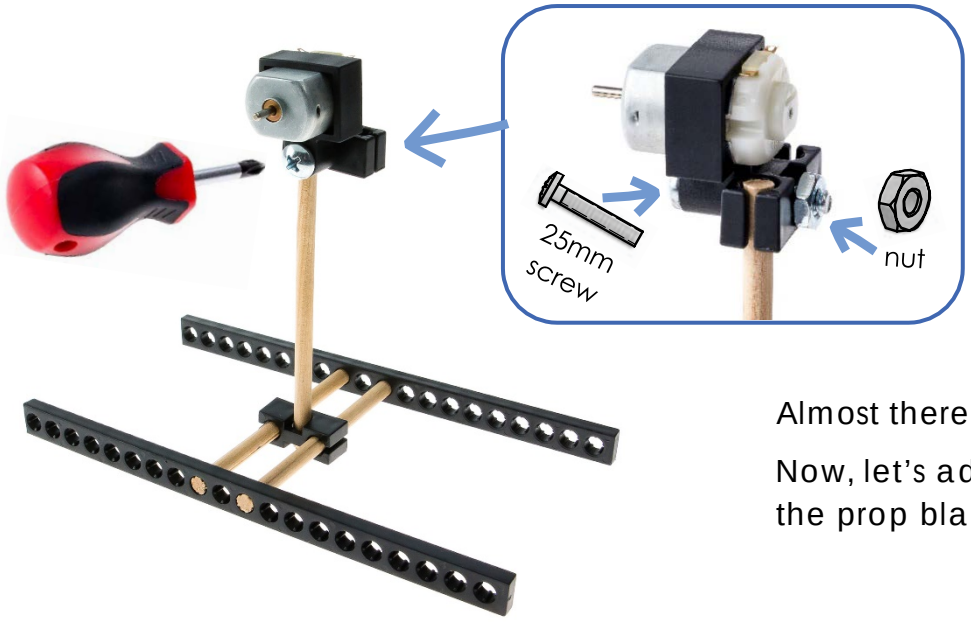
7 Push the outside hole of a **block** onto the **dowel**.



8 Push the **motor** into the **mount** as shown.

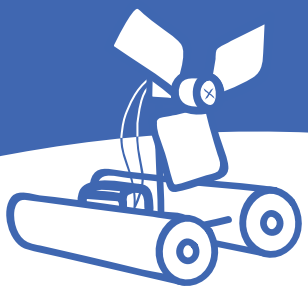


9 Attach the **motor mount** with a **25mm screw** and **nut**.



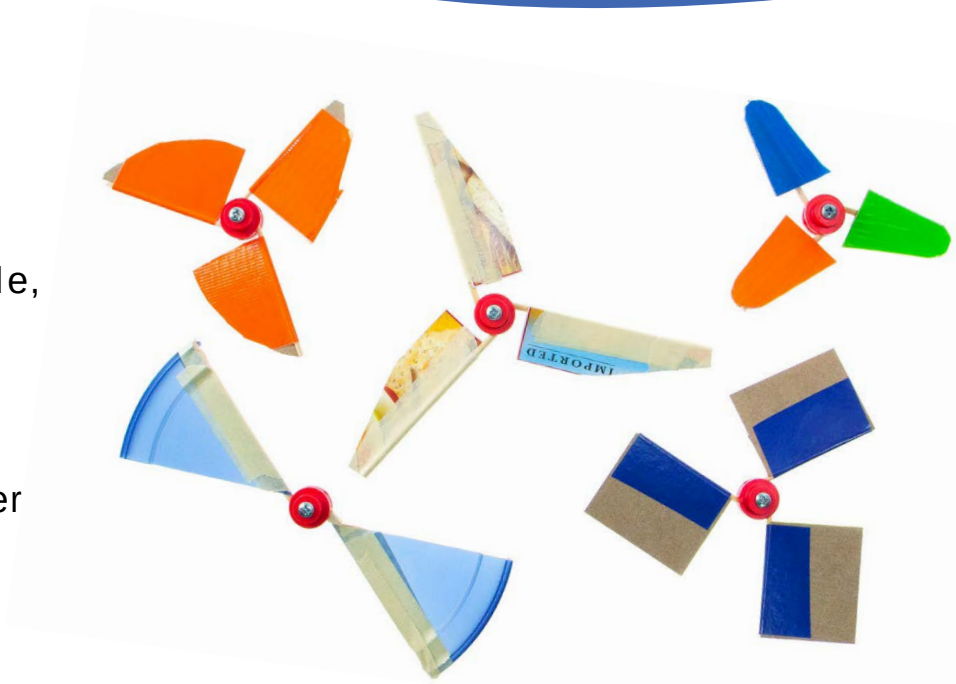
Almost there!

Now, let's add the prop blades...



Build-a-Boat Build Guide

Make the Propeller



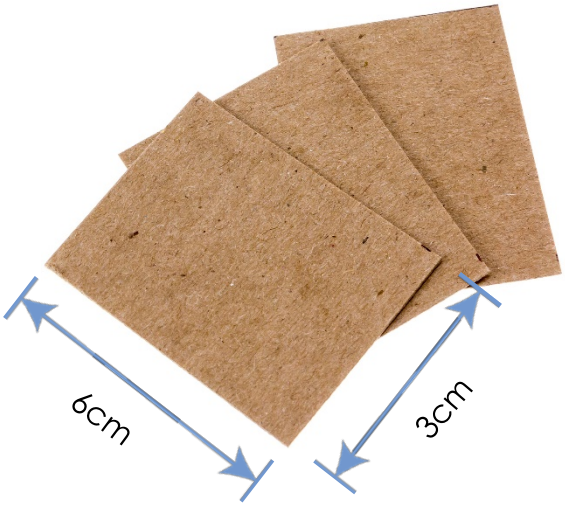
For this part of the build guide, you will need:

- Tape (any kind will work)
- Recycling Materials
- Mini Motor Hub Base & Cover
- Hub Screw
- Toothpicks (or skewers)

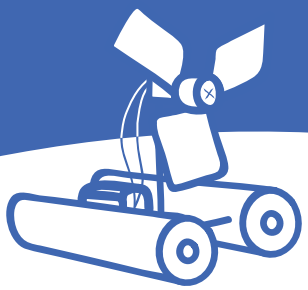
10 Cut the both ends off the **toothpicks**.

Skewers Option
Cut to size and cut off the pointed ends of **skewers**.

11 Measure and cut three 3cm x 6cm strips of **recycling materials.**



These will be your blades.



Build-a-Boat Build Guide

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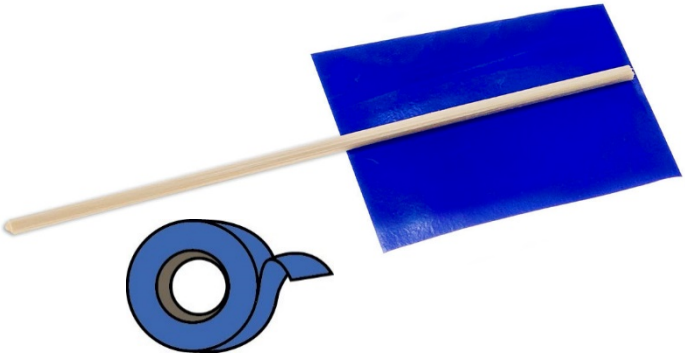
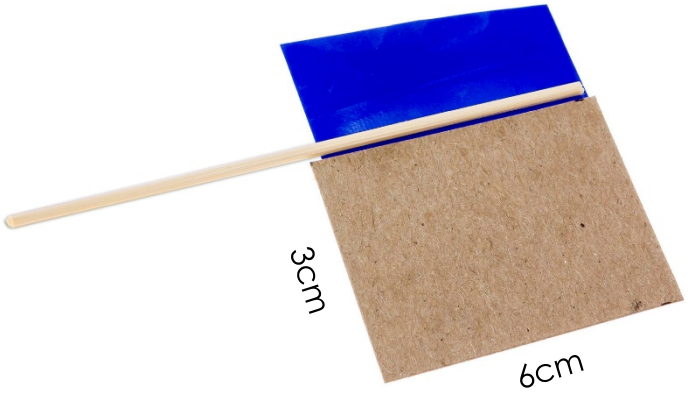
12 Lay a piece of **tape** (sticky side up) and lay a **toothpick** in the middle.



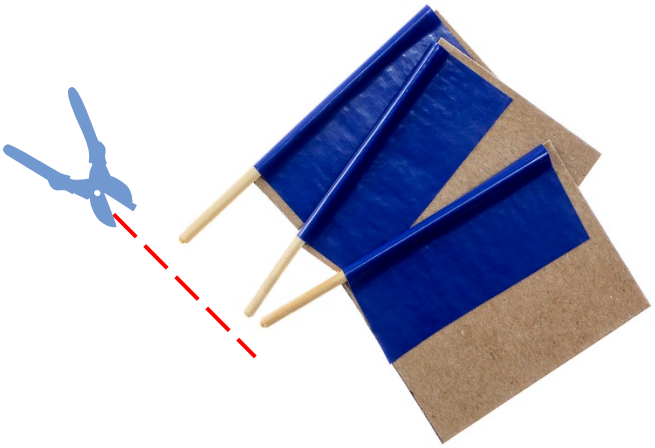
sticky side up

13 Place the **blade** on one half of the **tape**.



14 Fold over the **tape** (around the **toothpick** and **blade**).

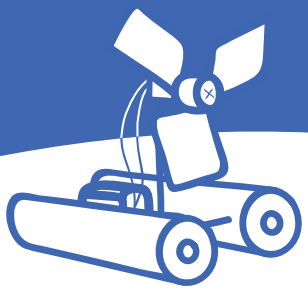
15 Measure 15mm from the end of **blade**... and cut.



Congratulations!

You made your first prop blade. Now, make two more.

You should have *three* when you are finished.



Build-a-Boat Build Guide

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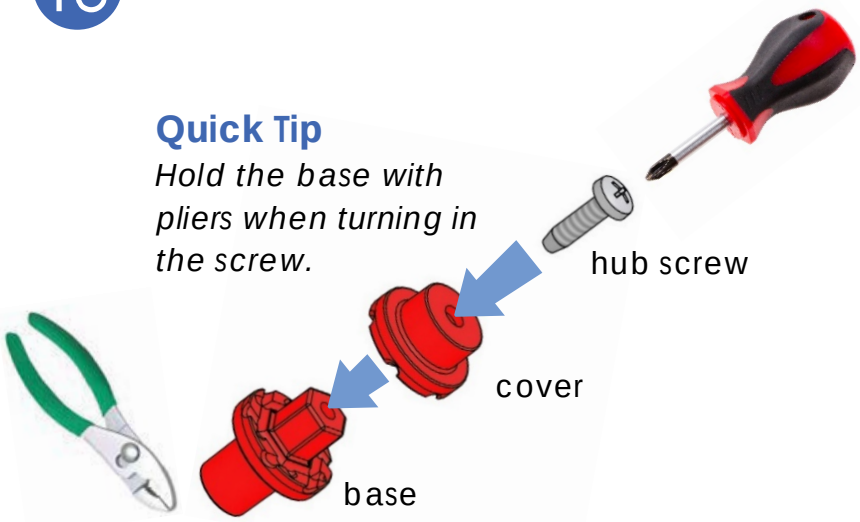
Safety First

If you're not already, wear eye protection during these steps and when operating your Boat.

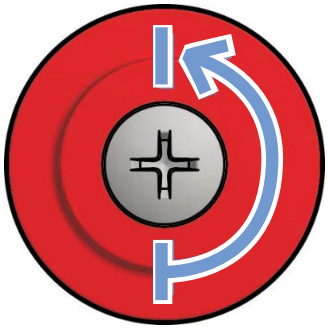
16 Screw the **cover** to the **base** using a **hub screw**.

Quick Tip

Hold the base with pliers when turning in the screw.

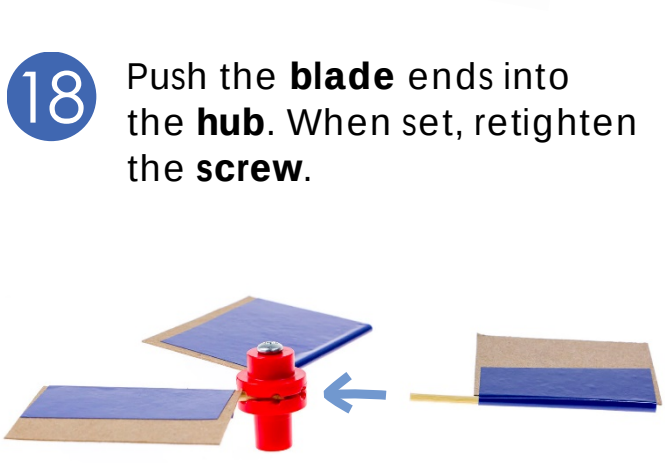


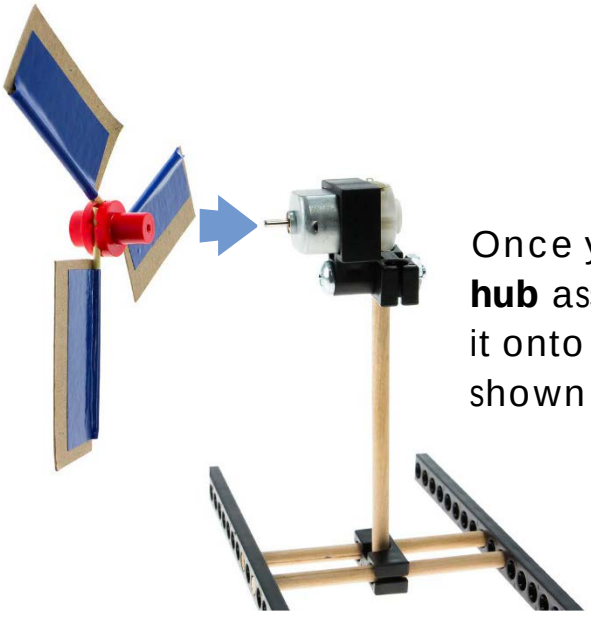
17 Loosen the **screw** ½ turn.



Front View

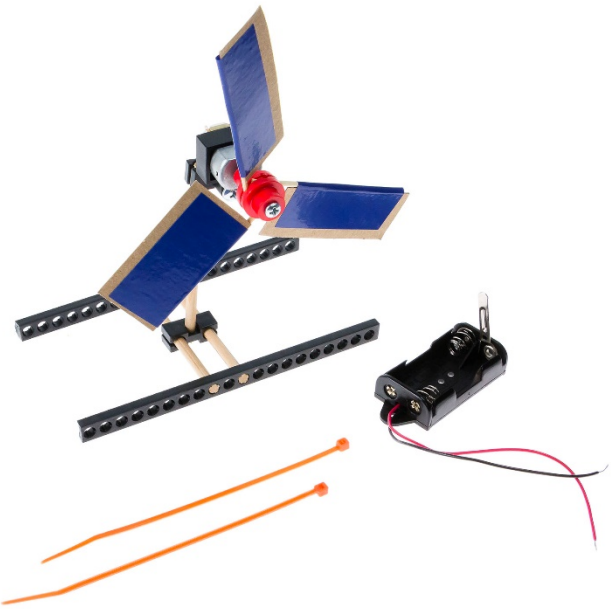
18 Push the **blade** ends into the **hub**. When set, retighten the **screw**.



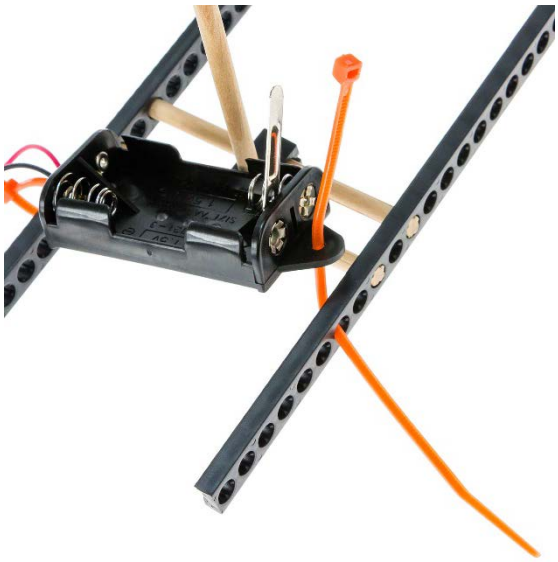


Once you have your **hub** assembled, push it onto your **motor** as shown on the left.

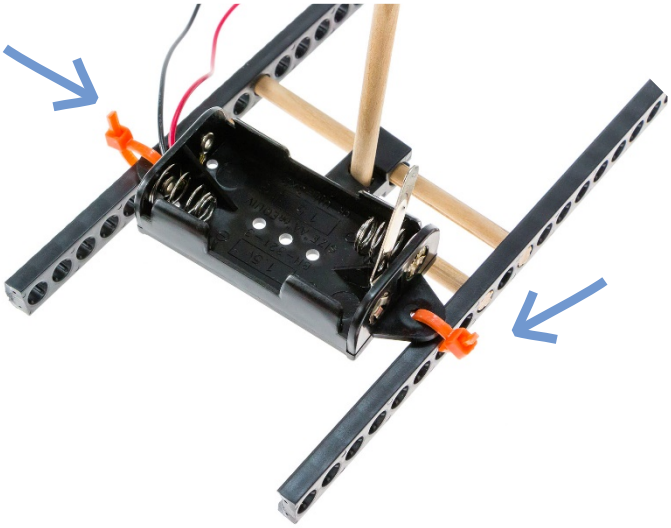
Connect the Power

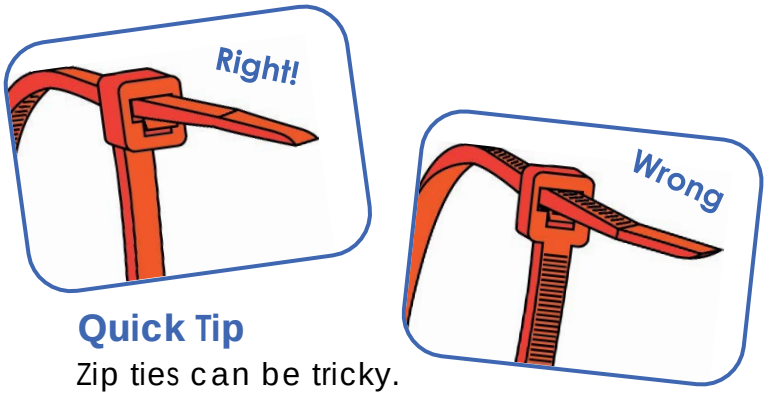


19 Put the **zip tie** through the **battery holder** and one of the holes on the **frame**.



20 Tighten and trim **zip ties**.

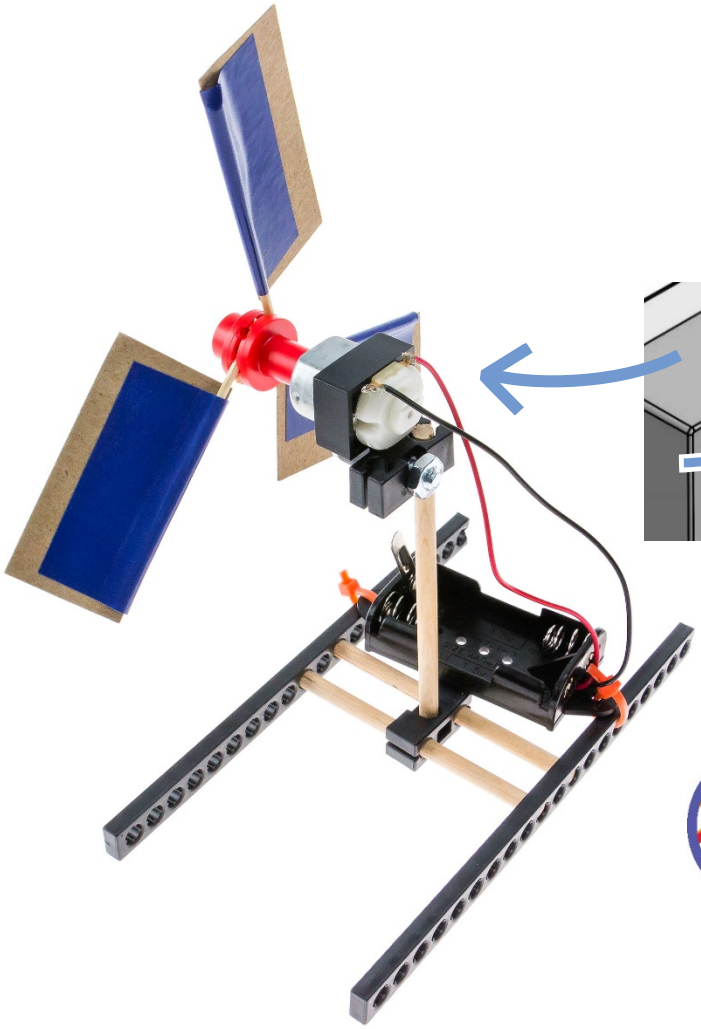


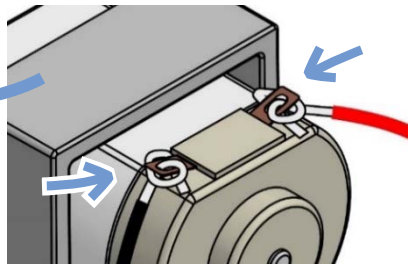


Quick Tip

Zip ties can be tricky. Make sure you put them on the right way.

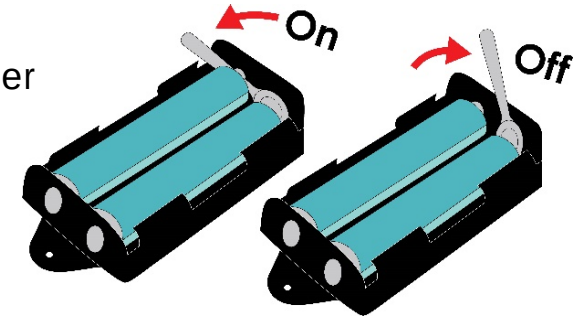
21 Connect the **motor** to the **battery holder**. Put the **battery holder** wires through and wrapped around the **motor** terminals.

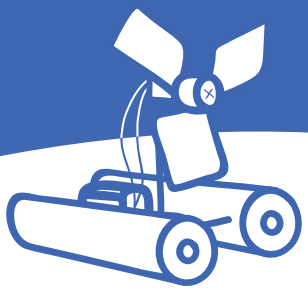




Caution: No Short Circuiting
Do not let the wires cross or touch the silver metal part of the motor.

22 Insert two AA batteries in the **battery holder**. Use the metal lever to turn your propeller on and off.





Build-a-Boat Build Guide

Buoyancy & Stability

23 Add **floating materials** (foam trays, pool noodles, plastic bottles, food containers, etc.) to your design to make your boat float.

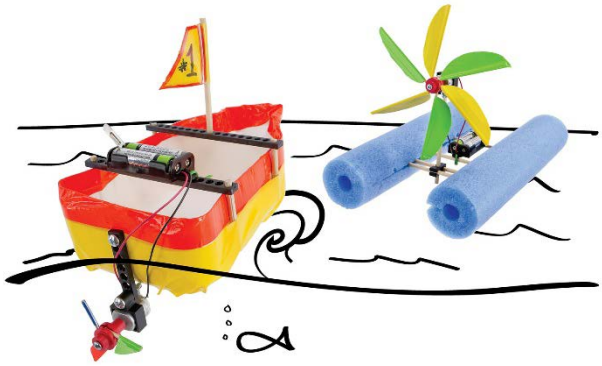
Quick Tip
Cut slits in your noodles to slide the frame into.

Add a Rudder
Use the water's current to your advantage and help push your boat along.

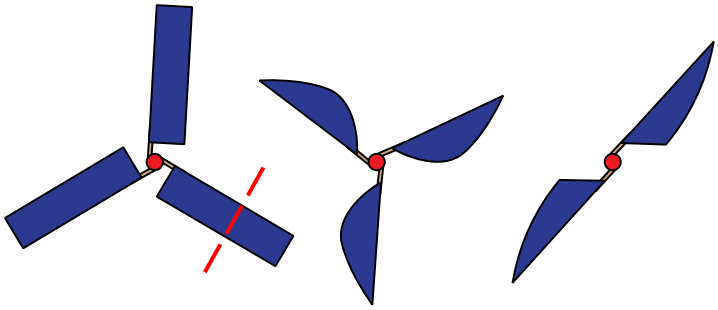
Congratulations!

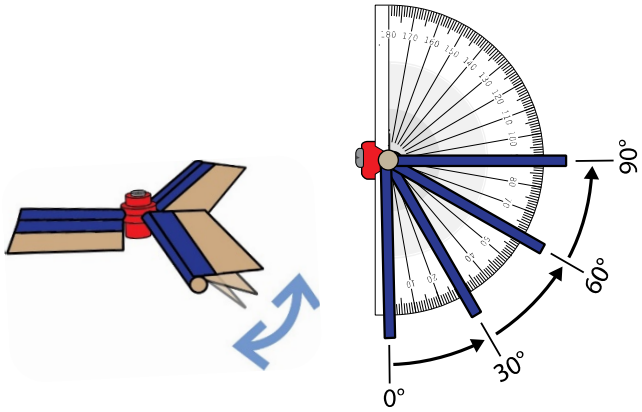
Your example Boat is finished!
The example isn't the best design.
You can make it so much better.

Find out how on the next page.



Make it Go





Try Changing Blade Shape & Size

Blade designs come in all shapes and sizes. Try adding to your blades by taping on extra pieces or cutting them down into new shapes.

Or try using only two blades or six!

Try Changing Blade Angle

A. Loosen the hub screw a half turn.
B. Change the blade angle using the protractor as shown.
C. Tighten the screw again.

Design an Underwater Propeller

Use what you've learned about propellers pushing air, and design a boat that uses a propeller to push water.

Quick Tips

- Dowels swell when wet.
- Use a smaller blade design.