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.

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**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**

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

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

Do not ream holes you will put screws into.

**Slide Stop**

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

**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.
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
TeacherGeek Tools You’ll Need

Tools available at teachergeek.com

Multi-Cutter
SKU 1823-81

Screwdriver
SKU 1823-90

Hammer
SKU 1824-41

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.
Frame Build

1. Cut two 8 cm dowels.

2. Push or tap the 8 cm dowels halfway through a block.

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

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

**Skewers Option**

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

These will be your blades.
Lay a piece of **tape** (sticky side up) and lay a **toothpick** in the middle.

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

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

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

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

You should have three when you are finished.
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.

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.
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.

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

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**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.
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.