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

For use with TeacherGeek Air Racer Activity Pack, or Maker Cart. Find documents and activity materials at teachergeek.com.
**Air Racer 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.

**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.

**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.

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

- **2 - Blocks**
- **3 - Dowels** 300mm (12”)
- **3 - Connector Strip**
- **3 - Wood Wheels**
- **2 - Nuts** #10

- **10 - Skewers** (or toothpicks)
- **1 - Hub Cover**
- **1 - Hub Base**
- **1 - Mini Hub Screw** ¾” #6
- **2 - 25mm Screws** 25mm (1”) #10

- **1 - Motor** 1.5V-3V
- **1 - Motor Mount**
- **1 - Battery Holder** w/ switch & leads
- **4 - Zip Ties**
- **1 - Slide Stop** 100mm (3”)
Tools available at teachergeek.com

TeacherGeek Tools You’ll Need

- Multi-Cutter
- Reamer
- Screwdriver
- Hammer

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. Prop blades spin very fast.

- **Recycling Materials**
  - Blades can be made from cardboard, chipboard, clean food packaging, plastic, etc.
  - They should not be made from anything sharp or metal.
Frame Build

1. **Cut two 8cm (3”) dowels.**

2. **Push or tap the 8cm (3”) dowels half-way through a block.**

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**Quick Tip**
Use a tapping block and hammer. Things will be much easier.
3 Cut a connector strip in half, 15cm (6”).

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

5 Cut a 10cm (4”) dowel.

6 Push or tap the 10cm dowel through the center hole of the block.
7. Ream the four outside holes on the frame. This will allow the dowels to spin.

8. Cut two 12 cm dowels. These will become axles for the wheels.

9. Tap or push one 12 cm (4.7”) dowel into a wood wheel to make an axle.

10. Slide the axles through the reamed holes and put on wheels as shown.

Quick Tip
Cut and use slide stop pieces as spacers or to keep wheels from falling off. Make sure there is still space to spin.

Use two 5 mm pieces of slide stop and slide on axle as shown.
Mount the Motor

11. Push the outside hole of a block onto the dowel.

12. Push the motor into the mount as shown.

This is what it should like.

13. 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
- Skewers (Toothpicks)

14 Cut both ends off the skewers

Skewers Option
Cut to size and cut off the pointed ends of skewers (or toothpicks).

15 Measure and cut three 3 cm (1”) x 6 cm (2.5”) strips of recycling materials.

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

17 Place the blade on one half of the tape.

18 Fold over the tape (around the skewer (or toothpick) and blade).

19 Measure 15mm from the end of blade to your dowels and cut.

Make sure the tape is creased tight around.

Congratulations!
You made your first prop blade. Now, make two more.
You should have three when you are finished.

Safety First
If you’re not already, wear eye protection during these steps and when operating your Air Racer.

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

**Quick Tip**
Hold the base with pliers when turning in the screw.

A Carefully **slide** the **skewers** (toothpicks) into **mini hub’s holes**.

B When set, **retighten** the **screw**. **Push** the **hub** onto your **motor**.
23 Put the **zip tie** through the **battery holder** and one of the **holes** on the **frame**.

24 **Tighten** and **trim zip ties**.

**Quick Tip**

Zip ties can be tricky. Make sure you put them on the right way.
25 **Connect** the motor to the battery holder. Put the battery holder wires through and wrap them around the motor terminals.

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

26 **Insert** two AA batteries in the battery holder. Use the metal lever to turn your Air Racer on and off.

**Good News**
Your example Air Racer is finished. Bad news, the example isn’t the best design, you can make it better.

Find out how on the next page.
Make your Air Racer go.

Does it already move?
Make it go faster, go farther.
Make it better. Change the blade, change the frame, the possibilities are endless!

**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.

**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.