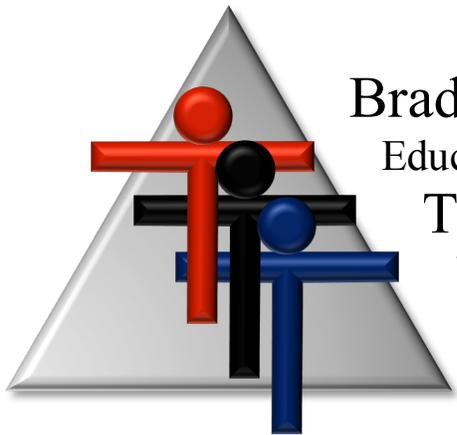


# Building a Hovercraft

Plus, two versions of toy hovercrafts!

It really flies!



Brad Fulton

Educator of the Year, 2005

Teacher to Teacher Press

[brad@tttpress.com](mailto:brad@tttpress.com)

[www.tttpress.com](http://www.tttpress.com)





*Don't be a  
pirate, matey!*



**This material is copyrighted and protected by  
U.S. anti-piracy laws.**

© 2022 by Teacher to Teacher Press. All rights reserved.

**As a purchaser of this handout, you have a single-user license.** You may duplicate student activity pages for your own classroom use only. Any unauthorized duplication of these materials by physical or electronic means or any public performance and demonstration of these materials without prior written consent of Teacher to Teacher Press are strictly prohibited. **Please print a physical copy.** Do not store or transfer an electronic copy onto a disc, drive, or cloud. If you lose your physical copy, let me know, and I'll be happy to help.

If you should need written permission to present these materials, you may contact me at my website, [www.tttpress.com](http://www.tttpress.com).

Thanks.

**Brad**



## Brad Fulton

### Educator of the Year

- ◆ Consultant
- ◆ Educator
- ◆ Author
- ◆ Keynote presenter
- ◆ Teacher trainer
- ◆ Conference speaker

PO Box 233, Millville, CA 96062  
(530) 547-4687  
brad@tttpress.com

Known throughout the country for motivating and engaging teachers and students, Brad has co-authored over a dozen books that provide easy-to-teach yet mathematically rich activities for busy teachers while teaching full time for over 30 years. In addition, he has co-authored over 40 teacher training manuals full of activities and ideas that help teachers who believe mathematics must be both meaningful and powerful.

#### **Seminar leader and trainer of mathematics teachers**

- ◆ 2005 California League of Middle Schools Educator of the Year
- ◆ California Math Council and NCTM national featured presenter
- ◆ Lead trainer for summer teacher training institutes
- ◆ Trainer/consultant for district, county, regional, and national workshops

#### **Author and co-author of mathematics curriculum**

- ◆ Simply Great Math Activities series: six books covering all major strands
- ◆ Angle On Geometry Program: over 400 pages of research-based geometry instruction
- ◆ Math Discoveries series: bringing math alive for students in middle schools
- ◆ Teacher training seminar materials handbooks for elementary, middle, and secondary school

#### **Available for workshops, keynote addresses, and conferences**

All workshops provide participants with complete, ready-to-use activities that require minimal preparation and give clear and specific directions. Participants also receive journal prompts, homework suggestions, and ideas for extensions and assessment.

*Brad's math activities are the best I've seen in 38 years of teaching!*

Wayne Dequer, 7th grade math teacher, Arcadia, CA

*"I can't begin to tell you how much you have inspired me!"*

Sue Bonesteel, Math Dept. Chair, Phoenix, AZ

*"Your entire audience was fully involved in math!! When they chatted, they chatted math. Real thinking!"*

Brenda McGaffigan, principal, Santa Ana, CA

*"Absolutely engaging. I can teach algebra to second graders!"*

Lisa Fellers, teacher

*References available upon request*

Like my activities? How about giving me a favorable rating on the Teachers Pay Teachers website? Four stars would be much appreciated and would help me sleep better at night.



Like me even more? Then please don't make copies for your colleagues. I know it's tempting when they say, "Wow! Groovy activity! Can I have a copy?" But this is how I make my money, and why are they still saying "groovy" anyway?



If we make copies for our friends, can we honestly tell our students not to copy or take things that don't belong to them? (Ouch!)



Discounted site licensed copies are available on the TPT website. Please encourage them to take advantage of this affordable option. Okay?

Thanks, and happy teaching,

*Brad* 

## OVERVIEW

### Required tools:

- Saw
- Drill
- Hole saw or jigsaw
- Sandpaper
- Staple gun

# Building a Hovercraft

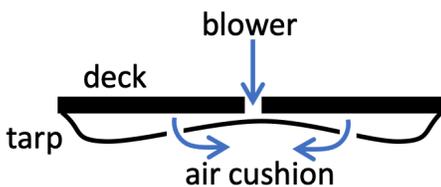
This project will show you a simple and inexpensive step-by-step plan how for building a working hovercraft on which you can actually fly. It safely flies a mere centimeter off the ground and provides an exciting and memorable ride. Basic tools and readily available materials are all that is required.



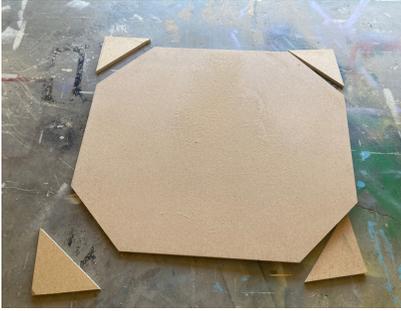
## PROCEDURE

### Materials:

- Leaf blower
- 4' x 4' x  $\frac{5}{8}$ " plywood
- 12" x 16" x  $\frac{1}{4}$ " plywood
- Wood glue
- Duct tape
- 5' x 6' reinforced plastic tarp
- Painter's caulking
- 45° ABS pipe
- Various hardware



1. I have built two of these for my students, and both worked excellently. One hovercraft has flown a high school football lineman, and it has also flown four second graders at once! The process is simple and can be completed by a person with basic skills with woodworking.
2. The hovercraft works by directing a strong air stream into the middle of the doughnut shaped diaphragm created by the tarp. The craft then lifts up on this cushion of inwardly directed air as shown in the margin.
3. Your first task is to get a leaf blower. This will provide the air pressure necessary to lift the craft off the ground. The blower will have to be adapted to the craft, so it can no longer work to blow leaves. I had the privilege that a former student now runs a lawnmower shop and donated a hefty leaf blower motor to me free of charge! I used it for many years until it finally had to be retired. He then gave me a deal on a brand-new leaf blower that will serve for many years to come.
4. You will need some  $\frac{5}{8}$ " or  $\frac{3}{4}$ " plywood or other sheet goods for the base. I cut mine to 42" wide by 48" long, but this can be varied a bit.



5. Cut the corners to create the modified octagon configuration. This will allow the tarp to inflate and create the doughnut shape which forms the air pocket on which the hover craft flies.



6. Sand the edges and round them over to make them smooth. If you have a router, this can be done quickly.



7. Next, we will build the adapter plate that connects the ABS pipe to the deck. The ABS is an 45° angle that fits onto the leaf blower's exhaust duct. You will need to take your blower to a hardware store to be sure you buy one that will fit your blower. I had to sand the duct on my blower a bit to get it to fit into a 4" ABS pipe.

Cut two squares slightly larger than the diameter of the ABS. Glue and clamp these together.



8. Next, use a hole saw or jigsaw to cut a circle the same diameter as the outer diameter of the ABS angled pipe.



9. The pipe should fit snugly. It can be glued into the adapter plate if you want.



10. I shaped mine a bit to make it look better, but this is not necessary.



11. Now use the adaptor to mark a corresponding hole centered near the front of the deck. This hole should be slightly smaller in diameter so the ABS pipe will seat onto the deck without falling through the hole.



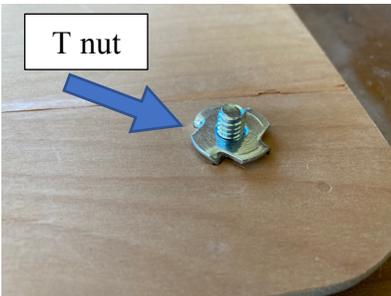
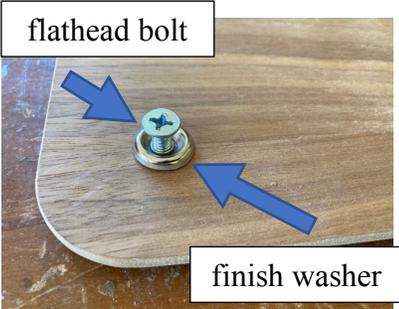


12. Now the bottom of the hovercraft is covered with a tarp. I purchased one of the silver colored ones as they are a bit thicker and will last longer when the hovercraft comes to a stop on asphalt or concrete and is abraded. I trimmed the edges wide enough to allow me to fold it over the top in a double thickness. I put a small bead of caulking down and pressed the tarp against it. Then I attached it with a continuous row of staples from a staple gun. Between the caulking and the staples, I had an airtight fit. By pulling the staples and peeling away the tarp from the caulking, I am able to replace the tarp when it wears out.

As you can see, I painted the deck of the hovercraft first.

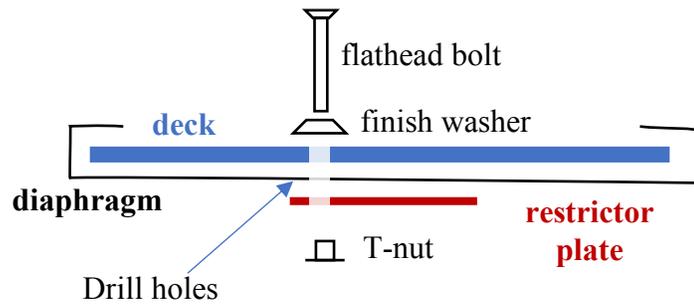


13. Then I covered these edges with a strong tape such as Gorilla Tape<sup>®</sup>. I used two layers to insure a tight fit.

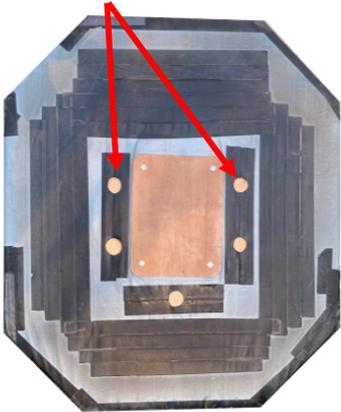


14. Now we will look at how I built the restrictor plate. This is bolted in the center of the bottom of the hovercraft. It keeps the diaphragm from ballooning out too far. By restricting the center of the diaphragm, the inflation is directed toward the outside of the tarp (diaphragm) resulting in a donut or bagel shaped bulge when the blower is activated.

The restrictor plate is made out of 1/4" material and measures about 12" by 16". It is attached with flathead bolts, finish washers, and T-nuts. The flathead bolts and finish washers are on the top deck of the craft so that they don't hurt the flier's behind. The T-nuts are on the underside of the restrictor plate. They are assembled as shown here.



outflow holes



15. All that remains is to cut the outflow holes in the diaphragm. I cut five holes as show here. (The sum area of these holes equals the area of the exhaust port on the blower; time to do a little math.) They are placed near the restrictor plate. This ensures that the air cushion is directed into the center of the bottom of the hovercraft. This is the air cushion that supports the craft. If the holes are too close to the outside perimeter of the deck, the air cushion will not develop beneath the deck.

To make the tarp last longer, I added more tape to the parts of the bottom that would receive the most abrasion from the ground.



16. And here is the finished project. Here are some suggestions and safety precautions for successful flying.

- There are no brakes on the hovercraft. To stop, let go of the blower trigger.
- When pushing someone, push them into an open area, and then stop pushing. My students get so excited they keep pushing faster and faster until they see an approaching wall. Then they let go, and the rider has to figure out how to stop quickly! For this reason, I'm typically the one doing the pushing.
- The hovercraft kicks up a lot of dust. You may want to have the students wear goggles.
- If your blower is gas powered, do not fly it indoors, of course.
- Balance is key. If flying solo, it is best to sit over the restrictor plate area with the feet on the golden arrows near the front. With two flyers, they should be about the same size and weight.

**Watch a short video showing the flight of the *Flyin' Lion*™:**

<https://bit.ly/diyhovercraft>





He's flying about a centimeter off the ground!



After many years of use, my leaf blower finally gave out. I replaced it with a brand-new model, but that meant that I had to create a new adapter to hook the blower up to the ABS intake pipe. I went to four plumbing and hardware stores trying to find some pipe that would adapt the blower tube to the ABS. No luck.

Finally, I cut the blower tube down and wrapped one end with many layers of duct tape until it fit nicely into the ABS as show here.



This fit snugly, and I added some screws to hold it together:



Ta-da!



If this seems to ambitious, you can make a toy hovercraft. Here are two suggestions.

#### Method 1

1. Find an old CD or DVD that you no longer need.
2. Find a push/pull cap from a liquid detergent bottle.



3. Glue the cap over the hole in the center of the CD.



4. Attach a balloon to the cap.
5. Open the cap and inflate the balloon from the back of the CD (the bottom of the hovercraft).
6. Close the cap while keeping the air inside the balloon.
7. Set the hovercraft on a smooth surface.
8. Pull the cap open and watch your hovercraft glide across the surface.



Method 2:

1. I bought a small fan from Dollar Tree®.



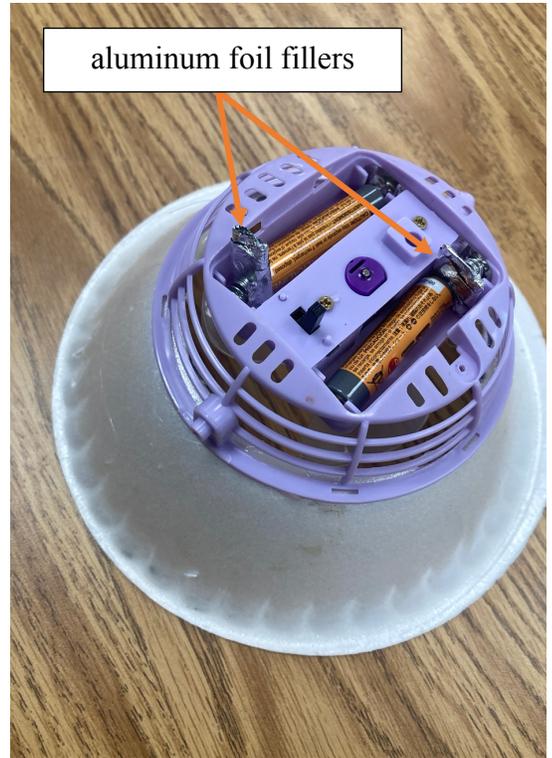
2. I removed the stand and the front cover.



3. I used the removed cover to draw a circle on a paper plate.
4. Then I cut out the circle and glued the fan unit to the bottom of the plate which is the top of the hovercraft.



5. Initially, my plate was not thick enough, so the fan blades hit the table top. After switching to a deeper Styrofoam bowl, it worked a bit, but it wasn't impressive.
6. I switched out the two AA batteries for two AAA batteries to save weight. That helped. The AAA batteries were too small for the battery holder however, so I had to roll up some wads of aluminum foil to fill the gap.
7. This would be a good STEM project. Students can problem solve in order to maximize the performance of this inexpensive hovercraft.



If you liked this activity, you might also like some of the other lessons available in my TeachersPayTeachers store. Simply go to [bit.ly/tttpressstore](http://bit.ly/tttpressstore) or use the QR code.



You can also find many free and inexpensive resources on my personal website, [www.tttpress.com](http://www.tttpress.com). **Be sure to subscribe to receive monthly newsletters, and FREE activities.**

Similar activities include:

- *Petroglyphs Lab* – Combine history and language arts in this fun and engaging activity in which students tell their story through petroglyphs.
- *Best Ever Bird Beak Challenge* – Learn about adaptation in this blended science and math activity that can be adapted from primary grades through middle school
- *Electric Dough* – Students learn the basics of wiring circuits using modeling dough, batteries, and lights!
- *Give Me a Hand* – Learn about prosthetics as students make a model hand with fingers that flex.
- *Heat and Temperature Unit* – 13 simple, engaging, and educational labs await as students learn about the physics of heat and temperature.

Feel free to contact me if you have questions or comments or would like to discuss a staff development training or keynote address at your site.

Happy teaching,  
*Brad*