Apogee Components

PEAK OF FLIGHT

NEWSLETTER

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Cover Photo: The Madcow Momba rocket rips into the sky with a skidmark motor. Get one for yourself at: www.ApogeeRockets.com/Rocket_Kits/High_Power_Rockets/Momba_Rocket_Kit

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Drag of Nose Cones

By Ashley Van Milligan

{Editor's Note: In Peak-of-Flight Newsletter #345 (www.ApogeeRockets.com/Education/Downloads/Newsletter345.pdf), I wrote about how to borrow time in a research wind tunnel. In this issue, we'll share some of the data that was collected by my daughter Ashley. She is 8 years old, and this is a snippet of her R&D project that she presented at NARAM-55 in Aurora, Ohio. The full version can be found on the Apogee web site at: www.ApogeeRockets.com/Tech/RD_Projects_from_the_NAR}

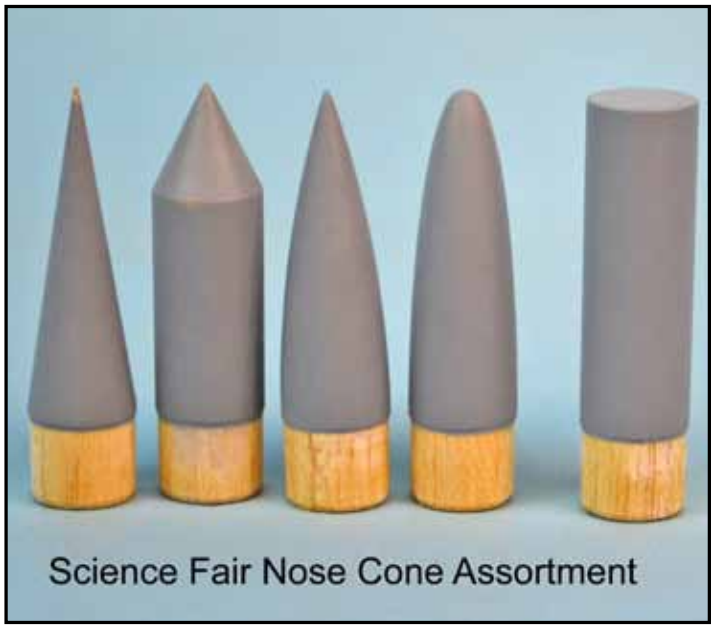
The Objectives Of The Work

My project was to find the best shaped nose cone that had the lowest drag. This was done by measuring the force in a wind tunnel.

The Approach Taken

1. Where did I get the idea for my research project? I got my idea from my dad's book, *69 Simple Science Fair Protectors With Model Rockets* (page 92), "Which Nose Cones Are the Best?"

2. Where did I get the nose cones? My dad made some of the nose cones. I got the rest from Apogee Components, at the *Science Fair Collection* (http://www.apogeerockets.com/Rocket_Kits/Skill_Level_1_Kits/Avion_Nose_Cone_Science_Fair_Kit).



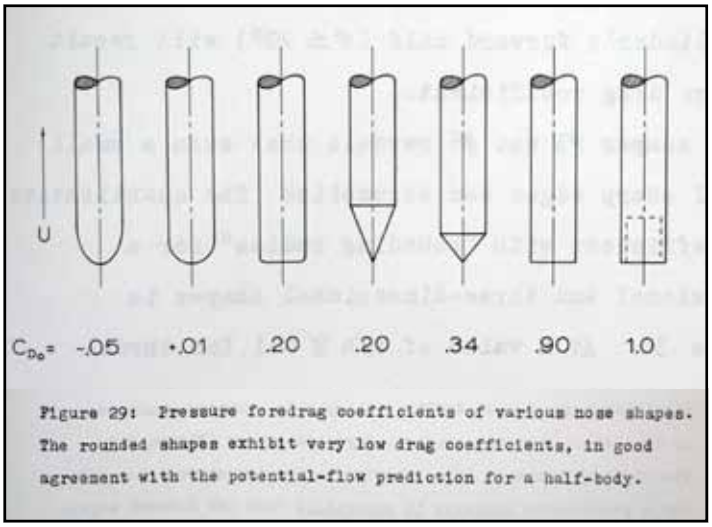
3. How did I make the nose cones? First I got the *Science Fair Nose Cones.* Then I lightly sanded them. Then I sealed them and sanded them to make them smooth. After that, I painted them gray and then I wet sanded them to make all of the nose cones the same smoothness. My dad helped me make the rest of them.

4. Then I went to the Air Force Academy to test them. The people there helped me with the wind tunnel and the measurements. We wrote down the data. It took 45 minutes to test all nine shapes.

5. When we got home we looked at the information. We wrote it down in our chart and my dad helped me make a graph showing how they compared.

References to previous work done on the subject, found in research preparatory to this report:

The references that I found show that not everyone agrees which nose cones have less drag.



Above image from: *Topics In Advanced Model Rocketry* ***(page 381), by Gordon K. Mandell, George J. Caporaso, William P. Bengen (www.ApogeeRockets.com/Rocket_Books_Videos/Books/Topics_In_Advanced_Model_Rocketry).***

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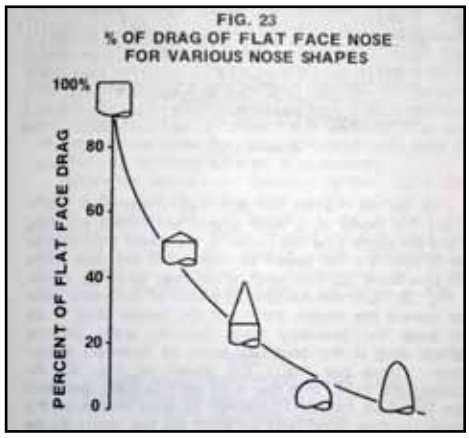
Drag of Nose Cones

The Equipment Used:

The nine nose cones that I tested:

#1 – Parabolic, 2" long. Plastic – Apogee Components, PNC-24A

#2 – Ogive, 2" long, Balsa – Apogee Components Science Fair Nose Cone Assortment



Above image from: Estes Industries, "TR-11 Aerodynamic Drag of Model Rockets" (page 11) by Dr. Gerald M. Gregorek

#3 – Long Elliptical, 2" long, Balsa – Apogee Components Science Fair Nose Cone Assortment

#4 – Short Elliptical, 1-3/8th inch long, lengthened to 2" long with a body tube. Apogee Components VFNC-24B.

#5- Long Cone, 2" long, Balsa – Apogee Components Science Fair Nose Cone Assortment

The short elliptical shape nose cone was lengthened by adding a straight tube to the back end.

#6-Short Cone, 2" long, Balsa – Apogee Components Science Fair Nose Cone Assortment

#7-Solid Cylinder, long, Balsa – Apogee Components Science Fair Nose Cone Assortment

#8-Cupped Cylinder, Made from a 2" long BT-50 tube, with a tube coupler for the shoulder. The bottom of the cup is 1.5 inches from the top. It was made from a cardboard circle.

#9-Vented Cupped Cylinder, Made from a 2" long BT-

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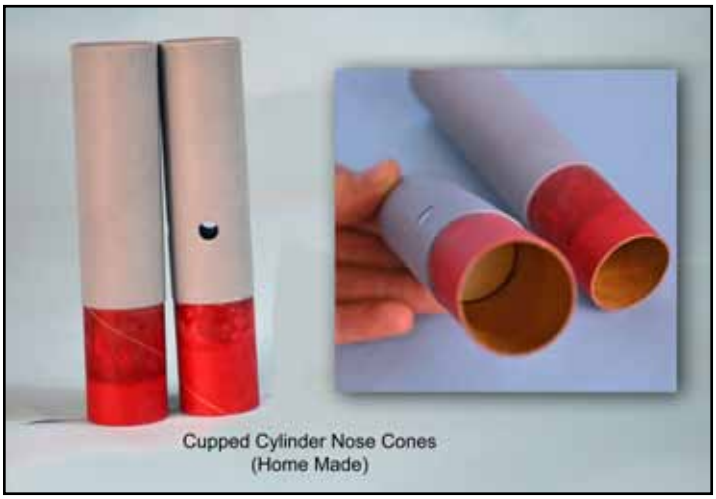
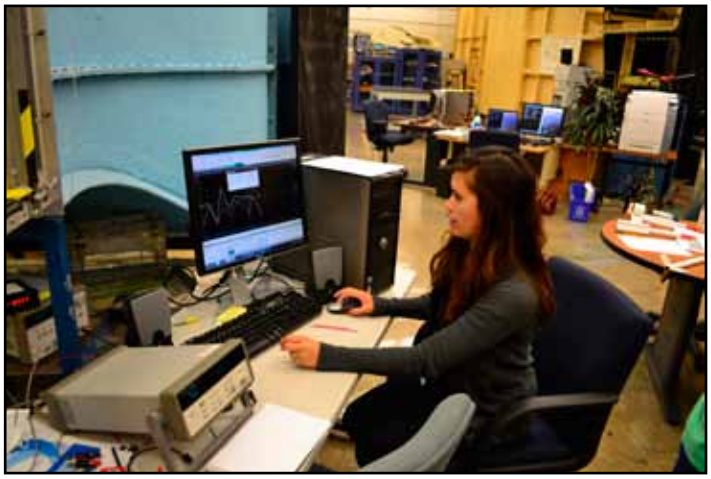
Drag of Nose Cones



The "cupped cylinder" nose cones were made from body tubes and couplers. A paper disk above the coupler closed off the tube.



Katrina McGuire helped run the wind tunnel for my nose cone project.

50 tube, with a tube coupler for the shoulder. The bottom of the cup is 1.5 inches from the top. It was made from a cardboard circle. Four vents were made with a paper punch above the bottom of the cup.

The Facilities Used

United States Air Force Academy Department of Aeronautics Laboratory: 12" Wind Tunnels Open Circuit, Eiffel type.

Katrina put the nose cones into the wind tunnel.

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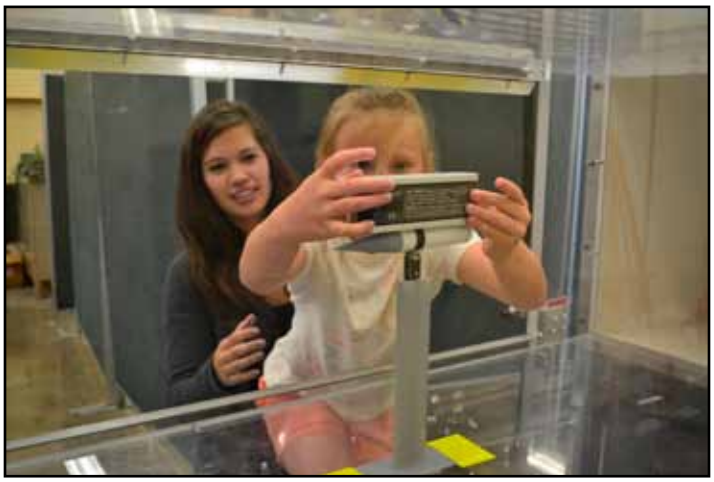
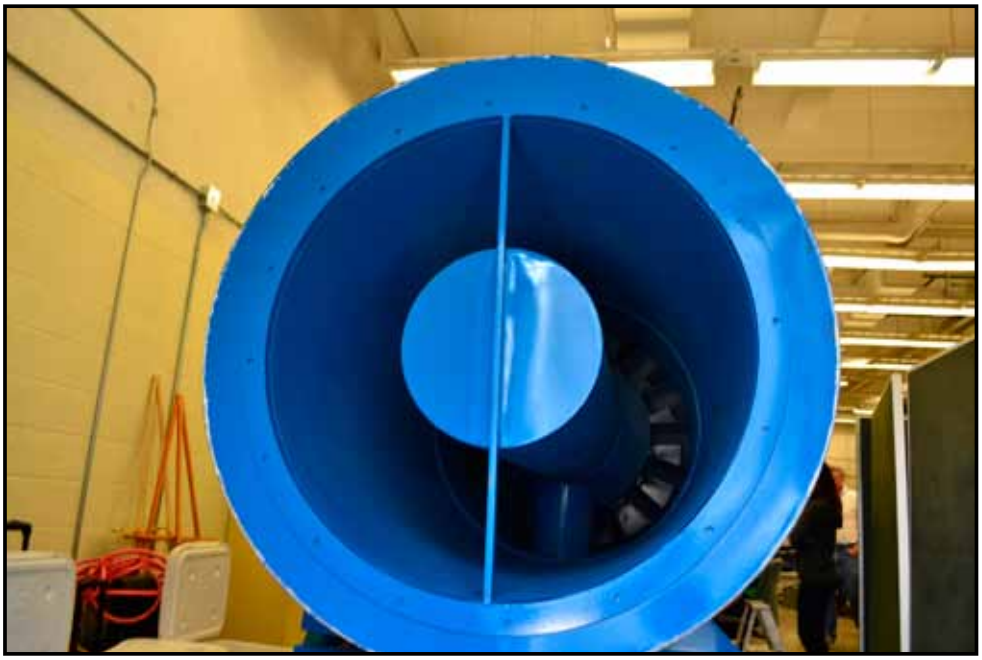
Drag of Nose Cones



I used a level to make sure the nose cone was level.

Picture of the wind tunnel.

Nose cone mounted in the wind tunnel.



The big fan in the wind tunnel.

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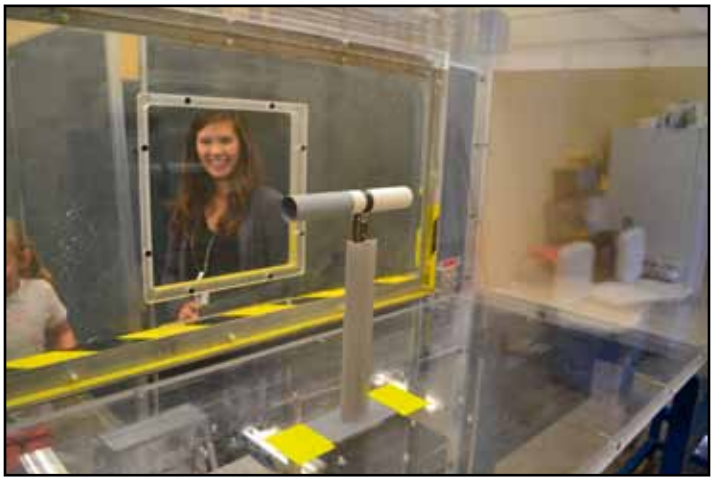
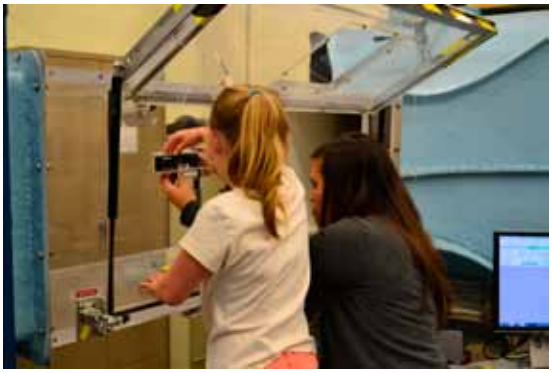
Drag of Nose Cones

Picture of the front of the wind tunnel where the air is sucked in.



The Cupped Cylinder inside the wind tunnel.

Left: This is me writing down data.



Levelling the nose cone.

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Drag of Nose Cones

Mr. Christopher Seaver is the Deputy Director for Laboratory Operations in the Department of Aeronautics at the United States Air Force Academy, and gave us permission to use the low speed wind tunnel for my project and my sister's project.

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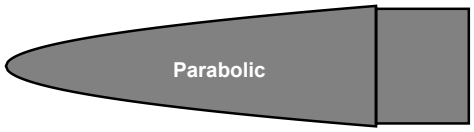
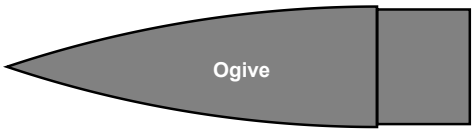
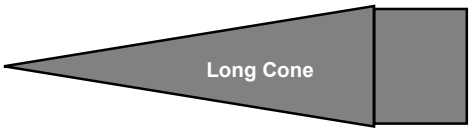
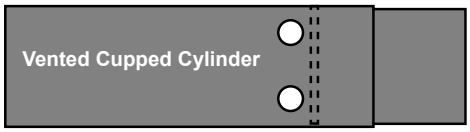
Drag of Nose Cones

Nose Shape	Wind Speed	Temp	Drag Force
	39.28 mph	72.0° F	4.477 g
	39.28 mph	72.0° F	4.942 g
	39.27 mph	72.0° F	4.149 g
	39.27 mph	72.0° F	4.791 g
	39.26 mph	72.5° F	4.561 g
	39.25 mph	72.0° F	5.248 g
	39.24 mph	72.0° F	8.659 g
	39.26 mph	72.0° F	10.459 g
	39.19 mph	72.5° F	10.399 g

The Data Collected:

The chart on the left shows the drag force for each nose cone we tested. This was the order they were tested in the wind tunnel.

The graph on the next page shows a relative comparison of all the nose cones. They are in order of lowest drag to highest drag.

The Conclusions Drawn

The conclusion drawn, if you want your rocket to go high you should use the best nose cone. You should use the Long Elliptical shape, because it has the lowest drag. Don't use the high drag shapes like the Cupped Cylinders.

Putting holes in the Cupped Cylinders does not make a big difference at all because the drag does not go down.

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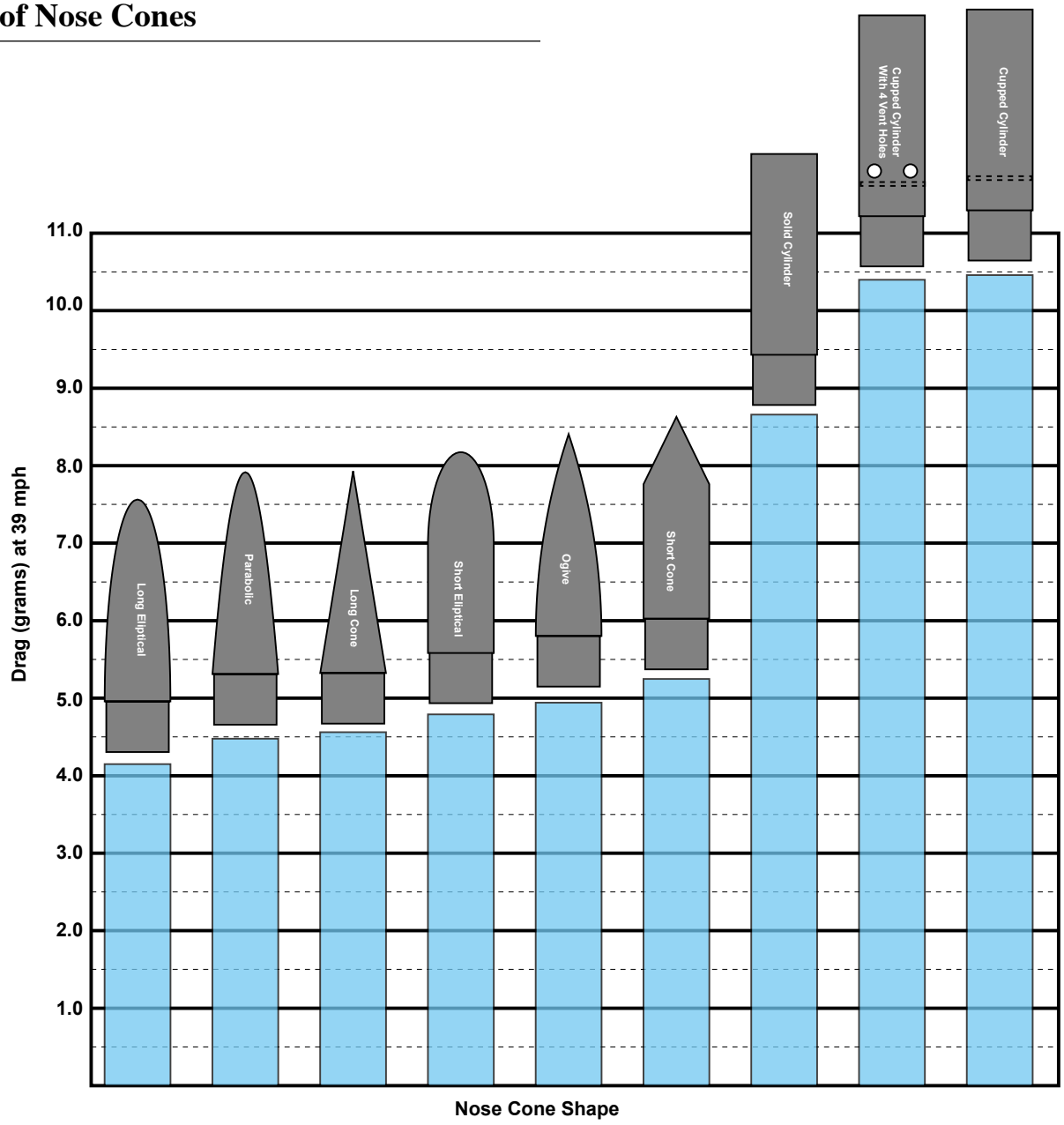
Drag of Nose Cones



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