What nose cone type has the best aerodynamic performance?

Background research

- IRJET

. Thin nose cones create less drag
. Less drag equals better aerodynamic performance
. More drag equals worse aerodynamic performance
. Wave drag occurs when air can't move out of the way of the tip of the nose

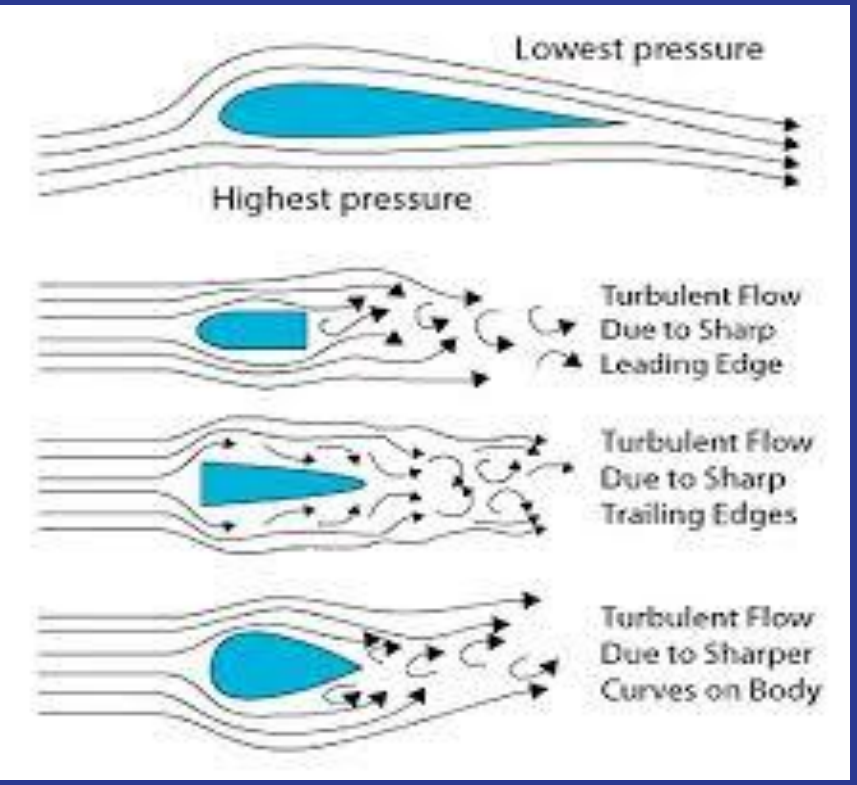
- Science learning hub

. High speed also causes drag
. Wings, cockpits, etc also cause drag
. The center of mass must be in the center of the aircraft to maintain stable flight

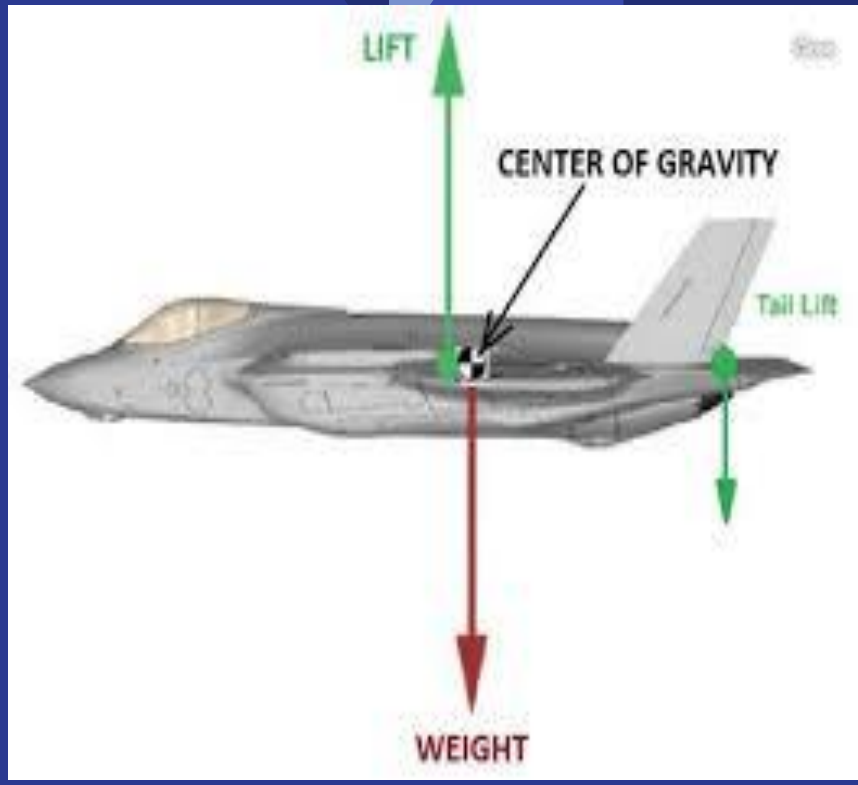
- Florida International University

.The first part of the of the wind tunnel is the fan itself, it blows air into the air tunnel
. The second part of the wind tunnel is the air straightener this "device" converts random air currents into smooth air
. The third part of the wind tunnel is the air compressor, this part compresses the air to make it more concentrated
. The fourth part of of the wind tunnel is the body that houses all of the parts and is used to actually test the cones in
. The fifth part of the wind tunnel is the air release. It's job is to release the air produced by the fan

Descriptive pictures

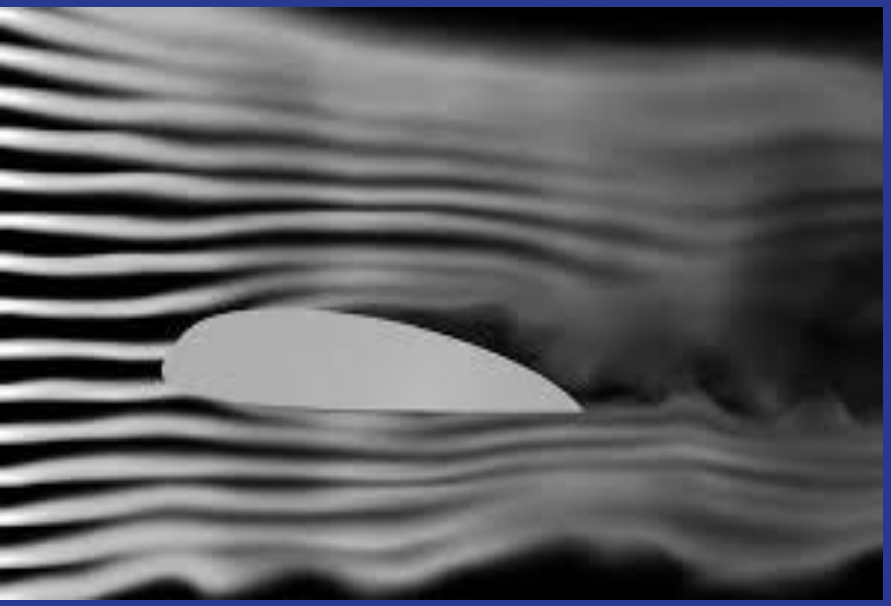


This image shows some shapes don't deflect air currents as well as others.

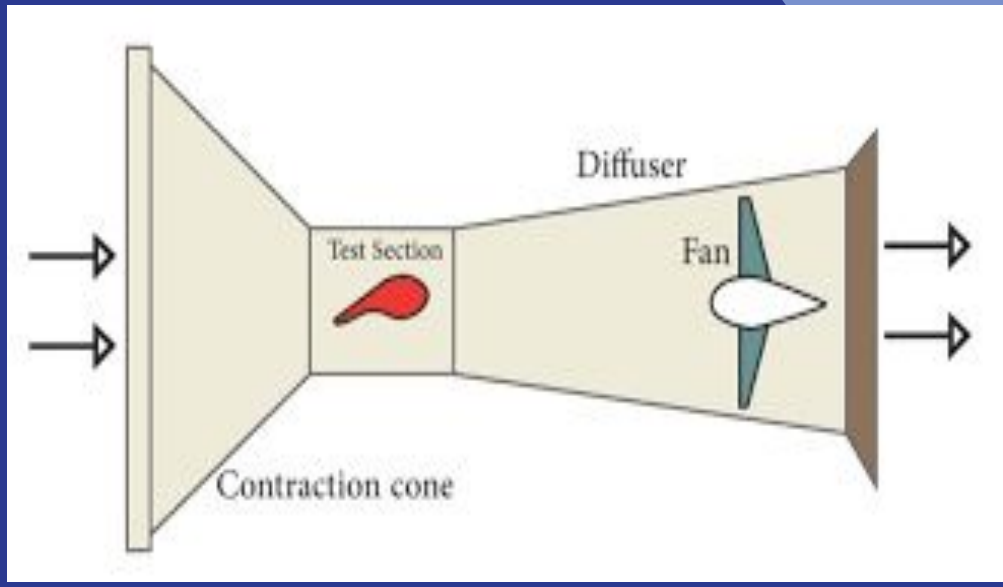


This image shows the center of gravity on a plane.

Descriptive images



Airflow around a standard airfoil.



Wind tunnel diagram.

Science question

Which nose cone shape will have the best aerodynamic performance?

Hypothesis

If different nose cones are tested in a wind tunnel, the sharpest nose cone will perform better than the other types of cones. Sharper nose cones are better at deflecting air currents.

Materials

- Trash can foldable box. Specifically in a square shape. NOT A CYLINDER!
- Box fan
- Fog machine
- Fog machine fluid
- Egg cartons (five) [air straightener]
- 3d printer and filament
- Computer
- Fishing line thread (5-10 inches)
- Scissors
- Razorblade
- 2 Glass panels
- Tape (one roll)

Procedures

Construct a wind tunnel

Construct a Wind Tunnel

1. Purchase a “trash can foldable box” from your local hardware store and follow directions to fold it into a square shape. Opposite from the open side cut the cardboard covering it so the front and ends of the box are open, measure a panel of glass and cut a hole that is two inches smaller than the glass panel itself , tape the glass to to the outside of the box.
2. Install the box fan into the back opening in the tube where the bottom would be if it were standing up.The fan should be blowing into the trash can..
3. To make the air straighteners, get an egg carton and cut out the bottom of the carton where it holds the eggs. From there you should have a egg carton with many holes in perfect rows and columns. Tape that to the front of the fan and it should face inside of the trash can
4. On the opposite side where it is open, if there are any flaps, cut them off completely so the opening is a perfect square.
5. With the fog machine, put it right behind the fan, preferably at the same level as the middle of the fan. The wind tunnel is now complete.

Procedures

Making the cones/setting up the fog machine

1. Go online to a 3d printing website and find a file that includes the following nose cones; conic, spherically blunted, and parametric elliptical.
2. Download the file and print it out. After a couple hours the print will be finished and you can remove it from the bed of the 3d printer.
3. If needed, grab a scraper and scrape away any uneven surfaces on the nose cones. Once done the nose cones will be finished and ready to test.
4. To set up the fog machine follow the brand instructions included in the package.

Testing procedures

1. Tie two fishing lines to a nose cone and tape it to the top of the cardboard. The wind tunnel should be laying sideways and the cone should be between the two viewing panels (one finishing line on the front and one on the back of the nose)

2. To start the test turn on the fog machine for around 15 seconds and then turn it off. Then turn on the box fan for around 10 seconds then turn it off. Video record the process to gather data to review later.

	Test 1	Test 2	Test 3
elliptical	Deflection not very good,movement,air came back around	Deflection still not good, movement,air still came back around	Deflection not good, movement, air came back around (overall: not good)
conic	Good deflection,high movement disrupted air	Good deflection still, high movement, disrupted air still present	Deflection still good, movement high, disrupted air currents (overall: good)
Spherically Blunted	Very good deflection, little to no movement	Still very good deflection, a little movement/ disrupted air	Very good deflection of air, little movement/ disrupted air (overall: very good)

Abstract

Our hypothesis was that the conic nose cone would be the best at deflecting air currents and reducing drag. The result, however, turned out to be the spherically blunted nose cone as the best performing subject. To create the wind tunnel, you must first get a cardboard trash can (foldable box), cut out needed portions of the trash can, install glass viewing panels, and seal the back with the fan and the air straightener. Make sure to place the fog machine behind the box fan at the same level. For testing procedures, turn on the fog machine, for a short period of time, turn it off, and then turn on the fan for a shorter period of time and look at the results. We were very shocked when we tested the elliptical nose cone and saw the amount of disrupted currents. We discovered that the sharper nose cones such as conic and other like it don't perform as well as the smoother nose cones.

Abstract

During testing, the tape holding the nose cones up kept peeling off the roof of the wind tunnel making the nose cones dip in certain directions, sometimes ruining our experiment mid-test. In trial one, which was the elliptical nose cone, we found out that it caused a lot of backflow and disrupted air. During trial two, which was spherically blunted, we found almost no backflow and almost no disrupted air currents. During trial three which was the conic nose cone, had lots of disrupted currents paired with a medium backflow of air. The information we gathered from this experiment is useful in real life for the reason that it streamlines the process of deciding which nose cone is best applied to a certain aircraft. If we were to do this project again we would have used stronger tape to better hold up the nose cones, we could also use a more conventional air straightener design for clearer results.

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