Think Like A Rocket Scientist!
Rocket Project - Student Instructions

If you are participating in the rocket project, then you probably want your rocket to fly as straight and as high as possible. You might think that building a paper or card stock model rocket is a simple task, but quite to the contrary, it is more difficult than building a much larger rocket. Careful attention to detail when building your rocket will make a big difference in its performance.

The compressed air launcher
Your rocket will be launched from one of the compressed air launchers built by volunteers at the Patriots Jet Team Foundation. The launcher will be pressurized to exactly 40 psi. You will be given a length of PVC pipe that is the same diameter as the pipe on the launcher to use as a guide when building your rocket body.

The rocket design
Here are a few hints about designing your rocket:

- The basic design has 3 parts: the body, the fins, and the nose cone. You may add, subtract, or modify any of the parts for your design.
- When taping the rocket body, place the tape on the long axis of the rocket. Don't wrap tape around the body and leave gaps for the air to escape.
- Fins assist in keeping a rocket on a straight path. However, you should be aware that fins are also a source of air drag that can slow your rocket's flight a bit. The trade-off is to use fins and accept the drag, or fly without fins and hope that the rocket doesn't wobble. Your choice. In any case, keep in mind that the larger the fins, the more drag they will produce.
- The nose cone can be your own design or the one on the template. Long, slender nose cones produce less drag than short, fat cones.

Hints about building your rocket
Once your design is complete and drawn onto the paper or card stock, carefully cut out the parts.

Build the rocket body first by wrapping the paper or card stock around the PVC pipe. The rocket body should fit snug around the pipe to "capture" all the power of the compressed air during launch. However, be careful not to make the fit so tight that it cannot be easily pulled off the pipe. Too tight and the rocket will stick on the launcher and reduce its altitude capability. In the worst case, it may not even get off the launcher! Too loose and the compressed air will leak out through the space between the launcher pipe and the rocket body.

If you have designed your rocket to have fins, be sure to space them evenly around the rocket body. For example, 4 fins would be spaced exactly 90 degrees apart, and 3 fins would be spaced 120 degrees apart. When attaching the fins to the rocket body, be very careful to use a minimum amount of tape. Use enough to ensure that the fins will stay on the body, but not so much that the air flow between the fins and the body is disturbed or blocked.

The nose cone will be the hardest part to build accurately. Do your best to keep the surface smooth and free of wrinkles. Also, take care to keep any tape from disturbing the smooth surface.

When fitting the nose cone to the rocket, make certain that it is exactly aligned with the longitudinal (long) axis of the rocket body. If the point of the nose cone is not aligned with the rocket body, your rocket will not ascend in a straight line. Also, take care when applying tape on this joint as any wrinkles or open edges will cause increased air drag on your rocket and reduce its performance.

What design feature of the rocket has the greatest effect on flight performance?
Air rockets fly though the air and therefore have to be designed to create as little air resistance as possible. Crooked fins or a blunt nose cone increases air drag (Friction) causing the rocket to slow quickly. The second most important design feature is weight. Weight is a more complicated factor than streamlining. Too much weight and the rocket will not fly very high. The same effect takes place if the rocket weighs too little.

What to consider While Building your Rocket:
Length of Nose Cone and Body Tube
Number and Shape of Fins
Pressure Cap or No Pressure Cap
Location of Pressure Cap
Location of Fins on Body Tube

Rocket Scientist Names:_____

_____

_____

_____

Draw A Picture Of Your Purposed Rocket In Detail

What is the name of your rocket?_____

Describe your mission objective:_____

_____

How will your rocket achieve its objective? _____

_____

BEFORE YOU BUILD YOUR ROCKET MAKE THESE DECISIONS:

Cone:

How long will it be in centimeters?

What special features (if any) will it have?

Body Tube:

How long will it be in centimeters?

What special features (if any) will it have?

Fins:

How many fins will it have?

How long will they be in centimeters?

What special features (if any) will it have?

Pressure Cap or No Pressure Cap?

Location of Pressure Cap?

How would you describe your taping?

Provide detailed list of materials and tools needed to build your rocket. (Include everything):

****Before Building your Rocket Add your designs to it.*****

Work together for success

Students will be divided into teams to design, build and launch their rockets. Teams will build their rockets with the materials provided: notebook paper, printer paper, or cardstock. These different materials are used in order for you to determine the best material and design for a rocket at the end of the project.

Do some research to learn about the basic principles of rockets and how they fly. There are many good sources of information on the internet.

Pool the information collected from every member of the team, then discuss your rocket design. Be sure that everyone on the team has a chance to provide suggestions before deciding on a design.

Look to your team members to find helpful skills. Some may be better at doing research. Others may have built models before and have good handcrafting skills. Combining the best skills of each team member will produce the best design and flight performance. This is the method used by NASA and aerospace companies to design and build orbital rockets.

Peer Evaluations:
Rockets stay at table student groups move to give suggestions based on rocket data.

Critique From Group 1:
Were the basic parts of the rocket met? If not what is missing?

What are strengths about their rocket?

What are weaknesses about their rocket?

Critique From Group 2:
Were the basic parts of the rocket met? If not what is missing?

What are strengths about their rocket?

What are weaknesses about their rocket?

Original Groups Critique after looking at other Rockets:
Were the basic parts of the rocket met? If not what is missing?

What are strengths about YOUR rocket?

What are the weaknesses about YOUR rocket?

What is the **ONE** thing that your group is going to modify in your 2nd Rocket?
This will be your Independent Variable.- With Teacher Approval you can now Build your 2nd Rocket