3, 2, 1 Blast Off! Bottle Rocket

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“Rocket science is tough, and rockets have a way of failing”

-Sally Ride

Event Description

Construct and launch one or two rockets designed to stay aloft the greatest amount of time.

- Failure to follow all construction rules will result in rockets not being allowed to launch due to safety issues or rockets being launched but placed in a lower tier
- Ranking within each tier is based on the greatest time aloft for one rocket flight
- Ties are broken based on the time aloft for the second rocket

Note: Free-Fall recovery systems (e.g., Parachutes) are allowed this year, but not required

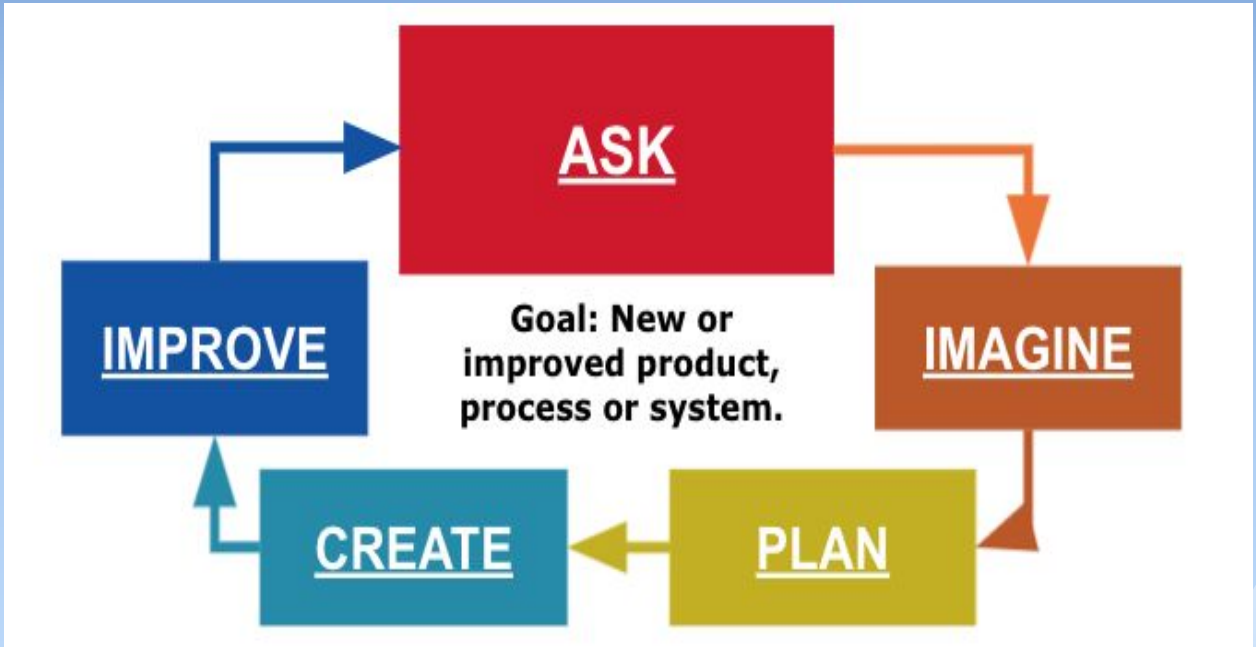
How NOT to do well in the Bottle Rocket Event

1. Don’t read the rules.
2. Build the rocket the night before.
3. Launch the rockets for < 100th time at the tournament.
4. Add unnecessary accoutrements to the rocket.
5. Put too much water in the pressure vessel.
6. Attach fins sloppily, flimsily, and anywheresily.
7. Use an unreliable rocket / parachute.

Common Mistakes

1. Using the wrong size bottle for the pressure chamber. Must be a 1 liter bottle.
2. Not using a carbonated soda bottle
3. Forgetting the bottle labels
4. Using a pointy nose cone
5. Using glue on the pressure chamber
6. Using a bottle that does not fit the launcher.
7. Not making sure rocket will stay in one piece throughout the launch. Timing ends when the first piece hits the ground.

Use the Engineering Design Cycle



ASK:
What problem do you want to solve?
How do you know it is doing what you want?

IMAGINE:
Do research!
Apply knowledge and creativity to brainstorm ideas. Select one to try!

PLAN:
Gather materials
Sketch plan/details
Pitch your idea

CREATE:
Follow the plan
Build a prototype/model and test it
Is it what you expected?

IMPROVE:
Analyze your test results.
What change would make it better?

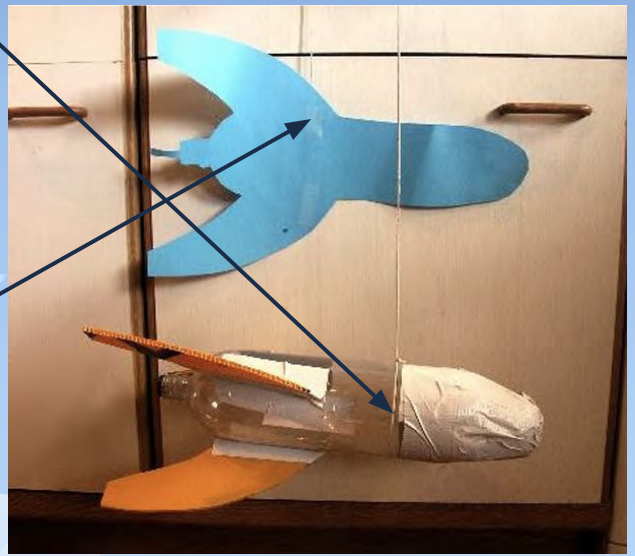
What forces does a rocket encounter during flight

Center of Gravity

- The point at which the rocket balances and should be more towards the rocket's nose.

Center of Pressure

- The point where half of the surface area of a rocket is on one side and half is on the other and should be more towards the rocket's tail.



Swing Test

Get a piece of string that is 3 or 4 feet long. Tie it around your bottle at the Center of Gravity mark. Use some tape to ensure the string does not move. Start spinning around slowly and gradually speed up so the rocket ”flies” around you on the string.

If you swing your rocket and the nose points in the direction of the swing, your rocket will likely fly stable. If you swing your rocket and it starts cartwheeling, this is likely evidence that the CG and CP are too close together. Adding some weight to the nose will likely help straighten out its flight. If you swing your rocket and it flies backwards, this means the Center of Pressure (CP) is in front of the Center of Gravity (CG). Try adding some weight to the nose and test again. If that does not help, the fins may be too small.

Design Decisions

- Type of bottle? Shape of bottle?
- Parachute or Backslider? Glider?
- 3 fins or 4 fins? Fin shape? Fin materials
- How much water? What's optimal?
- Nosecone? Length? Type? Material?
- Placement of CG and CP?
- Total mass of rocket?
- Windy day? Rainy day?

How to Build a Water Rocket

My friends Jake and Hannah Winemiller from Nerds, Inc created an awesome presentation on building water rockets. You can find it here. Pay careful attention to how they build and attach the fins.

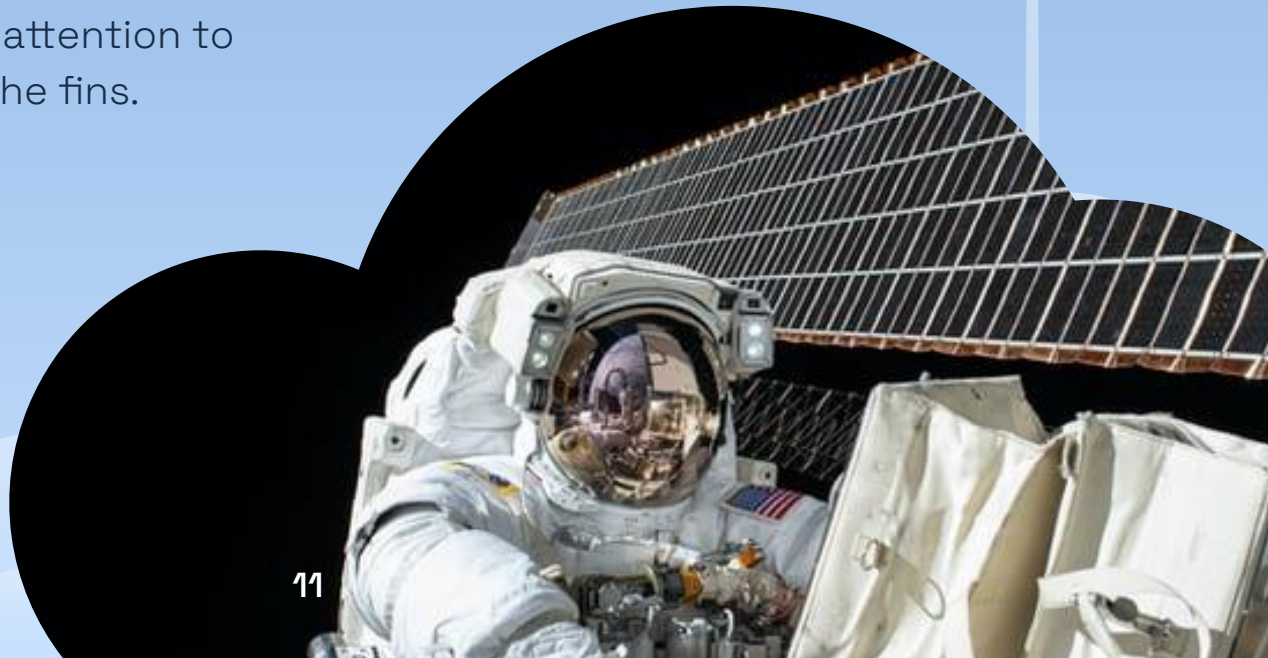
How to Make a Parachute

Video

Jake also made this about parachutes.

How to Balance and Test a Backslider Rocket

Video



Extra Resources

- www.water-rockets.com
- aircommandrockets.com
- NASA Rocket Index
- Nerds Inc
- Water Bottle Rockets (TeachEngineering)
- USWaterRockets.com
- Water Rocket Pages from U. Hornstein

Final Thoughts

Bottle Rockets is the best event in Science Olympiad. It can be a lot of fun and the kids will learn a lot, but only if they do the required researching, designing, building, and testing. Coaches should coach and make sure things are done safely, but it is important to let the kids do the work so they will learn.

Questions?

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