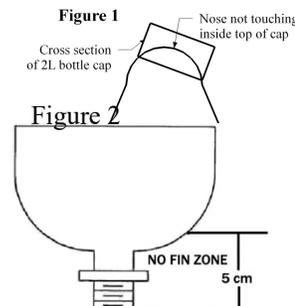


Bottle Rocket *Trial Event - NC Only B/C 2021

Will only be run in Satellite SO tournaments

1. **DESCRIPTION:** Prior to the tournament, teams will construct up to two rockets designed to keep a standard ping pong ball aloft for the greatest amount of time. **In 2021, the pressure vessel must be a 2-liter bottle.**
2. **ESSENTIAL STANDARDS ALIGNMENT:** 3.P.1, 5.P.1, Science as Inquiry
3. **TEAM OF UP TO:** 2
4. **MAXIMUM TIME:** 10 min.
5. **TEAMS:** Must bring up to 2 rockets, 2 ping pong balls, 2 recovery systems, carbonated beverage bottle labels (if removed), and safety glasses. Teams may also bring funnels, measuring cups, and/or other tools to help prepare their rockets.
6. **EVENT LEADERS:** Will review videos and calculate official times.
7. **SAFETY REQUIREMENTS:** Teams must wear safety glasses rated Z87+ during the loading, launching, and retrieving of their rockets. This must be completed under adult supervision.
8. **IMPOUND:** No
9. **CONSTRUCTION PARAMETERS:**
 - a. **PRESSURE VESSEL:** The rocket pressure vessel is the part of the rocket that attaches to the launcher and is filled with water and air. The pressure vessel must be made out of a single 2-liter plastic carbonated beverage bottle.
 - i. **LABELS** may be removed from the bottle, but labels must be presented at the safety inspection to prove that the bottle is carbonated. *Rockets without labels must not be launched, as this is a safety issue.*
 - ii. **BOTTLE OPENING:** Not all bottles are made the same, and there is no one specific brand that is guaranteed to work. Some bottles will not fit on the launcher. The easiest way to test this is by sliding a piece of 1/2 inch PVC into the bottle. If it fits loosely, the bottle will go on the launcher. If the PVC sticks and you have to apply any force to slide the PVC in, the bottle will not go on the launcher. See the event resource page for assistance.
 - iii. **STRUCTURAL INTEGRITY:** The structural integrity of the pressure vessel must not be altered. This includes, but is not limited to: physical, thermal, or chemical damage (e.g., cutting, sanding, using any glues). Event supervisors must assess the structural integrity by looking through the nozzle and sides of the bottle for discoloration, bubbles, thinning or cuts in the walls or glue of any kind. *Rockets violating this rule must not be launched, as this is a safety issue.*
 - b. **MATERIALS:**
 - i. Metal of any type (including tape with metal fibers) is prohibited everywhere on the rocket. *Rockets violating this rule must not be launched; this is a safety issue.*
 - ii. Toy or professional rockets or parts of rockets are not allowed.
 - c. **NOSE CONE:** Rockets must use a blunt or round nose. The nose must be designed such that when a standard bottle cap is placed on top of the nose, no portion of the nose touches the inside top of the bottle cap (see Figure 1). Teams must not use a nose that is sharp, pointed, or consisting of a rigid spike regardless of the material used. *Rockets violating this rule must not be launched; this is a safety issue.*
 - d. **FINS and OTHER PARTS:** Fins and other parts added to the pressure vessel must be 5 cm or higher above the level of the bottle's opening to ensure the rocket fits on the launcher (see Figure 2). Allow teams to fix if wrong.



- e. **ENERGY SOURCE:** Explosives, gases other than air, chemical reactions, pyrotechnics, electric or electronic devices, elastic powered flight assists, throwing devices, remote controls and tethers are prohibited at any time. All energy imparted to the rocket at launch must originate from the water/air pressure combination. *Rockets violating this rule must not be launched, as this is a safety issue.*
- f. **RECOVERY SYSTEM:** Any free-fall recovery system is allowed, provided that it does not violate any other rule; however, the recovery system must be judged as safe.
- g. **PING PONG BALL:** A standard ping pong ball must be launched with the rocket. It must separate from the rocket after launch. It may be attached to a recovery system in any way that does not change the ball. Tape & tying strings work well, sanding, drilling holes or gluing are not allowed.

10. **THE COMPETITION:**

- a. Teams will record a continuous video of pressurizing the launcher through until the ping pong ball lands and submit both their recorded time and video through Google Forms. Teams must bring and wear safety glasses for loading, launching, and retrieving their rockets. Teams may not share rockets with other teams (i.e. a varsity team may not loan a rocket to a JV team from the same or different schools).
- b. All rockets will be launched at **60 psi**. Once the rocket is pressurized, no contestant may touch or approach the rocket. If the rocket will not launch, bleed the air from the lines to depressurize the launcher first.
- c. Time aloft is recorded in tenths of a second. Timing begins when the rocket separates from the launcher and stops when the **ping pong ball** touches the ground, goes out of sight, or comes to rest on a tree, building, or other obstruction.
- d. If the ping pong ball falls off during launch, a time of 1 sec will be recorded and the Rocket will remain in Tier 1.
- e. If the ping pong ball does not separate from the rocket, the time will be recorded until the rocket touches the ground, goes out of sight, or comes to rest on a tree, building, or other obstruction. The Rocket will be moved to Tier 2.
- f. If the Rocket does not have a ping pong ball, it can still be launched and time will be recorded until the rocket touches the ground, goes out of sight, or comes to rest on a tree, building, or other obstruction. The Rocket will be moved to Tier 2.
- g. Event leaders are strongly encouraged to use three independent timers on all launches. The middle value of the three timers should be the officially recorded time.

11. **SCORING:**

- a. Rockets that violate a safety-related rule under Construction Parameters cannot be launched and will receive participation points only.
- b. Ranking within each tier is determined by the greatest time aloft for **one rocket** flight.
 - i. Tier 1: Rockets launched without any violations
 - ii. Tier 2: Any launch with competition violations, or a non-safety construction violation.
- c. Ties in tiers 1 and 2 are broken by the better combined score of each tied team's rocket flights.

12. **EVENT RESOURCES:**

See the Event Resources tab on our website for instructions, videos and more.