

1. **DESCRIPTION:** Prior to the tournament, teams will design, build, and bring up to two bottle rockets to the tournament to launch a ping pong ball attached to a parachute to stay aloft for the greatest amount of time.

A TEAM OF UP TO: 2

APPROXIMATE TIME: 5 minutes

EYE PROTECTION: B

2. **EVENT PARAMETERS:**

- a. Teams must provide up to two rockets, two unaltered standard ping pong balls, and two parachutes.
- b. Parachutes must be attached to ping pong balls with tape only. The ping pong ball attached to the parachute assembly makes up the parachute payload system.
- c. All participants must properly wear eye protection at all times. Participants without proper eye protection must be immediately informed and given a chance to obtain eye protection if time allows. Participants without eye protection will not compete.
- d. Event Supervisors must provide a launcher (that uses a Schrader valve), an air pump, a pressure gauge, and timing devices. Teams may bring their own manual bicycle pump with a pressure gauge to use, but it must attach to the launcher provided by the Event Supervisor.
- e. This event should be held inside with a high ceiling (greater than 20 feet recommended). Tournament directors must provide the ceiling height (in feet) to teams at least 1 month in advance. Extreme care must be taken to protect the floor and ceiling of any inside facilities used for practice and competition.

3. **CONSTRUCTION PARAMETERS:**

- a. Rocket pressure vessels must be made from a single 1-liter or less plastic carbonated beverage bottle with a nozzle opening internal diameter of approximately 2.2 cm (a 1/2-inch Schedule 40 PVC pipe must fit tightly inside the nozzle opening) and a standard neck height from flange to bottle's opening of under 1.6 cm. The bottle label must be presented.

Figure 1

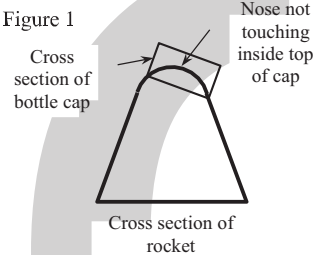


Figure 2

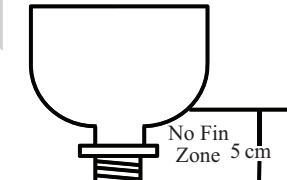
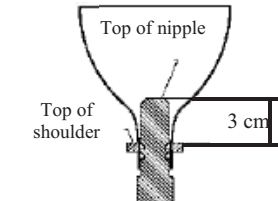
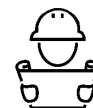


Figure 3.


- b. 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 hot or super glues, spray painting).
- c. The nose of the rocket must be rounded or blunt at the tip and designed such that when a standard bottle cap (~3.1 cm diameter x 1.25 cm tall) is placed on top of the nose, no portion of the nose touches the inside top of the bottle cap (see Figure 1).
- d. Only tape must be used to attach fins and other components to the pressure vessel. No glues of any type may be used on the pressure vessel. Metal of any type is prohibited anywhere on the rocket or parachute payload system.
- e. Fins and other parts added to the bottle must be 5 cm or higher above the level of the bottle's opening, to ensure rockets fit on the launcher (see Figure 2).
- f. All energy imparted to the rocket/parachute payload system must originate from air pressure provided by the Supervisor; no water. Gases other than air, explosives, liquids including water, chemical reactions, pyrotechnics, electrical devices, elastic powered flight assists, throwing devices, remote controls, and tethers are prohibited at any time.
- g. At the National Tournament the launcher nipple will extend into the rocket 1.173 in +/- 0.02 in (3 cm +/- 0.5 cm) above the top side of the shoulder of the bottle (see Figure 3).

4. **PRACTICE LOG:**

- a. During inspection, each team must present a flight log of recorded data for each rocket. Data must include 5 or more parameters (3 required and at least 2 additional) for 15 or more test flights prior to the competition for each rocket. The required parameters are: 1) pressure (psi), 2) estimated/recorded peak flight height (feet), 3) time aloft (seconds). The additional parameters are chosen by the team (examples include: # fins, parachute diameter, etc.)
- b. Teams must use their data to justify their pressure choice. Rockets without a flight log or an incomplete log will NOT be launched.



5. THE COMPETITION:

- a. Teams must arrive at the competition site ready to launch with proper eye protection to have their rocket(s) inspected for safety.
- b. Teams will have 5 minutes to make a total of two launches using the same rocket or two different rockets.
- c. When called to launch, teams will load their rocket onto the launcher. Once the rocket is loaded, but NOT pressurized, teams will place the parachute payload system on or in the rocket. After the payload parachute system is loaded it cannot be manipulated. Teams will then pressurize the rocket to the pressure (psi) of choice based on their practice log data. The Event Supervisor will check the gauge on the pump to ensure the rocket is pressurized to the psi chosen and justified by the team's data.
- d. The Event Supervisor will make sure 3 timers are ready and then signal a team member to make a loud announcement of, "3, 2, 1, LAUNCH!" Then a team member will proceed to launch the rocket. After launching, the team will prepare for the next launch.
- e. Timing begins when the rocket separates from the launcher and stops when the parachute payload system lands. The parachute payload system must separate from the rocket.
- f. If the parachute payload system does not separate from a rocket, timing is from when the rocket separates from the launcher to when any part of the rocket touches the ground. This launch is placed in Tier 2.
- g. If any part of a rocket or parachute payload system hits the ceiling or any part connected to the ceiling (e.g., a rafter, light, basketball hoop), then timing is stopped at the instant of contact. That launch is placed in Tier 3.
- h. If a rocket fails to separate from the launcher because of a problem with the supplied launcher then the launch never occurs and the launch can be restarted.
- i. All times for each launch MUST be recorded for breaking ties. Time aloft is recorded in hundredths of a second. The middle value is the officially recorded time.
- j. Teams filing an appeal must leave their rocket(s), parachute payload system(s), and Practice Log(s) in the event area.

6. SCORING:

- a. Ranking is determined by the greatest time aloft of a parachute payload system from a single launch within a tier.
- b. Rockets and/or parachute payload systems violating 2.c., 3.a.-f. and/or 4.a.-b. will NOT be launched. Teams unable to make any launches will receive participation points only.
- c. Ties will be broken by the best tier and/or greatest time aloft of the parachute payload system from each tied team's other launch.
- d. Tiers: The highest number tier will be applied when more than one is applicable:
 - i. Tier 1: A launch with no violations or problems
 - ii. Tier 2: A launch where the parachute payload system did not separate from the rocket
 - iii. Tier 3: A launch where the rocket or any part of the parachute payload system contacted the ceiling

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries a variety of resources to purchase; other resources are available on the Event Pages at soinc.org.