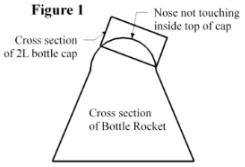
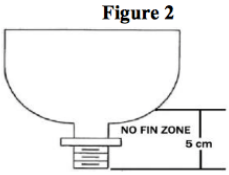
Ping Pong Parachute (revision 2/8/2019)

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 **IMPOUND:** No **EYE PROTECTION:** B **APPROX. TIME:** 10 min.
2. **EVENT PARAMETERS:**
   a. Teams must provide up to two rockets, unaltered ping pong balls, and parachutes. Parachutes may be attached to ping pong balls with tape only.
   b. Event supervisors must provide the launcher, air pump, pressure gauge, and timing devices. All rockets must be launched using the launcher provided by the supervisor. Teams may bring their own manual bicycle pump to use.
   c. This event should be held inside with a high ceiling (greater than 20 feet recommended). Tournament directors must provide the ceiling height and maximum psi to teams at least 1 month in advance. Launch pressure range is from 20 psi to 60 psi. Extreme care must be taken to protect the floor and ceiling of any inside facility used for practice and competition and rockets must be designed to not hit the ceiling.



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.
   b. 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 are prohibited anywhere on the rocket.
   c. 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).
   d. 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).
   e. All energy imparted to the rocket must originate from air pressure (no water!) provided by the supervisor. Explosives, gases other than air, water, chemical reactions, pyrotechnics, electrical devices, elastic powered flight assists, throwing devices, remote controls, and tethers are prohibited at any time.
   f. 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). Allow teams to fix.



4. **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. Allow teams to get eye protection if at all possible.
   b. 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 20 or more test flights prior to the competition for each rocket. The required parameters are: 1) pressure (psi), 2) estimated/recorded peak flight height (meters), 3) time aloft (seconds). The additional parameters are chosen by the team (examples include: # fins, parachute diameter, etc.). Teams must use their flight data log to justify their pressure choice. Rockets without a flight data log or an incomplete flight data log will NOT be launched.
   ~~c. Teams must present a flight data log for each rocket that includes at least 20 test launches and the following required variables: Pressure (psi), Altitude (feet), and time aloft (seconds).~~
   ~~d. No part of the rocket may hit the ceiling.~~
   e. Teams will have a total of two launches using the same rocket or two different rockets. Teams have a maximum of 8 minutes for both launches.
   f. When called to launch, teams will load their rocket onto the launcher. Once the rocket is loaded, but NOT pressurized, teams will place the ping pong ball and its parachute on or in the rocket, after which it cannot be manipulated. Teams will then pressurize the rocket to their exact pressure choice. The pressure will be checked by the event supervisor with a pressure gauge to determine the rocket is pressurized correctly.
   g. The event supervisor will make sure 3 timers are ready and then signal a team member to make a loud launch announcement of, "3, 2, 1, LAUNCH!" The team member will proceed to launch and after launching, the team will prepare for their next launch.
   h. Time aloft is recorded in hundredths of a second. Timing begins when the rocket separates from the launcher and stops when the ping-pong ball touches the ground. Ping pong ball must separate from the rocket.
   i. All times for each launch MUST be recorded for breaking ties. The middle value is the officially recorded time.
5. **SCORING**:
   a. Teams with violations of rules 2a, 3a-e and/or 4a-b will NOT be launched and receive participation points.
   ~~b. If part of the rocket hits the ceiling or if the ping pong ball doesn't separate from the rocket then the team receives a flight time of zero seconds for that launch.~~
   b. If the ping pong ball does not separate from a rocket, then timing is from when the rocket separates from the launcher to when any part of rocket touches the ground. This rocket is placed in Tier 2.

c. If any part of a rocket (including ping pong ball and parachute) hits the ceiling or any part connected to the ceiling, then that rocket is placed in Tier 3 and timing is stopped at the instant any part hits the ceiling.
d. Ranking is determined by the greatest time aloft of a ping pong ball from a single launch within a tier. Ties will be broken by the best tier and/or greatest time aloft of the ping pong ball from each tied team's other launch.