Version 4

2017 Happy Valley Build & Test Fest
Competition Information and Rules

DROP IT: Egg Drop	Pages 2 - 3
LAUNCH IT: Water Rocket	Pages 3 - 6
SPAN IT: Cardboard Bridge	Pages 6 - 8

General Competition Information

Happy Valley Build and Test Fest is an engineering design competition jointly presented to citizens of central Pennsylvania by the ***Discovery Space, KidTech, New Leaf Initiative*** and ***Centre Region Parks and Recreation (CRPR)***. The competition details:

Date: Saturday, April 29, 2017

Time:

9 - 10 a.m.	On-site Registration
10 a.m. – 3 p.m.	Competition and Award Ceremonies

Location: Spring Creek Park, Houserville, PA [Park #18 on the CRPR map: http://www.crpr.org/Parks/bike-hike/1117%20CRPR%20Parks%20Map%202.jpg]

Website:

For questions regarding the event details, contact Co-Director Michele Crowl (Discovery Space) michele@discoveryspace.org or Co-Director Liz Kisenwether (KidTech) liz.kisenwether@gmail.com.

For questions regarding on-line registration, contact Jeff Hall (CRPR) jhall@crcog.net

DROP IT: Egg Drop

ENGINEERING DESIGN CHALLENGE

Design and build a shipping container that will prevent an uncooked egg from breaking when dropped from a height of 50 feet.

CONSTRUCTION SPECIFICATIONS

All egg crates must meet the following specifications:

1. MATERIALS

A. Parachutes, balloons, helium balloons, drones, and propellers of any type are **NOT** permitted.

B. Eggs will be supplied (Grade A Large chicken eggs).

2. CONSTRUCTION

A. For Youth: The maximum dimensions of the egg crate shall be 9" x 9" x 9".
For Adults: The maximum dimensions of the egg crate shall be 8” x 8” x 8”.

B. For Youth: The entire egg crate must be able to pass through a square aperture of 9 inches by 9 inches (9" x 9") in all three axes (9" cubed dimension) to be eligible for competition.

For Adults: The entire egg crate must be able to pass through a square aperture of 8 inches by 8 inches (8" x 8") in all three axes (8" cubed dimension) to be eligible for competition.

TESTING AND JUDGING

A. Only one (1) entry (egg crate) per person will be accepted.

B. Each egg crate will be visually inspected and measured for compliance with all of the rules. Once the crate is checked in, no further adjustments will be permitted. An egg will be provided to each contestant.

C. Only one (1) crate may be used. Only one (1) attempt will be allowed for each entry.

D. The egg crate will be drop tested from a height of 50 feet onto a solid surface. After the drop, the contestant will remove the egg from the crate for inspection by the judge. Only the judge determines whether the egg survived the drop test, with no shell break, leak or crack.

E. Each egg crate that passes the drop test will be weighed, without the egg.

F. The winning entry in the Youth and Adult divisions will be determined by the egg crate that weighs the least and successfully completes the drop, without the egg breaking, leaking or cracking.

LAUNCH IT: Water Bottle Rocket

ENGINEERING DESIGN CHALLENGE

Construct a rocket propelled by "fuel" (12 ounces of water) and air compressed to 60 psi (pounds per square inch) that will be launched at a predetermined angle to reach maximum flight time possible.

CONSTRUCTION SPECIFICATIONS

1. MATERIALS

A. The pressure vessel MUST be one (1) clear 2-liter bottle; see Diagram 1.

B. Do not use metal, glass or spikes to construct the rocket. Use of these materials will result in automatic disqualification of your rocket.

C. The use of a parachute is not allowed.

2. CONSTRUCTION

A. On the bottom of the rocket, leave 7.5 cm from the throat of the exit plane clear of any covering (fins, markings, drawings, etc.) See Diagram 1.

B. Maximum total height of the rocket is 76.0 cm. See Diagram 1.

C. Nose-cone tip must have a maximum radius of 1.5 cm. See Diagram 2.

D. Fins must end 7.5 cm from the throat of the exit plane. See Diagram 1. No forward swept type of fins are allowed to be used on the rocket. The number of fins is up to the designer.

E. The maximum fin width from the bottle is 10.0 cm (or 16.5 cm from the center axis). See Diagram 3. The minimum fin width is up to the designer.

[Credit for Diagrams 1, 2 and 3: South Florida Science Center and Aquarium, 2016 Competition Information and Rules for the 30th Annual Engineering Competition]

TESTING AND JUDGING

A. Only one (1) rocket per person will be accepted.

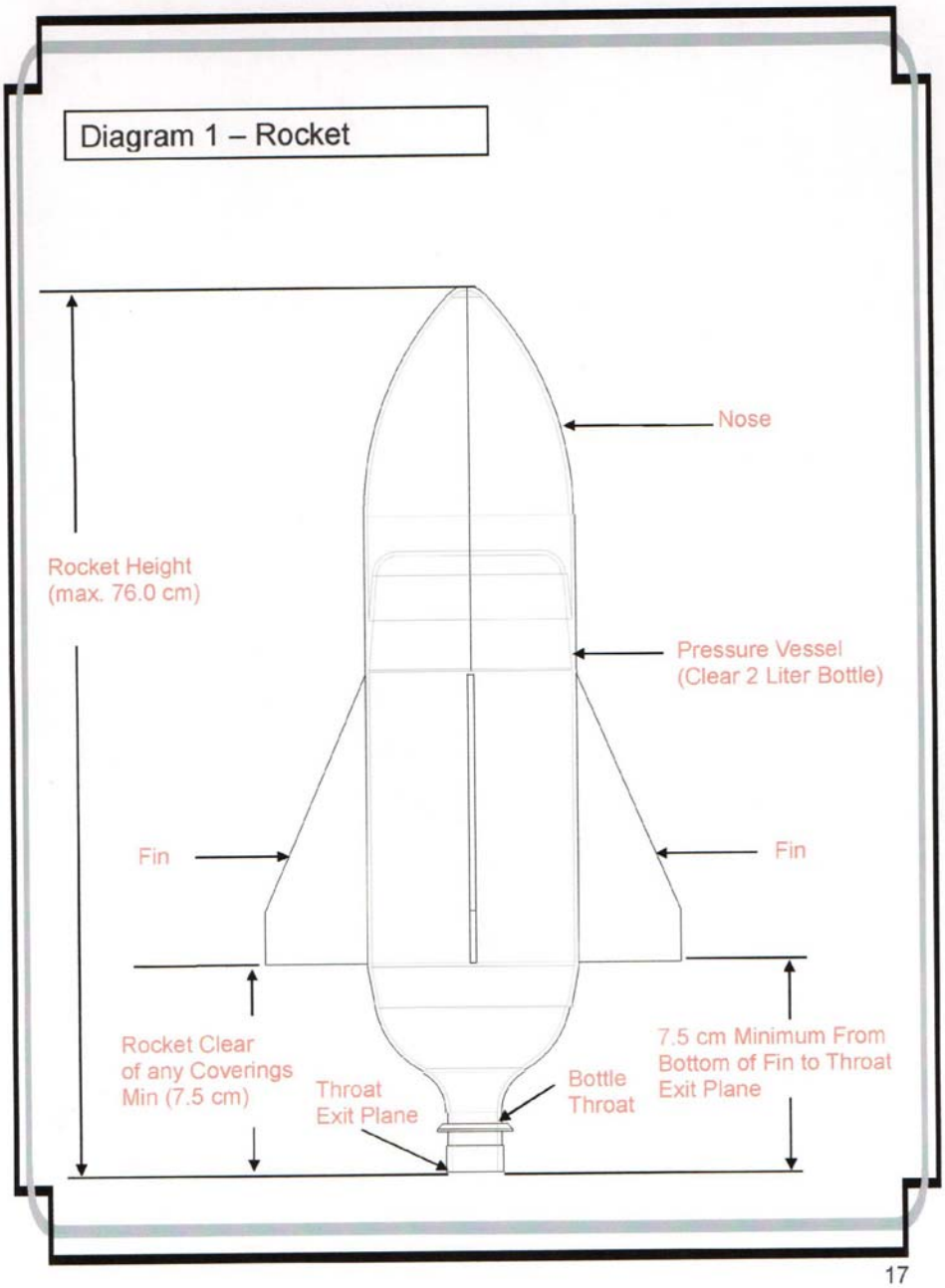


Diagram 1 – Rocket
Nose
Rocket Height
(max. 76.0 cm)
Pressure Vessel
(Clear 2 Liter Bottle)
Fin
Fin
Rocket Clear
of any Coverings
Min (7.5 cm)
Throat
Exit Plane
Bottle
Throat
7.5 cm Minimum From
Bottom of Fin to Throat
Exit Plane
17

Diagram 2 – Nose Cone Diagram

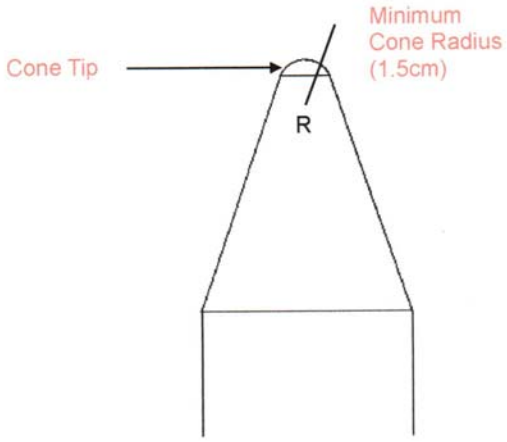
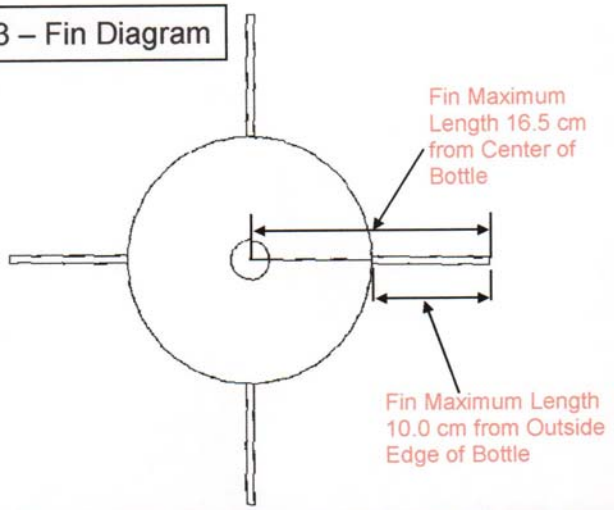


Diagram 3 – Fin Diagram



18

B. Each entry will be visually inspected and measured for compliance with all of the rules to be eligible to compete. Once the rocket is checked in, no further adjustments will be permitted.

C. The judge(s) will record the flight time for each rocket, which will be used to calculate the final score. *Flight time* is defined as the time from moment the launch button is pushed until the instant the rocket lands on the ground or hits an object on the ground. The flight time must be taken by at least three qualified judges and the average flight time is the rocket flight time. The final score will be calculated as a percentage of the greatest flight time recorded during the competition, using the following formula:

Final Score = (Rocket Flight Time / Max. flight time) x 100%

SPAN IT: Cardboard Bridge

ENGINEERING DESIGN CHALLENGE

Design and construct the lightest bridge capable of supporting the greatest weight.

CONSTRUCTION AND SPECIFICATIONS

1. MATERIALS

A. Bridges must be constructed of corrugated cardboard members. Participants must supply their own cardboard. Any of the corrugated cardboard types shown below in Diagram 4 are permissible materials.

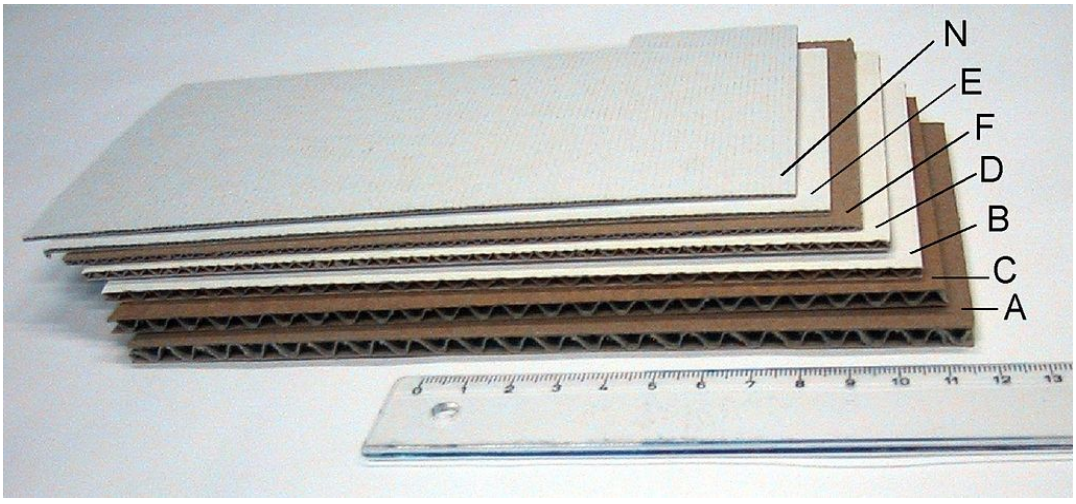


Diagram 4: Examples of corrugated cardboard.

Credit: Chris 73 / Wikimedia Commons, CC BY-SA 3.0,
https://commons.wikimedia.org/w/index.php?curid=2606709
Page URL: https://commons.wikimedia.org/wiki/File%3ACardboard_Main_Flutes_Labeled.jpg

B. Water-based glue, such as Elmer's Glue and Wood Glue can be used to join cardboard members. Any bridge submerged or coated in glue will be disqualified.

C. No other construction materials may be used.

2. CONSTRUCTION

A. Only one bridge entry per person.

B. The span, or length, of the bridge must be 18" with 1" bearing at each end. All bridges will be loaded with a clear span of 16". See Diagram 5.

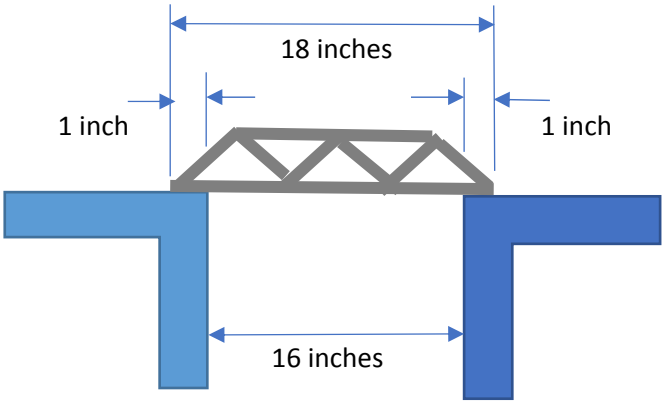


Diagram 5: Cardboard bridge length and orientation over the clear span

C. The height and width of the bridge must be a maximum of 8" H x 8" W. The entire bridge must be able to pass through a square aperture 8" wide and 8" tall to be eligible for competition.

D A bar will be placed across the mid-point on deck of the bridge to apply the test weight.

3. TESTING AND JUDGING

A. Each bridge will be visually inspected, measured, weighed and checked for compliance with all of the rules. Once the bridge is checked in, no further adjustments will be permitted.

B. Each bridge will be centered on supports spaced 16" apart.

C. The load will be applied using the loading bar which is attached to a bucket that is placed across the deck of the bridge at its mid-point. Loading will be applied until structural failure results. Failure is defined as the moment when the load bucket hits the ground. See Diagram 6.

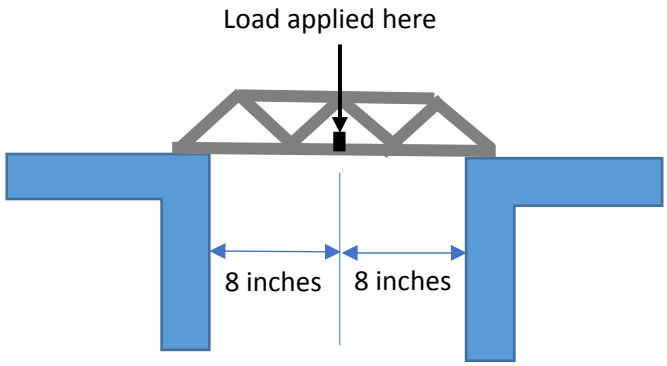


Diagram 6: Location of loading bar for testing

D. Bridge structure efficiency, **E**, will determine the winner.

$$\mathbf{E} = \frac{\text{Maximum weight (load) supported}}{\text{Weight of the bridge}}$$

The bridge with the highest value of **E** will be the winner.

HINTS:

- Do some research on bridge truss designs such as the Pratt Truss (https://www.garrettsbridges.com/design/pratt-truss/) and the Warren Truss (https://www.garrettsbridges.com/design/warren-truss/).

- Research library or web for additional truss types.

- To help maximize **E** (bridge structure efficiency), the weight of the bridge should be minimized. Think about bending, folding, creasing the cardboard to make strong members.