Mystery Design
Science Olympiad 2018, Indiana State Competition

Assigned Task
The competitors will design a zipline device (Figure 1) for a small stuffed semi-rigid bird (Figure 2). The zipline will need to be robust enough to be able to hang and slide 15 cm (~6 inches) from a rope while attached to a metal carabiner and also include a safety mechanism to hold the bird in place. This could be a restraint, foot strap or other securing mechanism to keep the bird in place.

Figure 1 - Examples of ziplines that are the basis for the Mystery Design event.

Build details
1. The same bird will be used for all tests
   a. Featherly Friends “Hazel” model
   b. Weight: 50 g
   c. Size: 4.5 cm x 4 in x 6.5 in
   d. The chair must only accommodate one bird
2. The bird must have a line of sight 360 degrees around its head.
   a. Must have at least 4 cm of clearance above and below the location of the eyes.
   b. Any obstruction to the bird’s sight must be no larger than 6cm width measured on the side facing where the bird is seated at the height of the eyes.
3. The bird must sit upright
   a. Unlike in Figure 1, the bird does not need to be “seated” in the device. Standing on a small platform or in a harness is considered appropriate.
   b. Points will be given based on the upright posture of the bird during the chairs operation and testing.
4. The bird must be secured to the platform
   a. In the event of a bumpy ride, the bird needs something 0.000 to hold it in place.
   b. DO NOT puncture or overly compress the bird
   c. Do not excessively wrap the bird in material.

Test details
The competition space will be fitted with a string/rope hanging horizontally between two points. The diameter of the rope will be no larger than 0.5”. After building the structure, competitors will test their chair with the bird on the apparatus.
5. The hanging rope…
   a. Will have a diameter no larger than 2 cm
   b. Will be hanging horizontal, except for minimal sag in the rope as it hangs between two points. Testing will start at the end of the rope.
   c. During testing, the carabiner will be horizontally pulled along the rope for 15 cm by a second rope that is attached to the top of the carabiner.
   d. The ends of the rope will not be accessible to competitors and will not be removed from the structure for any reason.

6. Competitors will have to place the bird into the apparatus before hanging it.
   a. The safety harnessing mechanism must not require any part of the apparatus to be taken apart/detached. This means all pieces used to build must remain in contact with each other in a single piece. Swinging/sliding/folding/etc are all suitable mechanisms that do not separate the pieces.

7. After the bird is in place, the apparatus will be attached to the carabiner by the competitors.
   a. Once in place, the competitors must not touch the suspended apparatus for 10 seconds. Any intervention will result in reduced points (see rubric below)

![Figure 2 - The bird that will be used at the competition](image)

Evaluation details
- After the official test of the device witnessed by the Event Supervisor or Event Volunteers, the competitors will need to write up their results
  - Max length: one 8.5” x 11” page, one side only
- Contents
  - How did the device perform in the test?
  - What was the result (Pass/Fail)
  - What are 2 areas where the design of the zipline could be improved?
    - Expand on why/how these changes will improve the robustness, aesthetics, or safety of the apparatus.

List of Provided Materials
The following list of materials will be provided on the day of the competition. Competitors are NOT ALLOWED to bring any additional materials unless specified below in the 'tools to bring' section. Items are being referred to by their commercial names where possible.

5 - 8”x11” 20# sheets of pink copy paper
5 - pipe cleaners
5 - regular craft sticks
1 - CD
5 - plastic bendy drinking straws
4 feet of masking tape (measured on site)
1 – 10x13 envelope

The following items will need to be supplied by each competing team. Bring these tools at the time of the competition. Tools are not required to be impounded with the drawing and design.

2 - Safety Glasses REQUIRED, one per team member
2 - Scissors (standard office style)
1 - Duct tape Approx. 2” width. Any color or pattern
2 - Ruler 12” length limit
5 - 3x5 index cards
Mystery Design Scoring Rubric

The following rubric outlines the points awarded for each aspect in this competition. The number in parenthesis indicates how many points each item is worth.

Part 1: Structure Design and Drawing

1. Drawing
   1.1. ____ Presence of Title (5)
   1.2. ____ Presence of Team Name (5)
   1.3. ____ Presence of Student(s) Name(s) (3)
   1.4. ____ Scale Accurately Defined and Consistently Applied (10)
   1.5. ____ Each Side View up to 4 sides (10)

2. Structure Design
   2.1. ____ Accurate and Complete Materials List (10)
   2.2. ____ Materials Use Rationale (20): includes material structural considerations such as tension, compression, moment of inertia, stiffness, elasticity, etc.
   2.3. ____ Accurate and Complete Cost of Materials list (6)
   2.4. ____ Aesthetics Consideration (6)

Part 2: On-site Structure Build, Test and Evaluation

1. ____ Ease of Use/Assembly- time to completion (10 for completing within 20 minutes)

2. Structure Testable
   2.1. ____ Bird can remain upright and secure without assistance (10)
   2.2. ____ Structure can be suspended on the rope without assistance (10)

3. Structure Passes Test
   3.1. ____ A safety mechanism can be applied to the bird (10)
   3.2. ____ The apparatus can be attached successfully to the carabiner unassisted (20)
   3.3. ____ No items (or the bird) fall during the 15 cm test (40)

4. ____ Quality of Performance Evaluation (25 total, 10 per improvement suggestion and 5 for writing ability): including rationale, clarity of thought regarding improvements, ability to share ideas in oral and written formats

Score Calculation

Part 1 Score: ____ Part 2 Score: ____ Total Team Score: _____ / 200