

Team Name: _____ Number: _____

Mystery Design

Science Olympiad 2017, Indiana State Competition

Assigned Task

The competitors will design a hanging chair (Figure 1a) for a stuffed Hoosier teddy bear (Figure 2). The chair will need to be robust enough to be able to hang from a rope independently and also include a safety mechanism to hold the bear in place. This could be a seatbelt, lap bar, restraint, or other securing mechanism to keep the bear in place.

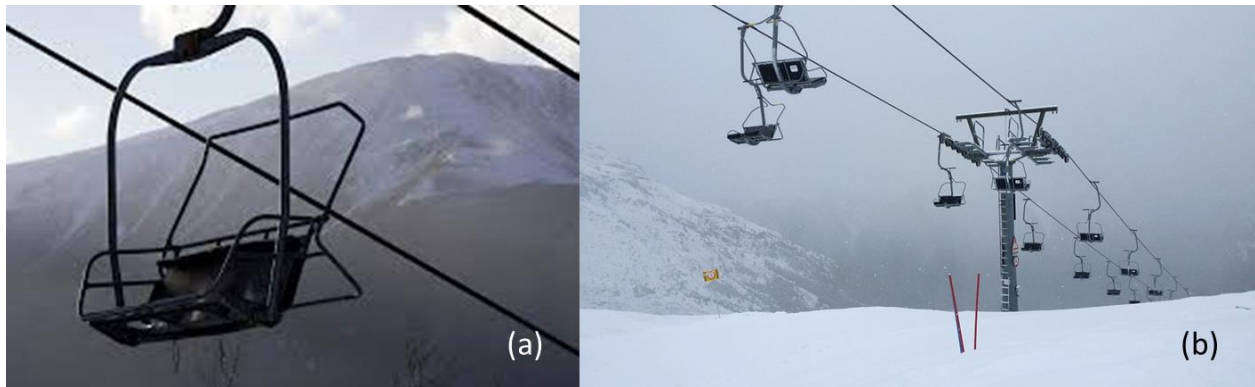


Figure 1 -An example of a Hanging Chair (a) and Chair Lift (b) that is the basis for the Mystery Design event.

Build details

1. The same bear will be used for all tests
 - a. Weight: 186.1 g
 - b. Size: 22 cm x 19 cm x 22 cm
 - c. The chair must only accommodate one bear
2. The bear 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 bear's sight must be no larger than 6cm width measured on the side facing where the bear is seated at the height of the eyes.
3. The bear must sit upright
 - a. Points will be given based on the upright posture of the bear during the chairs operation and testing.
 - b. The bear should sit facing either end point of the rope, so as to not be moving sideways if the chair was to move along the rope.
4. The bear must be secured to the chair
 - a. In the event of a bumpy ride, the bear would like something to hold it in place.
 - b. DO NOT puncture or overly compress the bear
5. The designed chair must be able to attach to a S-Hook for testing
 - a. The Hillman Group S-Hook, Lowes Item # 11787 Model # 320241
 - b. The hook will already be on the rope and provided by the competition

Team Name: _____ Number: _____

Test details

The competition space will be fitted with a string/rope hanging horizontally between two points. After building the structure, competitors will hang their chair with the bear in place.

6. 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 take place at the center of the hanging rope.
 - c. The ends of the rope will not be accessible to competitors and will not be removed from the structure for any reason.
 - d. Will have an S hook attached to the rope, and competitors will have to hang their design from the hook, NOT from the rope directly.
7. Competitors will have to place the bear into the chair before hanging it.
 - a. The safety harnessing mechanism must not require any part of the chair 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.
8. After the bear is in place, the chair will be attached to the rope hook by the competitors
 - a. Once in place, the competitors must not touch the suspended chair for 10 seconds. Any intervention will result in reduced points (see rubric below)

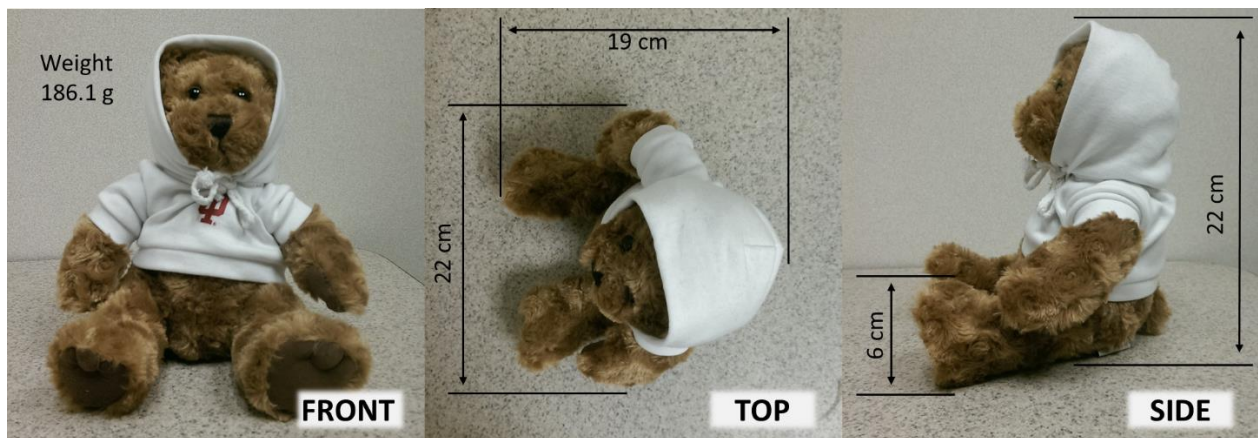


Figure 2 - The bear that will be used at the competition

Evaluation details

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

Team Name: _____ Number: _____

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.

Quantity	Item name	Description
1	Jumbo Fuzzy Stick	19"
1	Wooden paint stirring stick	53cm x 0.6 cm
4	Cylindrical pencil	unsharpened, 19 cm long x 0.7 cm diameter
2	Bottle cork	4.8 cm long x 2 cm diameter
4	Steel washer	0.2 cm thick x 1 cm inner diameter x 2.2 cm outer diameter
1	Thick paper sheet	7.1 cm x 25.1 cm
1	Postcard	14.6 cm x 10.1 cm
1	Poster paper sheet	28 cm x 43.2 cm
1	Standard 2-Pocket folder	30.5 cm x 22.8 cm
4	Metal paperclip	#2 size, .354" Width, 1.3" Length
1	Paper grocery bag	12" x 7" x 17", with handles (2)

List of Materials/Tools to Bring

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.

Quantity	Item name	Description
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

Team Name: _____ Number: _____

Team Name: _____ Number: _____

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 (4)
- 1.2. ____ Presence of Team Name (4)
- 1.3. ____ Presence of Student(s) Name(s) (2)
- 1.4. ____ Scale Accurately Defined and Consistently Applied (8)
- 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. ____ Bear can be seated upright in the chair and remain without assistance (10)
 - 2.2. ____ Chair structure can be suspended on the rope without assistance (10)
3. Structure Passes Test
 - 3.1. ____ A safety mechanism can be applied to the bear sitting upright in the chair (20)
 - 3.2. ____ The chair can be attached successfully to the rope unassisted for 10 seconds (20)
 - 3.3. ____ No items (or the bear) fall during the 10 second test(40)
4. ____ Quality of Performance Evaluation (20 total, 10 per improvement suggestion):
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