



Design/Build: Host Instructions

This information is not to be disseminated, shared, or given to any potential competitors, coaches, or students

Design and Build a Rescue Apparatus

The engineering brain is used to design a variety of devices. In this case, we will use the brain to design and build a device to rescue an animal from danger.

Material List for Teams

Teams are required to bring **two sets of the following materials*** to the competition. These materials must be packaged separately (as specified on the materials list posted in the coaches' information account).

- One meter of 3 ply jute twine
- Two quart-sized storage bags
- Fifty standard paperclips
- Twenty standard rubber bands
- Six binder clips (up to 1 1/4 ")
- One standard roll of clear adhesive tape
- One 12"x12" square of fabric or netting
- *One pair of scissors (*Note: Teams may use scissors to cut their material, but the scissors **may not** be used as part of the structure. One pair of scissors may be used in both the design and build phases.*)
- Six wooden clothespins
- Six 6" paper plates
- Twelve popsicle / craft sticks
- Six plastic spoons
- Six 1.5" metal washers

Material List for Hosts

Hosts are responsible for supplying the following materials, one per test station. (Note: Each test station should accommodate approximately 8-10 teams).

- **Table or stand** to ensure the rescue device is operated at a height of 28-30 inches
- **Wastebasket, basket, or cardboard box: depth 15 – 24", bottom 96-113 in²**
 - Rectangular 8"x12", square 10", or round with diameter of 11-12"
 - Each test station should have an identical wastebasket, basket, or box
- **Scale** to measure weight (grams), maximum of 1 kg. **One scale is recommended for every 15-20 teams (one per test station is not required)**. Examples:
 - <http://amazon.com/Digital-Kitchen-Altower-Multifunction-Cooking/dp/B07BVH4BRD>
 - <http://amazon.com/MIRA-Digital-Kitchen-Scale-Multi-Fuction/dp/B005QRWEBK>
- Marking tape (or masking tape)
- *Optional* **large container** for placing on scale to weigh devices



TSA will be supplying the following materials to hosts:

- **Small stuffed bear** (one per test station)
- **Bear target** (one per test station)
- **Test scorecards** (two per team)

Challenge

Teams are tasked to build and test a prototype of a device to rescue a bear cub that has fallen into a hole (or in our case, a trash can). In theory, the device will eventually be added to a rescue drone.

Teams may use only the materials on the TEAMS Design/Build Materials List. **Each team must have two sets of supplies bagged separately.** One set will be used during the last 10 minutes of the design phase to explore ideas and concepts. At the end of the design phase, **all materials from the first set must be put away and the second set of materials must be used for the final build.** In other words, using any material from the first set or not included on the material list will result in disqualification (exception: the same pair of scissors may be used).

Evaluation Criteria

The data collected that will be used to judge the rescue device includes the following:

Cost: Lower cost is better: 40% of your final score

The total cost of the design will be represented by the final weight. Each apparatus is to be weighed (in grams) and recorded on the scorecard. (If using a container to hold the apparatus, make sure that weight is not included on the scorecard).

Time of bear cub rescue: Less time is better: 50% of your final score

The time (in seconds) from 'go' to the release of the bear on the table top target. *Note that an unsuccessful rescue will receive a minimal number of points assigned.*

Bear cub accuracy: Higher accuracy is better: 10% of your final score

Accuracy as measured by placement of the bear on the target. Placing the bear face-down results in additional points. *Note that an unsuccessful rescue will receive a minimal number of points assigned*



Process

Each team will be allowed **15 minutes** for brainstorming, sketching and prototyping of design ideas. During the final 10 minutes of the design period, each team may open one set of materials and test potential design solutions. Designs/partial designs may not be tested at test stations in this phase. **The bears to be used in testing may NOT be used by the teams – they are to remain at the test station at all times.**

At 15 minutes, all materials (other than a pair of scissors) are to be discarded/set aside and a new set of materials open. (Using any materials from the initial set of materials will result in disqualification.) Teams then have **60 minutes** to build their final prototype. During this time, teams may test their design. Each team gets a maximum of 2 tests during this build and test phase: once a team tests twice, their testing is complete. Teams will receive the better of the two testing scores if they were able to test twice.

After 60 minutes (a total of **75 minutes from beginning to end**), all building is to stop.

After the build, teams who have not tested at all or have only tested once may test only one time during “final test”. This means that regardless of whether teams have one or two scorecards remaining, teams are only allowed to test one time after the build period and record their score.

Note – devices that fail on the final test (i.e. devices that are not able to rescue the bear cub) will receive a minimal score based on performance.

Each team is responsible for recording the final rescue time, weight of the entire apparatus, and placement score after each test. Scores should be written directly on the scorecards provided by TSA. The entire device is to be weighed by an adult volunteer after the rescue has taken place.

All test scorecards (including unused test scorecards) must be returned to TSA within 48 hours of the competition. This data will be entered into a computerized scoring template to produce the final score.

Brainstorm / Sketch / Prototype (15 minutes)	Design: No materials (5 minutes)
	Design: first set of materials allowed (10 minutes)

Put away / discard first set of materials (except scissors)

Build and test (60 minutes)	Build: second set of materials allowed. Teams may test up to 2 times.
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All building stops

Final test	Teams who have only tested once or not at all may test <u>one</u> time.
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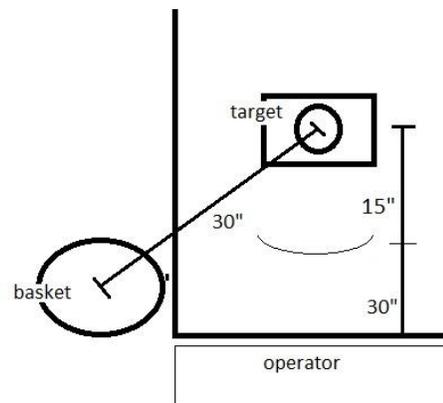
Testing

One test station per 8-10 teams is recommended.

One weigh station per every 15-20 teams is recommended.

Each test station should include:

- an adult volunteer serving as timekeeper with a stopwatch
- a table or stand to ensure the rescue device is operated at a height of 28-30 inches
- a basket or cardboard box matching the given dimensions
- a stuffed bear positioned on its back in the bottom of the basket or box
- a target placed on a table or flat surface that is 28-30 inches high; 30 inches from the center of the bottom of the basket or box, and 30 inches from the operator. A tape mark should be placed 15" from the center of the target.



Each team may have only **one** assigned operator. The operator must keep his/her hands above the height of the table (28-30 inches) at all times (if the operator's hand drops below this height, it counts as a failed test.) The operator must keep his/her hands at least 15" from the target at all times (if the operator's hand goes closer than 15" from the target, it counts as a failed test.)

The timekeeper will say 'go' and time begins.

The bear begins on its back in the center of the bottom of the container. The operator must use the device to pick up the bear. The stuffed bear may be lifted in any fashion except it may not be lifted by a loop around the neck (this would be a dangerous way to lift a bear cub). The bear may not be damaged, punctured, pierced, etc.

The bear should be placed on the target (which has been placed on the table top at a height of 28-30 inches) and released. Once it is released, the operator may try to position the bear on the target (using only the device), but this will add time. Note that scores are higher if the bear is placed face down (which would allow the cub to run away). Once the operator is satisfied at the placement of the bear, he/she must clearly say "stop" to the timekeeper, who then stops the time. The team must record their time on the scorecard.



Teams may have up to 3 minutes to remove the bear from the basket or cardboard box and place the bear on the target: if the bear is not successfully removed after 3 minutes, check “Not removed / exceeded 3 minutes” on the scorecard. Teams will record their time and target score on the scorecard.

After the rescue, the entire apparatus must be weighed at a scale. Note that the host site may wish to have a container on the scale, but should zero the weight before weighing each device. Instruct teams to record the weight of their device on the scorecard. The weight is verified by an adult volunteer who will sign and return the scorecard to TSA.

