The Tech Challenge
Presented by Amazon

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Rules

The Tech Challenge 2023: Survive the Storm!

Scenario

Severe weather ahead! Storms are getting worse, bringing strong winds that create danger and destruction. Can you use your engineering skills to defend against high wind conditions?

2023 Challenge

Build a structure to protect vulnerable objects from extreme winds.

Summary

- At events, The Tech will provide a raised build-area, wind, and vulnerable objects.
- Vulnerable objects are can-stacks of empty aluminum cans.
- Teams will design and build the protective structure(s).
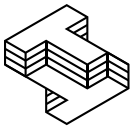
During the performance, teams will:

- Place can-stacks within a raised build-area on a rig provided by The Tech.
- Assemble team-designed and team-made protective structure(s) around the can-stacks.
- Watch as a series of three timed performance runs are made with one or two fans blowing air directed at the raised build-area.

A message from the judges

Before you start this year's challenge, consider the following:

- Work together, test lots of ideas, and keep trying when the going gets tough. Failures are expected as part of the process. Be ready to tell us about your journey, even the times when you felt like quitting.
- We value original thinking. We encourage you to pursue surprising solutions that are better than anything we might imagine.
- If you find a simple and elegant solution, that's also wonderful.
- We admire every team that takes on the challenge. Your solution does not need to be perfect to be amazing.
- We are looking for teams that model outstanding creativity, critical thinking, communication and collaboration. The Tech Challenge is about challenging yourself. Show us what you can do.

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Teamwork

We want teams to show cooperation, communication and planning. All team members should participate during performance and interview. It is up to your team to show teamwork to the judges.

Rig (All dimensions are approximate)

Rig diagrams (Figures 1–3) are included below. The Tech will provide a rig for test trials and Showcase. The rig consists of a table top with two fans and a raised build-area.

Rig specifications:

1. Raised build-area

   a. A 36 x 36 inch (91.4 x 91.4 cm) box raised 3 1/16 inches (7.8 cm) above the table top.

   b. Top surface is smooth plastic.

   c. Visible through the surface plastic and filling the entire 36 x 36 inch (91.4 x 91.4 cm) area is a 9 x 9 grid.

   d. Each grid cell is 4 x 4 inches (10.2 x 10.2 cm).

2. Both fans are 20 inch (50.8 cm) three-speed high-velocity fans (Maxx Air HVFF20S or equivalent) and are mounted vertical to the table top.
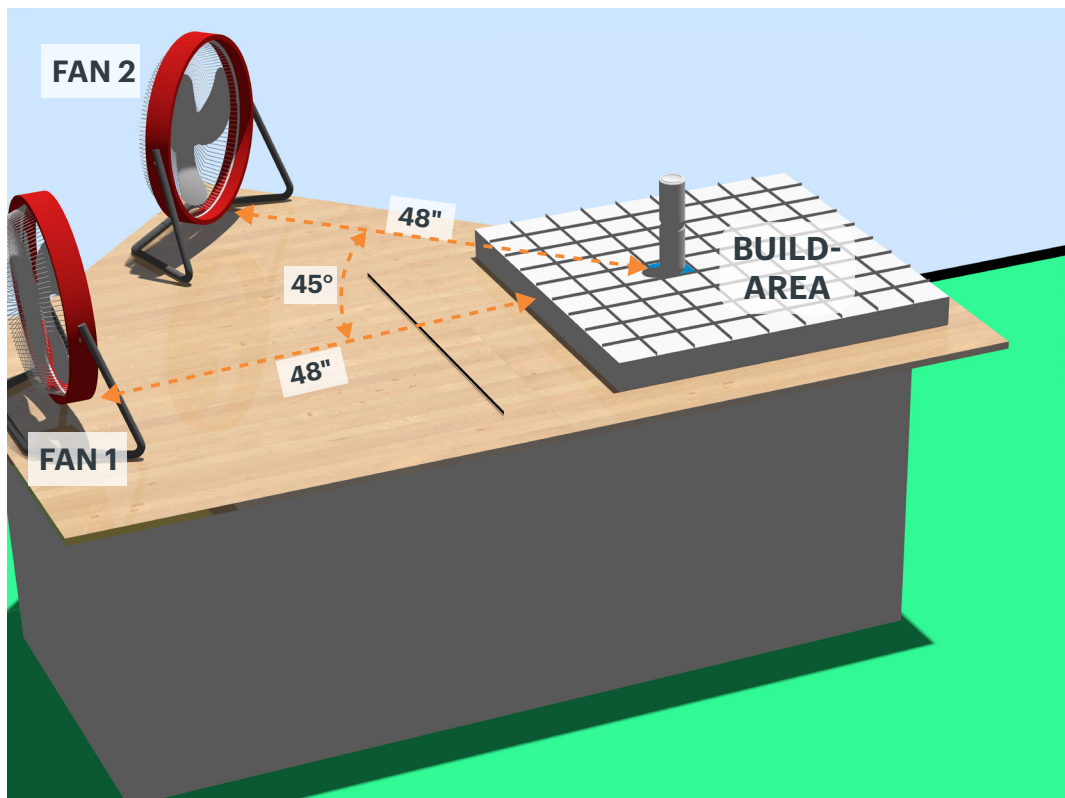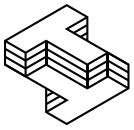

Figure 1:

Rig diagram (Build-area in Grades 4–8 position)

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3. The two fans are angled as shown in Figures 2 and 3 below.

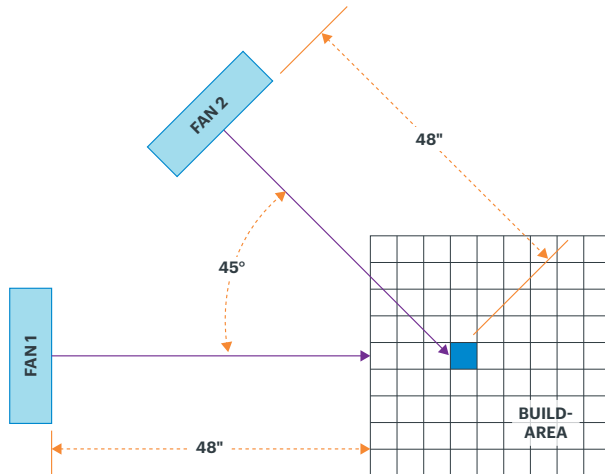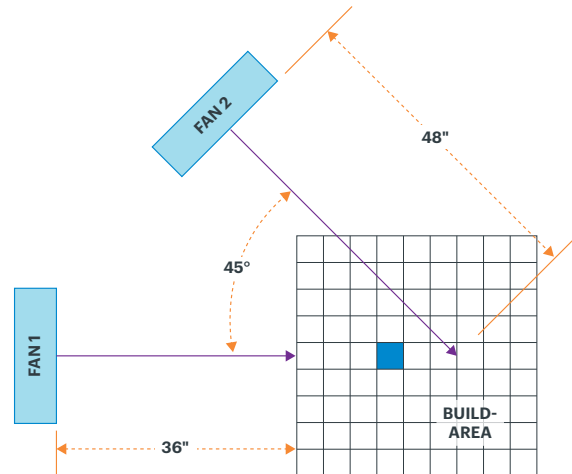*Figure 2: Grades 4–8 fan placement*

Figure 3: Grades 9–12 fan placement

4. For Grades 9–12 only, the raised build-area is moved 12 inches (30.5 cm) closer to Fan 1. Both Fan 1 and Fan 2 remain in the same position on the table top, pointing in the same direction as for Grades 4–8.

5. One grid cell (5th from left and 4th from front) is blue. You are required to fill this cell.

Can-stack placement

For this year's Tech Challenge, the vulnerable objects that you are protecting from the wind are stacks of empty aluminum cans. Cans used during test trials and Showcase are provided by The Tech.

1. Can specifications:

   a. Standard empty aluminum 12-ounce (340.2 g) can with tab removed (see Figure 4)

   b. Approximate diameter = 2.6 inches (6.6 cm)

   c. Approximate height = 4.8 inches (12.2 cm)

   d. Approximate weight = 0.5 ounce (14.2 g)

2. Can-stack = one column of multiple cans stacked on top of each other. Cans within each can-stack **will not** be fastened together. Each can-stack must have a minimum of two cans.

Figure 4:

Can with tab removed

3. The total number of cans teams must use is listed in Table 1.

Table 1: Number of cans by grade level

Grade	# of cans
4-5	14
6	21
7-8	27
9-12	27

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4. One can-stack must be placed within the blue cell described above.

5. Only one can-stack may be placed within a grid-cell. The base of the can-stack must be entirely within the grid-cell and cannot be on any grid lines.

6. No two can-stacks can be placed in adjacent grid-cells. Placement in grid-cells that are diagonal to each other is allowed (see Figure 5).
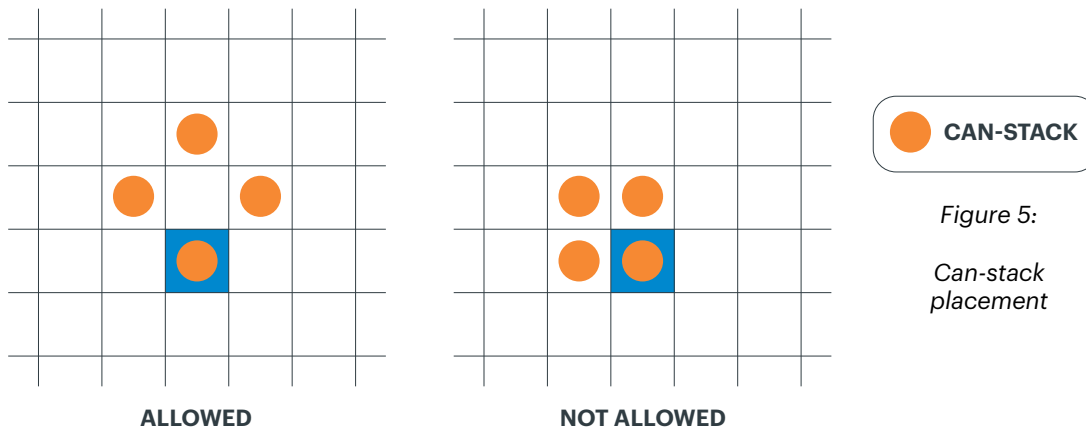
7. Can-stacks cannot touch each other.

ALLOWED   **NOT ALLOWED**

 CAN-STACK

Figure 5:

Can-stack placement

Protective structure(s)

Teams will design and build a structure(s) located on the raised build-area to protect the can-stacks from wind.
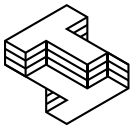
1. All pieces of the protective structure(s) must fit in the backpack provided by The Tech.

   a. Protective structure(s) must be labeled with team number.

2. Protective structure(s) pieces must be completely inside the zipped-up backpack at the beginning of the performance period. The protective structure(s) will be assembled during the performance period.

3. The protective structure(s) may be made of any materials, as long as they are safe (see safety section below).

4. The maximum protective structure(s) weight per grade is listed in Table 2 below. Protective structure(s) inside backpack will be weighed at Showcase. The backpack should only contain your protective structure(s).

Table 2: Weight limit by grade level

Grade	Maximum protective structure(s) weight	Maximum weight for structure(s) & backpack
4-5	20 oz (567 g)	31 oz (879 g)
6	18 oz (510 g)	29 oz (822 g)
7-8	16 oz (454 g)	27 oz (765 g)
9-12	16 oz (454 g)	27 oz (765 g)

Figure 6:

Tech provided backpack (color may vary)

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5. When assembled and throughout the performance, the footprint of the protective structure(s) must be entirely within the 36 x 36 inch (91.4 x 91.4 cm) raised build-area.

6. The only protective structure material allowed to touch the raised build-area surface is uncoated cardboard.

7. The protective structure(s) may only touch the top surface of the raised build-area.

8. The protective structure(s) must be constructed so the judges can see that the success criteria are met, without anyone touching the structure(s). In other words, your can-stacks must be visible throughout the performance period.

9. No part of the protective structure(s) can occupy space between can-stacks (see Figure 7).

10. No part of the protective structure(s), up to can-stack height, can be placed within any grid cell that contains a can-stack (see Figure 8).
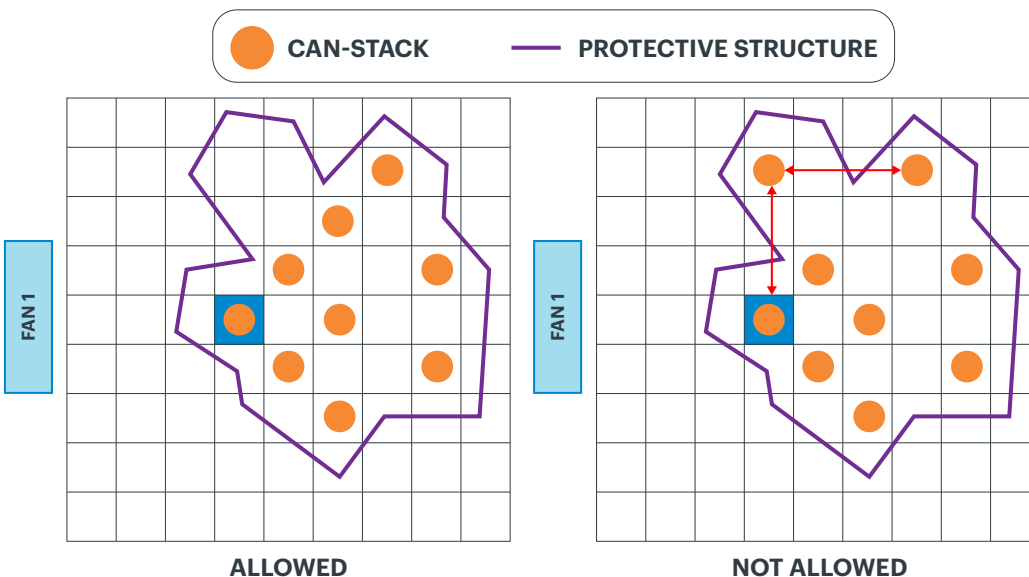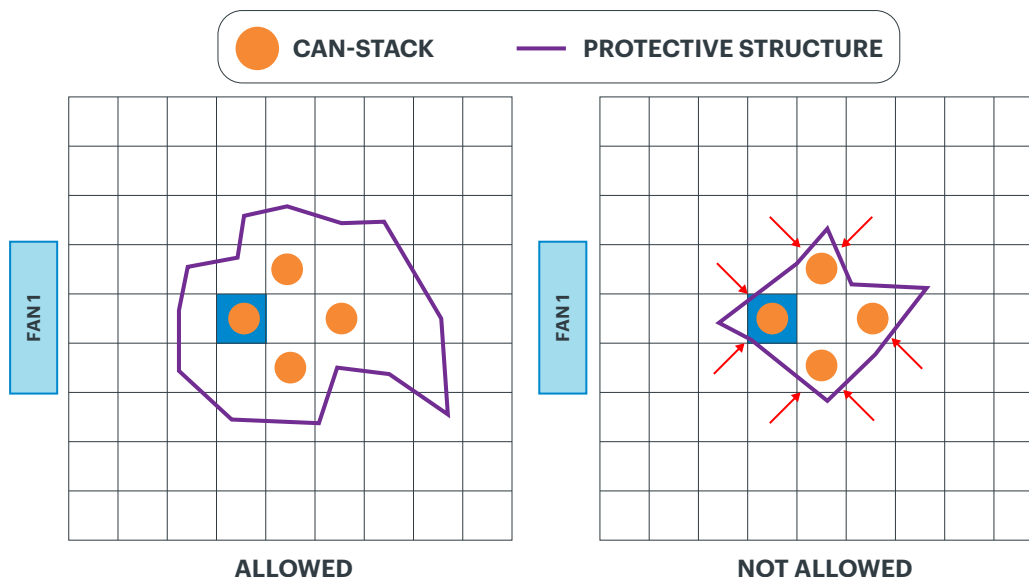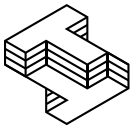

Figure 7:

Protective structure placement

Figure 8:

Protective structure placement

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Performance period

1. Performance period and setup, including can-stack placement and protective structure(s) assembly, is six minutes.

   a. If a performance run is in progress at the end of six minutes, the run will be allowed to finish.

2. Judges will initiate the performance period once the participants are ready.

3. Team members will place can-stacks in raised build-area. Total number of cans teams must use are listed in Table 1.

4. Team members will assemble their protective structure(s) and place them in the raised build-area as described above.

5. Once the team indicates they are ready and have moved into the defined safety area, the judges will start the performance runs.

6. Each performance run time is 30 seconds maximum from the time the fan is turned on.

7. Performance run parameters by grade level (fan numbers and speeds) are listed in Table 3.

8. Can-stack and structure movement will be evaluated at the end of each performance run.
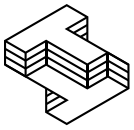
Table 3: Performance runs

Grade(s)	Run 1		Run 2		Run 3	
	Fan	Speed	Fan	Speed	Fan	Speed
4–5	1	Low	2	Medium	1 & 2	High
6	1	Low	2	Medium	1 & 2	High
7–8	1	Low	2	Medium	1 & 2	High
9–12	1	Low	2	Medium	1 & 2	High

9. Adjusting the can-stack and/or structure(s) between performance runs is considered a reset.

10. Resets are allowed within the six-minute performance period. This allows teams to repeat a failed run. Ideally, teams will complete performance without a reset.

Success criteria

1. All can-stacks remain standing.

2. No can-stacks are touching each other or the team's protective structure(s).

3. Protective structure(s) footprint stays entirely on the raised build-area.
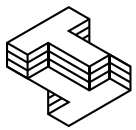
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Engineering journal

As part of the challenge, teams will record their process and submit a team journal that will be reviewed by the judges.

1. Start the journal when you first start thinking about and working on the Challenge.

2. How the team works together to research, brainstorm, build, test, evaluate, document, revise and repeat (iterate) is as important as the solution itself. The engineering journal is a record of this process.

3. What types of problems did you have and how did you fix them?

4. Great journals show someone exactly how to build your final solution.

5. Organized records should be kept of all team activities. The team's engineering journal is a living document.

6. Journals may be typed or handwritten. Legibility and organization are important.

7. For the Showcase, each team must submit only one PDF file for their engineering journal.

8. Teams may want to bring a hard copy of their journal or a part of their journal, such as drawings, sketches, photos, etc., with them to the Showcase to share with the interview judges.

9. More information on engineering journal requirements can be found in the Team Guide on The Tech Challenge website (**https://www.thetech.org/media/mdgdjk55/ ttc_teamguide_2023.pdf**).

Safety

1. Safety is the top priority during the entire Tech Challenge.

2. Teams will be judged on safe design, construction, testing and operation.

3. Judges have full authority to stop any activity they view as unsafe. The judges' word is final.

4. Each team will identify a team Safety Officer who will ensure safety throughout the project. All team members are responsible for safety.

5. Safety gear must be worn during tool use, device assembly, etc. as appropriate.

    a. Eye protection is required. Teams must use ANSI-approved eye protection (e.g., glasses, goggles, mask). Regular eyeglasses do not provide the necessary level of eye protection and are not an acceptable substitute for ANSI-approved eye protection.

6. Long hair should be tied back or tucked into a hat during device build, assembly and testing.

7. Be cautious while operating fans. Do not remove fan finger guards or grills.

8. Teams may not use flammable liquids or gasses.

9. Teams may not use pressurized gasses greater than 5 psi. Teams using pressurized gas must be able to demonstrate to judges by using a gauge that the pressure does not exceed 5 psi.

10. No pressurized tanks/cylinders.

11. No use of animals allowed.

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12. The use of AC power is not permitted at test trials or Showcase.

13. Closed-toe shoes are highly recommended during tool use, building, testing and Showcase.

14. For more information on safety, see The Tech Challenge Resources Page (**https://www.thetech.org/studentresources**) and refer to the California Department of Education Science Safety Handbook 2014 (**https://www.cde.ca.gov/pd/ca/sc/documents/scisafebook2014.pdf**).

Adviser

Teams must have an adult adviser. Team solutions must be designed, built and tested by team members, not the adviser.

1. The adviser's role is to guide, facilitate and encourage.

2. The adviser may not be a Tech Challenge judge.

3. An adviser may work with more than one team. However, it is important that advisers ensure each team receives the necessary level of attention.

4. See the Adviser Guide (**https://www.thetech.org/media/m2wa4bqe/ttc_adviserguide_2023.pdf**).

Spirit of the Challenge

The Tech Challenge emphasizes the importance of engineering solutions that would be practical in real life. Test rigs involve small-scale representations of real-world conditions. Teams should develop designs that represent real-life solutions.

The Spirit of the Challenge is an important factor in scoring. The best engineering journals document an understanding of real-world factors and contain a detailed explanation of how your design might have practical, real-life applications. Teams should expect judges to press them on this issue and will be asked questions such as "How would your design work in real life?" A good explanation of how their design approach is compatible with the Spirit of the Challenge will have a positive influence on the team's score.

While store-bought solutions are not prohibited, they are not in the Spirit of the Challenge.

Important Note Regarding the Rules

Clarifications and additions to the rules may occur. Teams are encouraged to check the website for changes. When changes are made, registered Tech Challenge teams will be alerted by email. Changes will also be noted in the rules on The Tech Challenge website in **red type**.

The website also includes answers to frequently asked questions (FAQs) which are posted and updated periodically (**https://www.thetech.org/thetechchallenge/faq**).