The Tech Challenge
Presented by Amazon

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Rules
The Tech Challenge 2024: Cosmic Quest

Scenario

SPACE – the possibilities are limitless! From figuring out how to redirect asteroids to finding planets that could support life, scientists are always collecting information about our universe. Scientists are on a quest to learn more about a distant planet and its largest moon. Can your team deliver fragile but highly important supplies to this moon's surface?

2024 Challenge

The challenge: Deliver multiple payloads to different locations.

Summary

- The Tech will provide a rig composed of one raised launch platform and three raised targets, representing different moon surface types and configurations.

- Each team will:
    - design and build a launcher with a base that must fit on the launch platform.
   - design and build payloads, including team-supplied tennis balls.

During the performance, teams will:

- place and secure the launcher on the launch platform.

- load, aim, and launch payloads to land on each of the targets.

A message from the judges

We are looking for teams that model outstanding creativity, critical thinking, communication, and teamwork. The Tech Challenge is about challenging yourself. Show us what you can do.

- Work together, test lots of ideas, and keep trying when the going gets tough. Failures are a normal part of the process. Be ready to tell us about your journey, even the times when you felt like quitting.

- Simple solutions are often the best. We value original thinking and encourage you to pursue surprising solutions that are better than anything we might imagine.

- We admire every team that takes on the challenge. Your solution does not need to be perfect to be amazing.

- Store-bought solutions are not in the Spirit of the Challenge. We are looking for teams to design and build devices using their own creativity.

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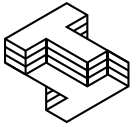
Teamwork

We want teams to show cooperation, collaboration, 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)

The Tech will provide the rig for test trials and Showcase. The rig consists of a launch area, raised launch platform, and three targets. See Figure One and Figure Two below. **Complete rig drawings can be found on our website.**

Rig specifications:

1. **Launch area:** 2.44 x 2.44 m (8 ft x 8 ft)
2. **Launch platform**
   a. Shape: round with 90.8 cm (35.75 in) diameter
   b. Height: 30 cm (12 in)
   c. Surface: 1.9 cm (.75 in) thick flat plywood with sufficient overhang to allow for clamping
   d. Distance from platform edge to front of the launch area: 25.4 cm (10 in)
   • The launch platform will be located in the launch area.
3. **Target 1: The Pit**
   a. Shape: rectangle 61 x 91 cm (24 in x 36 in)
   b. Height: 61 cm (24 in)
   c. Surface: soft cushion-like pillow filled with shredded t-shirts
   d. Distance from center of the launch platform to the center of the target: 2 m (6 ft 7 in)
4. **Target 2: The Shelf**
   a. Shape: rectangle 51 x 76 cm (20 in x 30 in)
   • Shelf has a semi-circle backboard that is 38 cm (15 in) high at its highest point.
   b. Height: 122 cm (48 in)
   c. Surface: 80-grit sandpaper
   d. Distance from center of the launch platform to center of the target: 3.5 m (11.5 ft)
5. **Target 3: The Rocky Slope**
   a. Shape: rectangle 61 x 91 cm (24 in x 36 in) at a 10 degree angle
   b. Surface: loose lava rock
   c. Height: lowest part of the slope is 91 cm (36 in)
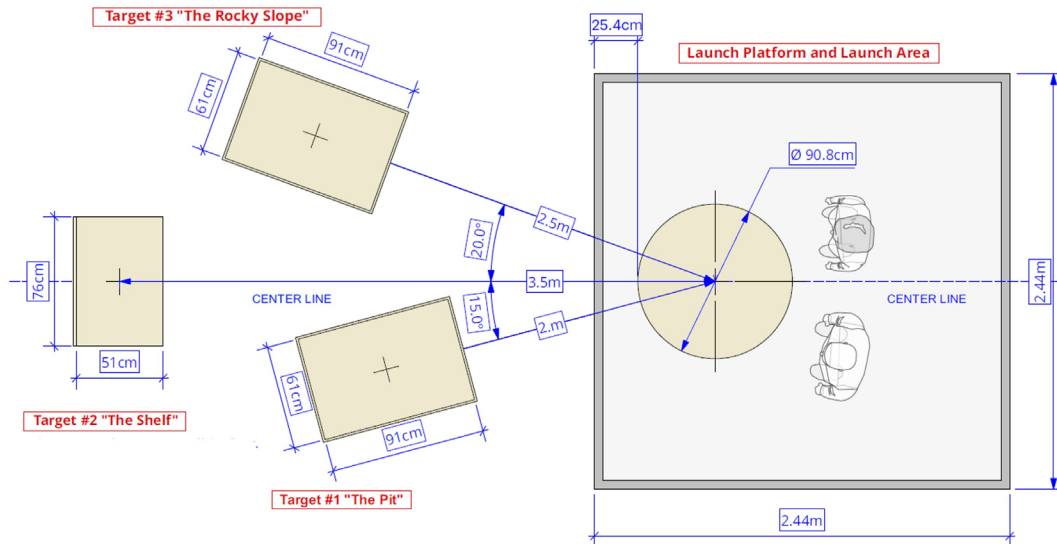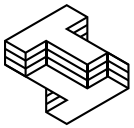   d. Distance from the center of the launch platform to the center of the target: 2.5 m (8.2 ft)
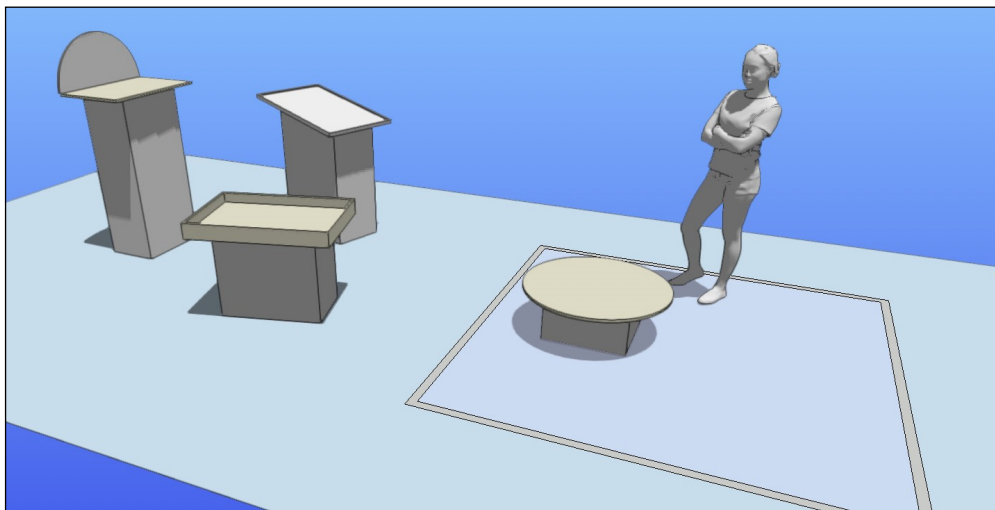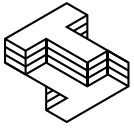
Figure 1

Figure 2

Launcher

1. Each team must have their own launcher. Teams may not share their launcher or any part of their launcher with other teams.

2. Weight limit: None. However, the team must be able to transport and set up the launcher and devices by themselves.

3. The base of the launcher must fit within the launch platform surface area and must remain on the launch platform during launch attempts.

4. Teams can clamp their launcher to the launch platform or use weights to hold the launcher down.

   a. Clamps and/or weights must be supplied by the team. The clamps/weights may not be shared with other teams in the same division.

   b. The launch platform must be left in the same condition after the performance as it was before the performance. This means no screw holes, residue, etc.

5. No part of the launcher may go outside the launch area during the performance.

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6. Teams may have only one launcher for all launches, but it may be modified between launches.

7. Trigger:

   a. A trigger mechanism must be built into your device and used during test trials and Showcase.

   b. The trigger must be activated in a safe manner. Make sure no body parts get in the way of the launcher in motion.

8. Human power can only be used to aim, load, and trigger the launcher.

> **What is a trigger?**
>
> It's a built-in release mechanism that starts your device.
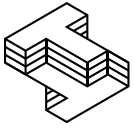>
> Example of triggers include:
> - pulling a string
> - pressing a button
> - flipping a latch
> - opening a clip
> - removing a stick

Payload

1. Each payload may only be launched once.

2. Each payload must consist of one standard 6.6 cm (2.6 in) diameter unmodified tennis ball plus any materials necessary to aid in landing and remaining on the target surface.

3. Judges must be able to either see or feel where the tennis ball is in the payload.

4. The maximum weight of each payload is 454 grams (1 lb).

5. The maximum size of each payload prior to launch is 25 cm x 30 cm x 38 cm (10 in x 12 in x 15 in). (The size of a standard bankers box.)

6. The payload must remain in one piece.

7. The payload must not damage the target or leave any residue on the target.

8. No unsafe payloads (sharp edges, etc.) will be allowed.

9. Since there is no atmosphere, solutions requiring an atmosphere, such as drones, parachutes, gliders, etc., are not allowed.

Performance

1. During performance, all team members must remain in the launch area.

2. During performance, only launched payloads may leave the launch area.

3. Only one payload may be launched at a time.

4. Teams may choose any order to deliver their payloads.

5. The total performance period, including setup and all launches, is five minutes maximum.

   a. We recommend two minutes or less for setup.

   b. Judges will instruct team members when to start.

6. Team members:

   a. Assemble their launcher and clamp/weight the launcher to/on the launch platform as appropriate.

   b. Aim the launcher at your selected target.

   c. Load the launcher and set the trigger.

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- Safety note: At no time should any member of the team put themselves in the path of the launcher mechanism.

   d. Perform a short countdown (e.g., 3 … 2 … 1) and initiate the trigger device.

   e. Evaluate the success of their payload delivery before proceeding further.

7. Recovery of payloads is not allowed during device performance. Staff appointed by The Tech will retrieve payloads after the performance period and return them to the team.

8. The team may continue until:

   a. All success criteria are met.

   b. Or nine launches are attempted.

   c. Or the five-minute performance period ends.

Success Criteria

1. In order to be considered a successful landing, the entire tennis ball must be on the target surface.

2. The minimum number of payloads to be delivered is listed Table 1.

Table 1: Payload Distribution

Grade	Payloads on Targets	Distribution
4–5	3	1 on each target
6	4	2 on target of your choice + 1 on each of other two targets
7–8	5	2 on 2 targets of your choice + 1 on remaining target
9–12	6	2 on each target

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.
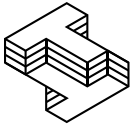
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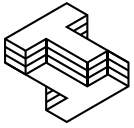**thetech.org/thetechchallenge**
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7. For the Showcase, each team must submit only one PDF file for their engineering journal.

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/h4jdnjce/ttc_teamguide_2024.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 member as its Safety Officer who will ensure safety throughout the project. All team members are responsible for safety.

5. Teams must be able to transport their launcher and devices safely without the assistance of others, including parents, advisers, siblings, friends, etc. The use of carts, wagons, or other transport devices is encouraged.

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

   a. Eye protection is required. Teams must provide their own 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.

   b. Head protection is required. Teams must provide their own head protection (e.g., bump hats, bicycle helmets, hardhats, or athletic helmets). Head protection must be worn at all times when in designated areas around test rigs or when constructing/testing devices.

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

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 team-provided gauge that the pressure does not exceed 5 psi.

10. No pressurized tanks/cylinders are allowed.

11. No use of animals is allowed.

12. Batteries used must be sealed and in good condition.

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

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

15. For more information on safety, see The Tech Challenge Student Resources Page (**https://www.thetech.org/core-programs/the-tech-challenge/team-members/#studentResources**).

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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/2dkdwlcq/ttc_adviserguide_2024.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 in the rules will also be noted on The Tech Challenge website in **red type**.

The website includes answers to frequently asked questions (FAQs) which are posted and updated periodically (**https://www.thetech.org/core-programs/the-tech-challenge/faq/**).