

Team Guide

Welcome to The Tech Challenge! You and your friends are joining a rich legacy of young innovators who take on real-world challenges in true Silicon Valley style — with hard work, resourcefulness and a lot of fun. Please read this entire guide. These guidelines will help you get the most out of The Tech Challenge.



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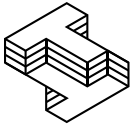
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1. Getting Started

This is our first time doing The Tech Challenge. How do we get started?

1. **Form a team.** Find two to six people (including you) in Grades 4-12. You can have students from different grades on your team, but you'll participate in the division of the member in the highest grade. Example: If the oldest student is in 9th grade and the rest of your team is in 7th grade, you'll participate in the high school division.
2. **Find an adviser.** Advisers must be at least 18 years old. Their job is to monitor safety rules and help your team stay on track. An adviser doesn't have to be an engineer. They can be teachers, parents or any other responsible adult. Make sure your adviser reads the [Adviser Guide](#).
3. **Register.** Your adviser should [register](#) your team for The Tech Challenge.
4. **Make a calendar.** Mark down [important dates](#), including the [showcase](#) in May, as well as supporting events such as info clinics, team workshops and test trials.

We have a team and an adviser, and we've registered. What now?

Read the rules. This will help you understand the challenge. Updates will be emailed to your adviser.

What exactly does an adviser do?

Your adviser should guide your team, but should not do the project for you. Ask for help finding answers, getting supplies and using tools. When they have nothing else to do, send them out for pizza! It's OK to respectfully ask your adviser to step aside, but always make sure he or she is present when you use tools or test your device.

How many times do we need to meet?

This is up to your team. Make a list of things you want to get done at each meeting. A key to success: make a calendar and meet regularly. Your team should follow all county and state health department guidelines regarding physical distancing and mask wearing.

What's an info clinic?

It's a chance for you, your team, adviser and family members to learn about the challenge.

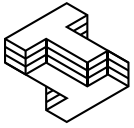
What's a test trial?

This is a chance for your team to test its device and get feedback from judges.

What are the judges looking for?

The judges are looking for the following:

- A team commitment to safety.
- Examples of teamwork, and how each person on the team contributed to the project.
- Multiple designs were considered, and an explanation of how the team decided which one to build.
- That the team tested the device during every stage of development.
- How the team overcame failure.



2. How to be a Strong Team

Do you have any advice about working as part of a team?

- **Work together.** Listen to each other. Team members may have different skills and strengths. Use this to your advantage.
- **Learn from your mistakes.** The first device you build may not work. Innovators create, test and improve, over and over and over. They learn from failure and persevere to find the best solution.
- **Start your engineering journal early.** Take notes at the info clinic and every meeting. Keep them in your journal, then figure out what works well and what needs improvement.
- **Be patient.** The engineering design process doesn't always go in order. Sometimes you move back to a step you've done before, like brainstorming, to help improve your design.
- **Persevere.** You'll run into roadblocks. Don't give up!

OK, that's all great, but really: what do we do next?

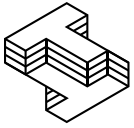
- **Start your engineering journal.** This can be as simple as keeping notes in a binder. More about this later.
 - **Define the problem.** Talk about the challenge and break it down into parts. For example, the 2018 challenge, Drop & Dash, had at least two parts: survive a 10-foot drop and move the payload to the target. Some teams broke the problem down into even smaller parts.
 - **Discuss criteria and constraints.** These are goals and limits of your device. For example, what does it need to do? How big can it be? How much can it weigh?
 - **Make a budget.** We're not just talking about money here. We're also talking about budgeting time. How much time do you have to brainstorm? How much work do you need to do to be ready for test trials or the showcase?
- **Brainstorm.** What's that? Keep reading ...



What's brainstorming?

Brainstorming is a way of solving problems by coming up with ideas off the top of your head. Here are some things to think about before you start brainstorming:

- **Don't judge.** There are no bad or stupid ideas.
- **Build on the ideas of your teammates.** One person says, "we could do this" and another says, "yes, and we could do this too" and BAM! You have a great idea.
- **Stay focused.** Hold off on discussing things not related to the challenge until after you finish talking about your project.
- **Go for quantity.** Come up with as many ideas as you can in a short period of time.
- **Encourage crazy ideas.** You never know what might work!
- **Draw quick sketches.** A picture is worth a thousand words.



How to brainstorm:

1. Bring:

- Lots of paper, Post-its, pens, markers and crayons in many colors.
- The rules, pictures of the test rig and your engineering journal.

2. Pick a team member to write down ideas and keep them in your journal.

3. Talk about the challenge.

- What's the problem you're trying to solve?
- How have similar problems been solved in the past?
- What do you know about the science and engineering behind the challenge?

4. Brainstorm.

- Try not to brainstorm for more than an hour.
- List ideas and draw quick sketches.
- Be sure to list everybody's ideas.

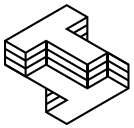
5. Evaluate.

- Review the ideas at the end of your brainstorming sessions, before you forget any details.
- Organize your ideas into categories.
- As a team, pick which ideas you want to work on first.
- Don't throw any ideas away. Who knows? They may be useful to you later.

Here are a few brainstorming games to get you started:

- **Popcorn:** Shout out ideas quickly, like popping popcorn. You'll need a few people to write down ideas since this can move quickly.
- **Other People's Shoes:** Think of ways different people, like Harry Potter, Santa Claus, your science teacher, etc. would solve your problem.
- **Wildest Idea:** Cook up the most outrageous ideas you can imagine. Finish the sentence, "Wouldn't it be wild if ..."
- **Post-it:** Everyone gets a stack of Post-its. Each person writes ideas on the notes that get put on a wall for evaluation.

You might brainstorm not just at the beginning of the engineering design process, but also at other times. Run into problems mid-way through your project? Can't find a quick fix? Use your new brainstorming skills to figure out a solution!

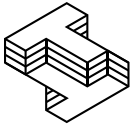


3. Engineering Design Process

You guys talk a lot about the engineering design process. What is that?
There are many ways to describe the engineering design process*.



Engineers don't always follow these steps in order. You might design something, test it, find a problem and go back to an earlier step to modify your design. This is called iteration, and it's likely that in your process you will do the same.



How does The Tech Challenge teach engineering?

The Tech Challenge includes fun, the chance to build stuff, teamwork and sportsmanship, but there are official guidelines called NGSS Engineering Standards that are also incorporated into The Tech Challenge philosophy and rules. The guidelines make for heavy reading, but if you want to give it a try, click [here](#) and check them out! As always, if you have questions email challenge@thetech.org and we'll get right back to you.

Meanwhile, here's shortened versions of a few concepts from these standards we use in The Tech Challenge.

- **Define engineering problems**

Define the criteria and constraints of the challenge, taking into account scientific principles, how your solution may affect people and the environment and how those may affect your solution.

- **Develop possible solutions**

Use an organized process to find which of your brainstormed solutions best meets the criteria and constraints of the challenge.

- **Optimize the solution**

Test early and often. Collect and analyze data to see the similarities and differences between your brainstormed solutions and support your argument that you've found the best one. Be able to show how your device evolved from brainstorming to final design.

How often should we test?

Test at every stage of development. For example, build a rapid prototype. Test it. Did your prototype do what you expected it to do? Refine your prototype. Test it again. Did it work better or worse than it did the first time? Make more changes. **Test early and often.**

Remember to write the results of all your testing in your journal, and describe how each of your tests helped you make your device better.

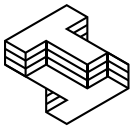
You guys also talk a lot about failure. Isn't failure a bad thing?

Every great engineering project comes with plenty of failure ... or rather, plenty of opportunities to improve your design. How else will you know what doesn't work? You can use that information to make your solution better.

How do we decide what to build?

That's up to you, but in addition to coolness factor you should consider things like:

- How much will it cost to build?
- How long will the project take?
- Would it work in real life?



Here’s a simple [decision matrix](#) you can use to identify your ideas’ pros and cons. This is just an example. Change the information you collect to suit your project.

| | Cost | Time | Work in real life? |
|---------|------|---------|--------------------|
| Idea #1 | \$5 | 3 years | Probably not |
| Idea #2 | \$50 | 3 weeks | Yes |

Use the data you collect to determine which is the best solution for your team to build. Don’t forget to record your argument and decision in your engineering journal.



4. Engineering Journal

Who should compile your engineering journal?

ALL team members should help. The contents should reflect the ideas, thoughts, inspiration and creativity of all team members, even if only one person is taking notes.

What should be in your engineering journal?

Take a look at the Engineering Design Process graphic. Each step of the process should be documented in your engineering journal. Use it as a guide. ([See below](#) for some ideas on this!)

Where should we write our engineering journal?

Write your engineering journal in a place that is easy for your team to update. This could be a notebook, binder or digital format like a Google doc. However, you will need to turn your journal in online as a PDF, so keep that in mind.

When should we write our engineering journal?

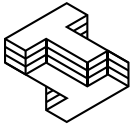
Right from the beginning, document your team’s ideas and activities. Keep writing, sketching and sharing throughout your project. Don’t leave it until the end. You might forget the best parts!

What is the secret to creating a great journal?

Don’t roll your eyes, but we want to hear how you worked through challenges and solved problems.

- What did you discover?
- What was hard and how did you work through it?
- What types of problems did you have?
- How did you fix them?
- How did you work together?

We want examples that are specific to your project. The best journals will tell the judges what you learned and how that helped you improve your design or how it might help you in the future. Great journals also show exactly how to build your final solution.



More on documenting the engineering design process in your journal ...

Here are some suggestions about things to include along the way



- **Define the Problem**

- Brainstorming and planning meeting notes
- Diagrams



- **Do Background Research**

- Research sources
- Notes on what you learned
- Conclusions and connections



- **Specify Requirements**

- Team decisions on the requirements for your solutions/devices



- **Brainstorm, Evaluate and Choose Solution**

- Brainstorming notes and diagrams
- Sketches
- Testing and results
- How did you decide which ideas to move forward? (make sure you document that!)



- **Develop and Prototype**

- Drawings, pictures and diagrams with measurements
- Materials
- Construction notes
- Flaws or improvements made



- **Test**

- Methods
- Results (how did you decide which ideas to move forward?)
- Test more than once!



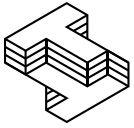
- **Does Solution Meet Requirements?**

- Notes on how your solution/device met your requirements
- Anything you used to help you decide



- **Share Your Solution**

- Organize all your notes
- Sketches
- Pictures
- Diagrams
- Scoresheets



Common Questions

Do we have to take meeting minutes?

No, but for many teams this is the easiest way to record your progress. Other methods may include a timeline, schedule or dated notes on brainstorming, prototyping, testing and changes to devices.

Is a Table of Contents required?

No, but it needs to be organized so it makes sense to readers (Judges) who have never seen it before.

What sections are required?

There are no specific section requirements. Teams are welcome to organize their journal to reflect how their team solved the Tech Challenge.

Can we put all our information on a presentation board?

No. You must submit your journal online in PDF format.

Is it okay for each team member to write a journal?

Only one engineering journal will be accepted per team. All team members may take notes, make drawings and sketches, take pictures, record test data, and write reflections on what they have learned. But these must all be compiled and organized into ONE engineering journal.

How long does the journal have to be?

There are no length or word count requirements.

Are there examples of excellent journals we can look at?

Each team is unique and chooses to solve the Tech Challenge based on their own thinking, creativity and ingenuity. Your journal should reflect this uniqueness. Using an example from another team's journal might limit your own creativity, so we do not offer examples.

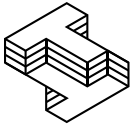


5. Showcase

How do we get ready for the showcase?

Make sure you've completed your solution, talked about what everyone is supposed to do and prepared your journal in ways that demonstrate your spirit, ingenuity and teamwork! Practice talking about your device and your process. Be confident. Judges want to see what makes you a strong, creative team. Judges will consider three categories:

- **Engineering design process:** Judges will talk with your team about how it arrived at a solution. Your engineering journal and ability to discuss your process are just as important as your device.
- **Engineering journal:** Your team will turn in its journal in PDF format. Don't forget to make it clear which design is your final solution. Your team won't be around to answer questions during this part of the judging.



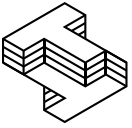
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- **Device performance:** Your team will demonstrate its solution and judges will evaluate how well your design meets the challenge.

6. 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.

The Spirit of the Challenge is an important factor in scoring. The best engineering journals document an understanding of real-world factors. Teams should expect judges to ask questions such as “How can the ideas you’ve used for your solution be applied in real life?”

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



7. Design Sheet Template

When brainstorming, it often helps to create a design sheet for each idea so that you can keep track of your ideas and add them to your journal.

This is a sample template for a design sheet. Feel free to create your own.

Design Sheet # _____

Design Name: _____

Designer: _____

Pros

Cons

How would this design work?

Questions and challenges:

Sketch: