Down To Earth: Mission Tech Force

Our Future With Robots: Engineering Journal

Robots are more than just helpers. They can also interact with humans to keep things running smoothly. Think about ways robots can help you improve your community or make your Earth a better place. **How might you design a robotic arm that humans can remotely control at a safe distance to address each problem below?** Which would you like to investigate?

- ☐ Imagine you work for the Federal Emergency Management Agency (FEMA) and need to assist communities in removing debris after natural disasters such as hurricanes, tornadoes, and floods. What kind of robotic arm could help you do that?
- ☐ Suppose you're a civil engineer working for your state's transportation department. How could you use robotics to build or upgrade bridges, roads, or buildings to make your community more sustainable and resilient to climate change and natural disasters?
- ☐ What if you're a project manager for a small manufacturing company? How might a robot help you reduce the energy your company's factory uses or the carbon dioxide emissions it creates? Or how could robotics be used to keep employees safe?

You will build and test a prototype of your robotic arm. A prototype is a kind of functional model meant to be evaluated for its performance. It's a physical representation of your solution to a problem that can be tested in some way. Engineers use prototypes to look for potential flaws in their designs. Often, early prototypes are simpler or smaller than the final item and may not be operational, though you should be able to explain how it would work. To design a piece of technology, engineers create many prototypes improving the design with each one. We call this process "iteration," and it's the heart of the engineering design process.

Use this journal to plan, prototype, and test your robotic arm using materials in your house, like scrap cardboard, recycled plastic containers, and craft supplies. **What are some materials you have available?**

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Imagine A Solution

When engineers imagine ways to solve a problem, they often work with others to brainstorm. When you brainstorm, you try to come up with as many different ideas as possible. Be creative! **Write as many solutions to your problem as you can imagine.**

What is your strongest idea? **Describe how your robotic arm will solve a specific problem.** What will it do? How will it work? What materials will you need to build and test your arm?

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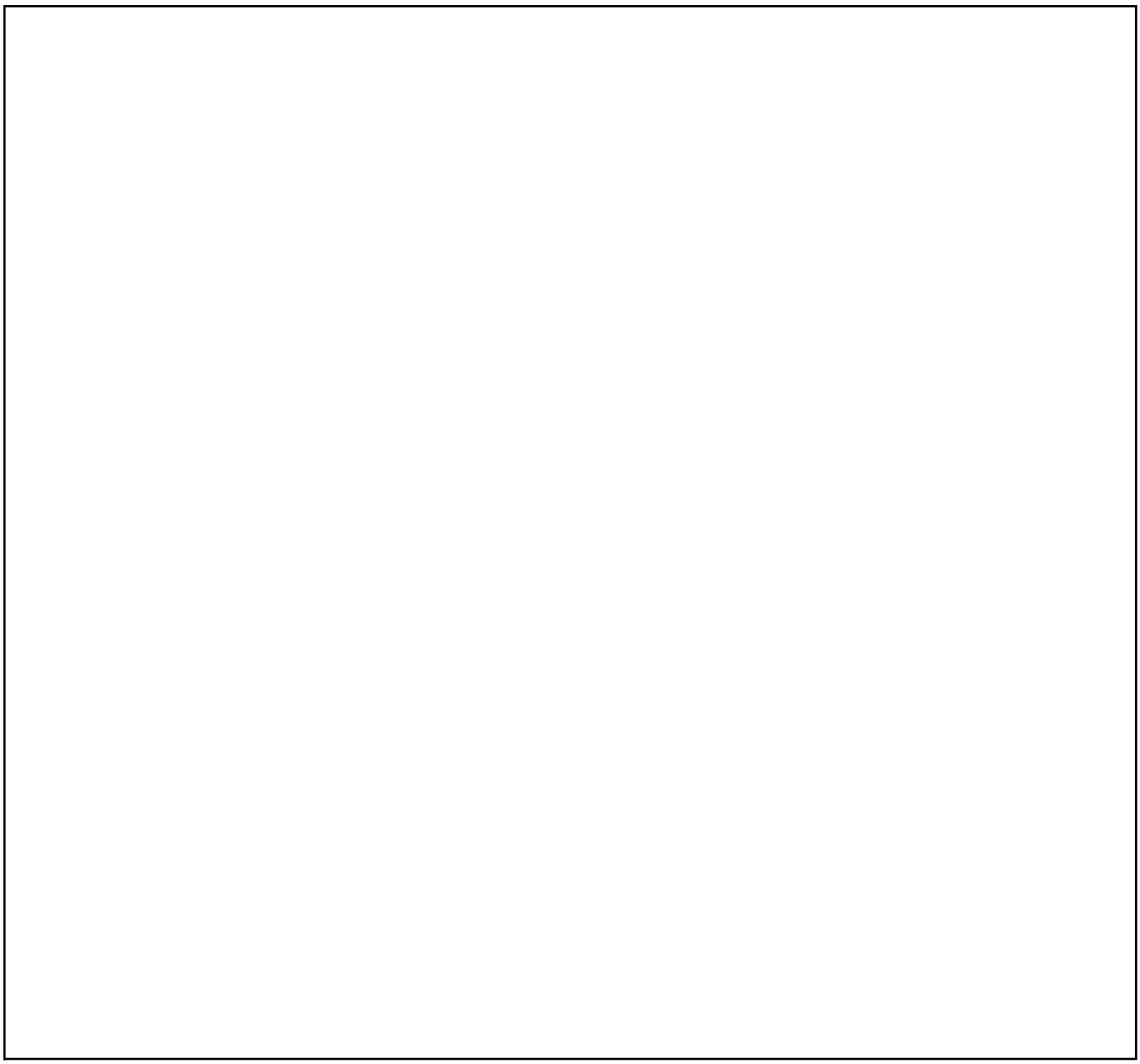
Plan Your Robotic Arm

Now it's time to plan. For engineers, that usually means making a design sketch. A design sketch is a way to plan your ideas on paper before you start building in 3D. Sketching before building ensures you understand how pieces will fit together. It also provides a way to check that you have enough materials, time, and space to create what you want. Sketch your design below. Be sure to label the parts and materials planned. Provide a scale. Use additional paper if needed, or try computer-aided design (CAD) to create your drawing.



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Create, Iterate, And Test

How will you test your robotic arm? What should it be able to do? Describe how you will know your design is successful.

This is the part you've been waiting for! It's time to get building. Using your design sketch, construct a prototype of your robotic arm. As you build, you may find that some materials don't work as you expected. Some pieces may not fit together quite right. Your design may need changes. That's OK! It's part of the process.

Does the robotic arm work as expected? Does it work consistently? Is it well constructed?

How can you improve your design?