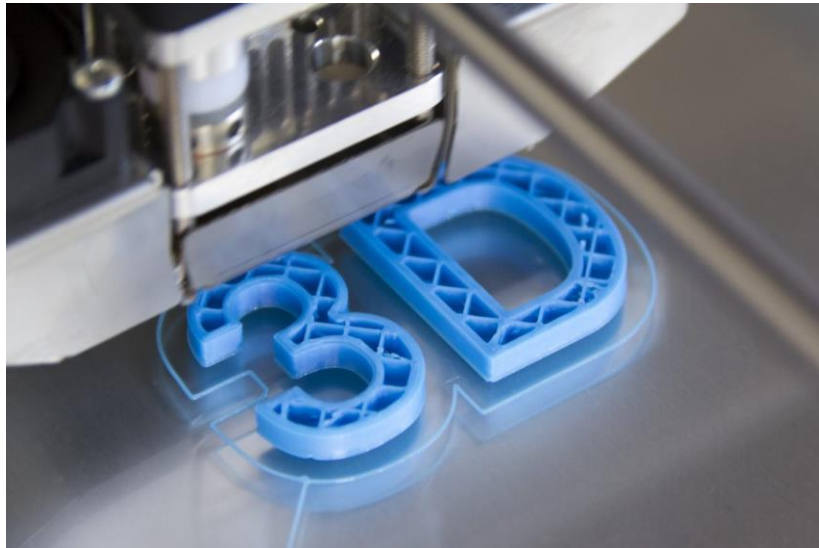


3D PRINTING CHALLENGE

Mechanical Engineering Challenge

3D Printing

Three- Dimensional, also known as 3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file. Three dimensions means the object has volume, a top and bottom, left and right (sides), as well as a front and back. The creation of a 3D printed object is achieved using additive processes. In an additive process an object is created by laying down successive layers of material until the object is created. 3D printing enables you to produce complex shapes using less material than traditional manufacturing methods.



Mechanical Engineering

One of the most diverse and versatile engineering fields, mechanical engineering is the study of objects and systems in motion. As such, the field of mechanical engineering touches virtually every aspect of modern life, including the human body, a highly complex machine. The role of a mechanical engineer is to take a product from an idea to the marketplace.

Related Careers:

- Aerospace engineer.
- Automotive engineer.
- CAD (computer-aided design) technician.
- Contracting civil engineer.
- Control and instrumentation engineer.
- Maintenance engineer.
- Mechanical engineer.
- Nuclear engineer.

3D Printing and Mechanical Engineering

3D printing or additive manufacturing is a process of making three dimensional solid objects from a digital file. The creation of a 3D printed object is achieved using additive processes. In an additive process an object is created by laying down successive layers of material until the object is created.

3D Printing contributions to Mechanical Engineering:

- developing your prototype.
- improvement of your designs.
- optimization of your inventory.
- maximize the performance of your mechanical system by optimizing its structure.
- speed up your manufacturing process.
- reduce assemblies and welding steps.
- produces exact replicas.
- mass produces identical replicas.
- customized pieces/parts.

3D Pens

3D pens allow for small scale, quicker and finer additions to 3D projects. While difficult to manage at first, with practice and patience, many things can be done with a 3D pen. Let's get some practice of our own now!

Case Study: The International Space Station



You are a mechanical engineer working for NASA in Florida. Currently, you are on the International Space Station (ISS), 254 miles from Earth.

Although a rocket can transport astronauts into space in less than 10 minutes, it takes hours, and even days, to rendezvous with the International Space Station. Despite being relatively close, the ISS is traveling at more than 17,000 miles per hour in a circular orbit around Earth. Anything moving that fast, whether in space or on the ground, is going to be hard to catch.



Problem

While doing quality control checks, the safety officer of your crew finds a damaged gear on the International Space Station (ISS). There are no replacement parts and you need this gear in order for anyone to enter or leave the ISS. To complicate things, you do not have the proper tools to remove the damaged gear.



Challenge

- Design a tool that can remove the damaged gear
- Create a tool that can remove the damaged gear
- Use a template to create a replacement gear

Objectives

- List STEM Careers that involve Mechanical Engineering
- Operate 3D printing tools
- Create a 3D prototype that can be used in mechanical engineering

Materials

- 3D pen
- Filament
- Patience
- Practice



Activity

Planning

With your group, discuss the problem and brainstorm at least 5 possible solutions for the challenge. Remember, you have to not only create a new gear, but you have to design a tool that removes the damaged gear as well.



Design

Draw your solutions your team came up with during your planning time. Make the sketches large enough (2 inches x 2 inches) so that you can use them as stencils when you are ready to print. As a team, choose 1 tool and 1 gear that you will print.

Test

In order to make the new gear you need to use your pen, but first you need to know how it works.



This is the Pen you will be using

These are the buttons that control the filament going in and out of the pen



This is the Extruding tip

Use caution around this part of the pen. The extrusion tip heats to extreme temperatures and can burn and injure you unless you are careful.



This button releases the pressure the gear places on the filament to help remove it from the pen.





This is the filament feed hole. This is where you place the filament into the pen

Now that you know your tool you will be using its time to start making! Do your best to follow the stencils you've created and make the gear for the ISS!
Good luck!

Reflection

1. What do mechanical engineers do?
2. Why is 3D printing used so often in the field of mechanical engineering?
3. Why did your team have to brainstorm at least 5 ideas?
4. Why didn't NASA just send a new part and tool to the ISS?
5. What was the most difficult part of designing the tool?
6. What was the most difficult part of creating the gear and tool?

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