

STEM ACTIVITY LESSON

INTRO. TO 3D MODELING AND PRINTING IN SPACE



Grade Level

6th - 12th



Focus Areas

Computer Science and Creativity



Standards

MS-ETS1-4 | HS-SEP

BACKGROUND INFORMATION

3D printing, also known as additive manufacturing, creates objects by layering materials like plastic filament one row at a time from a digital model. While plastic is common, other materials like resin, metal, and nylon are also used. This technology is already transforming industries such as healthcare, aerospace, and automotive, and is increasingly found in schools, homes, and labs. In space, 3D printing offers solutions for long missions by allowing astronauts to manufacture tools and parts as needed, reducing reliance on resupply from Earth. NASA successfully 3D prints aboard the International Space Station and uses printed parts on Mars rovers like Perseverance. Scientists are exploring 3D printing for constructing future Moon habitats, including printing with simulated regolith—lunar soil—which is abundant and may offer protection from radiation.

STUDENT REAL-LIFE

CONNECTIONS

- Just like 3D printers build objects layer by layer, LEGO and Minecraft involve creating complex structures one piece or block at a time.
- Imagine forgetting your school supplies and having to find a creative solution using what's around—like borrowing, sharing, or improvising.

LESSON

OBJECTIVES

- Identify the uses of 3D printing in space.
- Recognize how natural resources like regolith can be used to create Lunar habitats using 3D printing.
- Create a 3D model of a Lunar habitat.

MATERIALS

LIST

- Planning page (30)
- Computers or tablets with internet access (30)
- Computer Mouse (30)
- Link to "Lunar Surface" file: [Lunar Surface](https://www.tinkercad.com/things/7wl3UIGkTf-lunar-surface) (<https://www.tinkercad.com/things/7wl3UIGkTf-lunar-surface>)
- How We Design worksheet (30)
- 3x3in sticky note (30)

ACTIVITY

DIRECTIONS

Prepare

- Have "Lunar Surface" link ready to share with students. When they open it, that will create a copy for them to use and design on.
- You can set-up an optional class code for your students to use when logging into TinkerCAD.

Excite

- Using think-pair-share: What have you heard about 3D printing already?
- Show students an image of a 3D printer model such as Prusa i3 or Ender S1 Pro. Explain that a 3D printer builds a 3D model by layering down lines of melted material onto the print bed, one layer at a time until the object is built. The most common material is plastic filament called PLA, or polylactic acid. It's a thermoplastic material derived from renewable sources like corn starch or sugarcane.
- Ask students to share aloud to the class: How could 3D printing be useful in space?
- Explain to students some of the ways 3D printing is currently used in space, from experiments to printed objects on the International Space Station, to parts of a Mars rover being 3D printed.

Explore

- Explain to students that before you can print an object, you must have a CAD file for it. CAD (Computer Aided Design) files can be made on a variety of software. The file is converted to a form the printer can read, and then the object in the file can be 3D printed. Students will experience part of this process by designing in a software called TinkerCAD.
- Have students log in to TinkerCAD. They can log in using a class code if you set one up, or just by using any google account they have.
- Give students the "How We Design" worksheet.

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ACTIVITY

DIRECTIONS (CONTINUED)

Explain

- Have students set aside their computers or tablets. Explain that 3D modeling has many uses, both on earth and in space. Tell students about how NASA is looking at 3D printing to help with exploring the moon. For example, future Moon missions may need bigger habitats to house the people, life support, solar panels, etc. That habitat could be 3D printed using regolith (the loose dirt and rock) from the moon.
- Explain to students what regolith is. Show them the image of Buzz Aldrin's footprint in the regolith.
- Have students think-pair-share: Why would it be useful to use regolith when designing a Moon habitat? What other items would be needed aside from the material to make the walls?

Extend / Expand

- Tell students that they are designing a Moon base of their own. Their TinkerCAD design will show the outside of a Moon base. They can design it however they want, but need to be able to explain:
 - What materials are used to build the Moon base?
 - How does the Moon base get power?
 - How do people get in and out of the Moon base?
 - What supplies and equipment are on the outside of the Moon base?
- Students will build their Moon base in either a new TinkerCAD file, or using the provided "Lunar Landscape" file. If students use the Lunar Landscape file, be sure to share the link with them.



Elaborate

- Have students answer the following questions on an exit sticky note or in their notebooks:
 - How can 3D printing a Moon base help with space exploration? Why not just send pre-built habitats instead?
 - What are some other ways that 3D printing could be helpful in space?
- If there is time, have students share their answers with the class.

HOW WE DESIGN USING TINKERCAD

Directions: Use this page to learn how to design in TinkerCAD. As you go, draw or write a description of what you learned from each tutorial.

1. Go to TinkerCAD.com and log in.
2. Click Resources -> Learning Center.
3. Click on the first tutorial (Place It). Work through the tutorials, and as you complete each one fill out the chart below.

Tutorial	What did you learn how to do?
Place It	
View It	
Move It	
Rotate It	
Size It	
Group It	
Copy It	
Duplicate It	
Hide It	
Align It	
Creating Holes	