

Educational Exercises Helping Students See Technology at Work

SOLIDWORKS Apps for Kids are designed to inspire students to create, invent, and shape their futures. Educators can use the following exercise to engage their students, and help them imagine and explore how their abilities can impact the world.

SOLIDWORKS Apps for Kids | Living in Space





In this activity, students will use the SOLIDWORKS Apps for Kids to create 3D models of human habitats in space. Students can either start from scratch, or use one of the basic habitat structure models provided as part of this exercise.

Before introducing the students to SOLIDWORKS Apps for Kids, read the "Consider This" section below to your students, then use the included questions to encourage them to consider the challenges of living in space.

CONSIDER THIS

Have you ever dreamed of living in space? Space travel is an exciting challenge that thousands of people every day are working to make safer and easier. Because most places outside Earth won't easily support human life, human explorers will have to bring or build everything they need to survive with them into space. The area around a creature that it needs to survive is called its habitat. Take a moment and consider some of the ways space travel is different from traveling here on Earth, and why habitats in space need to be different too.

- What types of things would you need if you were taking a long trip away from home?
- What kinds of equipment would be needed to study places and objects in space?
- What ways could astronauts get the important things they need once they're in space?

TIP: If the students are having trouble thinking of the things astronauts would need for a journey into space, you may want to prompt them to consider things they packed on a recent long trip or vacation. Ask them to think about how they would sleep, work, play, exercise, and relax. Also, ask them think about how they would acquire necessities like air, food, water, power, etc.

MODELING THE HABITATS

Once the students have had time to consider the habitats they'd like to create, have them launch SOLIDWORKS Apps for Kids Classroom. To help the students get started, we've created a few simple animal models for this exercise. You can access the Sample Content in the Sample Lessons section of the Organization tab in your Classroom account. Share this content to your class and the students can use it as a starting point by clicking the "Riff" button on the model they like. Students can also start completely from scratch by launching the **Shape It** app from the plus sign in the main menu at the top of the app.

SOLIDWORKS has some video tutorials that can help students get familiar with the **Shape It** app's basic features. Students can watch the videos by clicking the Help icon in the main menu at the top of the app. But since the **Shape It** app works a lot like modeling clay, many students will be comfortable jumping right in and learning about the app as they go.

TIP: The included habitat models for this project may seem advanced, but they are really just combinations of basic shapes that have been pushed, stretched, or reshaped to look like buildings and other habitat structures. Encourage the students to start working with their models by adding a few of the basic shapes side-by-side onto the work area, and then start clicking on the shapes to mold them into looking more like the structures they want to create. Also encourage students not to get frustrated if their models do not look like they want immediately. 3D modeling can involve a lot of reshaping to get something exactly right, and students should be reminded that many creations may need lots of changes over time, and that this process of making changes is how ideas are improved.



The **Shape It** app allows students to place multiple objects together to make more complex models.

To add new shapes, click the Shapes button at the bottom of the app, then select the shape you want to add. If you want to work with a simple shape, choose the Box, Cone, or Cylinder. The app also allows you add more complex shapes like a Torus, Globe, or Ball as well.

Click the shape you want and it will be added to your model.



The **Shape It** app works similar to modeling clay. Just click on a section of a shape and drag it somewhere to begin changing the shape. You can also click on edges and corners between sections of a shape, and then drag those as well.

When you click on a section of a shape, a popup menu with more editing options appears. These extra options can allow you make big changes to the shape, like add new sections, smooth or sharpen a section, or even make a duplicate of the shape in the model.

Experiment with different options to see how creative you can be with your space habitat.



Students should keep in mind the shape of the structure is only one part of its design. Many similarly-shapes structures will look very different once unique styling elements, like color and exterior markings, are added.

TIP: It's important for students to not get frustrated if their models don't look perfect. Patience, and determination are great qualities to have when creating new things. Encourage students to stick with it, and focus on completing individual parts of their structures one-at-a-time.



STYLIZING THE HABITAT

Once students have shaped their models, they can also decorate them in the SOLIDWORKS **Style It** app. Student can open the **Style It** app by clicking the Apps button in the main menu at the top of the app. Students should experiment with the different painting and styling tools in the app.

The Style It app has a collection of powerful styling tools for students to use:

- The Bucket tool lets students paint an entire shape a single color in Body Color mode, or paint just parts of a shape in Patch Color mode.
- The Paint tool lets student select a brush size and paint colors directly onto shapes.
- The Stickers tool lets students add even more detail with stickers on the shapes.
- The Scene tool lets students add a background picture to their model.



To use the Bucket tool, click the Bucket tool icon at the bottom of the app. This will open up the Bucket tool side menu.

The Bucket tool has two modes: Body Color and Patch Color. Body Color mode will paint and entire shape, while the Patch Color mode will paint individual sections of the shape in the color selected. This will open up the Paint tool side menu. The Paint tool.



To use the Paint tool, click the Paint tool icon at the bottom of the app. This will open up the Paint tool side menu.

The Paint tool has two modes: Paint and Erase. The Paint mode allows you to change the brush size and draw the selected paint color directly onto the shape. The Erase mode allows you remove parts of what you've painted in Brush mode.



To add stickers to your model, click the Sticker tool at the bottom of the app. This will open up the Sticker tool side menu.

The **Style It** app has a collection of exciting stickers available. To add a sticker, click on the sticker you want, and then click on the section of the shape in your model to place the sticker.

When styling the structures, students should consider how each structure will be used in the habitat and ways its appearance will compliment the structure's use.



To add a background picture behind your habitat, click the Scene tool at the bottom of the app. This will open up the Scene tool side menu. Click a scene for your habitat.

TIP: For this exercise, students should also consider using a background scene when styling their habitat. The **Style It** app has several different backgrounds, like Space, Alien Landscape, and Desert included in the app's Scenes feature, that should be helpful in picturing how the new habitat would actually look.

PRINTING THE HABITAT

Students can print a 2D or 3D version of their structures in the SOLIDWORKS **Print It** app. Student can open the **Print It** app by clicking the Apps button in the main menu at the top of the app. The 2D Print feature can print out a color rendering of the habitat with the background selected in the **Style It** app. The 3D Print feature will let students download an STL file to be imported into the software that comes with most 3D printers. Students should make sure their models are scaled to fit within the printable area of their 3D printer before 3D printing.

TIP: Depending on the complexity of the habitat models, and on the speed of the device being used, it may take a moment for the 3D Print button to become available. This is normal behavior, as the system is having to run a lot of calculations to translate the models into the 3D files.

After the print is complete, student should carefully remove their models from the printer. The models may need to be cleaned up to remove any unwanted, stray filament material. Once removed, the students can paint their habitat to make them just like the digital versions in the app.



The **Print It** app relies on a very easy-to-use design to enable students to print their new habitat models. After selecting the type of print, click on the download button (Download STL, 2D Print, or Cube Print) and the files will be downloaded to your device's drive. From there, use the printing software you've setup on your printer to print what you'd like.









DISCUSSING SPACE HABITATS

After students have shaped and styled their models, have them consider and discuss the following questions about creating habitats for living in space:

- Think about the habitat you made. What parts do you think turned out the best?
- What parts of your habitat have specific purposes like, areas for working, exercising, eating, and other activities?
- How does your habitat make it easier for humans to survive in space?
- How could you use your habitat model to explain to someone what a mission to another planet would be like?

THE FUTURE OF HABITATS IN SPACE

The videos listed below can help students explore and understand how scientists and engineers are planning for the future of space exploration and habitation in space. Read the introduction paragraph to the students, then have them view the videos for that topic. After students have viewed the videos, you can use the included questions to encourage discussion on those topics.

NASA's BEAM Expandable Habitat

Did you know there are thousands of people around the world who are working and planning for a future where humans visit other planets? Have you ever wondered what living in space or on another planet would be like? In the following video, you'll learn some of the ways scientists and engineers at NASA are planning for humans to spend longer and longer amounts of time



in space. After you watch the video, you'll have a chance to talk about how these new ideas could lead to humans living on other planets.

BEAM Installation Video: http://bit.ly/career5366

- What are some of the things a space habitat needs to allow humans to live and work in space?
- What are some challenges to building human habitats in space and on other planets?
- What ways would an expandable habitat section make living in space better?
- Imagine if you lived on a space station, or in a habitat on another planet. What are some ways your life would be different if you lived in a space habitat, like the one shown in the video?

NASA employees thousands of people working to direct and oversee how we explore our universe. In addition to the video above, the <u>CareerOnestop</u> website has more information on the scientific and engineering careers related to exploring our universe.

3D Printing a Space Vehicle

Have you ever dreamed of exploring another planet? Engineers at NASA don't just dream about it, they're working to make it possible. In the following video, you'll learn how these engineers use advanced 3D modeling and printing methods to construct space vehicles that could someday drive across the surface of another planet. After you watch the video, you'll have a chance to talk about how their



work makes the dream of safe, exciting space exploration closer to reality.

3D Printing a Space Vehicle Video: http://bit.ly/career3120

- What are some of the things a vehicle needs to have to explore the surface of another planet?
- Why is getting vehicles on the surface of another planet so difficult?
- In what ways is the design and construction of the NASA Rover similar to the way you designed your 3D habitats with Solidworks App for Kids?
- How have inventions like 3D printing made building things like the NASA Rover better?

NASA engineers design, build, and test all kinds of exciting equipment in the quest to better understand our universe. In addition to the video above, the <u>NASA For Students</u> website has more information on how the many ways NASA works to unlock the mysteries of the universe.

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Videos and associated images courtesy of NASA.

EDUCATOR RUBRIC

ITEM	Does Not Meet Expectations	Meets Expectations	Exceeds Expectations
Understanding the Assignment – Consider This	Student does not express opinions, or could not name differences between living and traveling in space, compared to on Earth.	Student is able to express differences between living and traveling in space, compared to on Earth.	Student can express how astronauts can get the important things needed to survive in space.
Using the Shape It app to Modify or Create a Model	Student was unwilling or unable to add shapes and objects to a new model, or add or adjust objects in a riffed copy of an existing model.	Student modified an existing model or created a new one by adding or modifying shapes in the model.	Student demonstrated original creativity and/or artistic ability by making substantial modifications or new models that are associated with the goals of the lesson.
Using the Style It app to Decorate a Model	Student was unwilling or unable to add decorations to a new model, or add or adjust decorations in a riffed copy of an existing model.	Student decorated an existing or new model by adding or modifying colors or stickers in the model.	Student demonstrated original creativity and/or artistic ability by decorating their models in ways that blended successfully with the background scenes in the lesson.
Printing the Model (optional)	Student was unwilling or unable to print the model, even with assistance.	Student was able to print the model with assistance.	Student was able to print the model with little or no assistance.
Discussing Space Habitats	Student was unwilling or unable to express why he/she designed their habitat, or why it would help humans live in space.	Student was able to express their reasoning for designing their habitat, or why it would help humans live in space.	Student was able to express reasoning for their habitat, why it is helpful to human life in space, and the types of space exploration it could promote.
The Future of Habitats in Space	Student did not express or understand careers in science and engineering related to space exploration.	Student is able to name some challenges to living in space, or the difficulties in getting vehicles to other planets.	Student is able to name some challenges to living in, or getting vehicles to, space, and how science and engineering careers help make space exploration easier.



This project is most closely aligned with the middle school engineering standards in the Next Generation Science Standards (MS-ETS1-1 and 1-4) and (MS-LS 2-2) MS-LS 4-4:

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions..

Students design, develop and then refine their own animals based on characteristics of their habitat. They have opportunities to improve their designs.

In addition, this project addresses cross cutting concepts of how patterns can be used to identify cause and effect relationships.

Additional standards addressed in the conversation and development of this model include:

ETS1.A: Defining and Delimiting Engineering Problems

The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)

MS-ETS1.B.6 (Middle School Engineering Design): Models of all kinds are important for testing solutions.

MS-ETS1.B.1 (Middle School Engineering Design): A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.

MS-ETS1.B.3 (Middle School Engineering Design): There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.

MS-ETS1.B.4 (Middle School Engineering Design): Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.