



JUNIOR RANGER Space Tech Explorer

Explorer's Activities

AGES 5 TO 12

Explore. Learn. Protect.

NASA and the National Park Service, or NPS, work together to celebrate America's heritage and the excitement of exploration—on Earth and in space! In celebration of Earth Day's 50th anniversary, NASA and NPS created three additional Junior Ranger Spaceflight Explorer activities focused on space technology and its connection to your life on Earth.

1. Space Tech in Your Campsite
2. Space Tech Supports Your Parks
3. Living off the Land (and Moon!)



NPS honors Lewis and Clark at Gateway Arch National Park in Saint Louis, Missouri

Ready to explore your national parks?
Find Your Park at <https://www.nps.gov>

America Explores

In 1804, Meriwether Lewis and William Clark led a group of explorers from St. Louis, Missouri, across a great wilderness to the Pacific Ocean.

During the decades that followed, millions of Americans migrated west. The journey required settlers to live off the land, using the resources found around them to build homes, grow food, and form new communities. Settlers also benefited from new advances in technology, such as the creation and use of steamboats, locomotives, railroads, and the telegraph.

William Clark



Meriwether Lewis



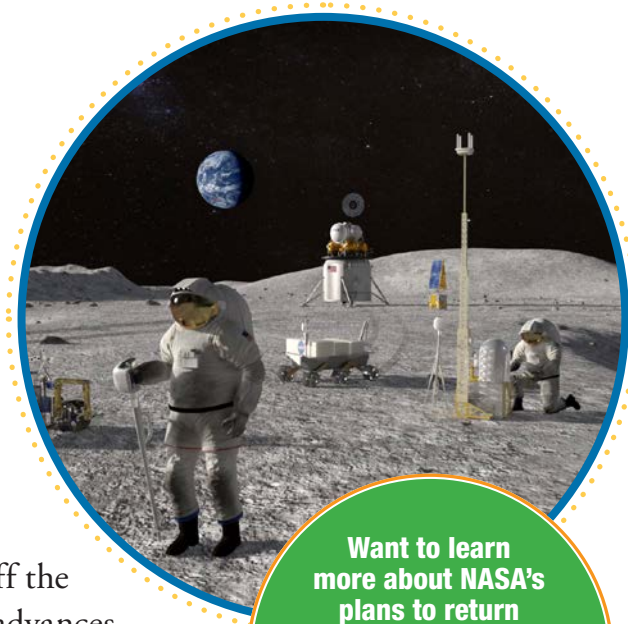


NASA Technology Helps Us Explore Earth and Beyond

In 1969, 165 years after Lewis and Clark left Missouri, Americans set off to explore beyond our world. The Apollo program was the first time humans left Earth's orbit, traveled into deep space, and stepped on the Moon. **With the Artemis program, NASA is planning to send astronauts to the Moon by 2024 to help prepare for the next giant leap—sending humans to Mars.** Like earlier settlers, we will need to travel farther, communicate longer distances, and live off the land, or in this case, the Moon and Mars. Once again, advances in technology are needed to accomplish our ambitious goals.

NASA technology is critical for space exploration, but did you know this same technology also helps us on Earth? NASA spinoffs are products that started as NASA technology, or were worked on by NASA, that are now used for other purposes. From space blankets, to digital cameras, to improved GPS, spinoffs can be found in our homes, cities, and even national parks.

Whether you are in your backyard, public lands, or deep space, technology drives exploration.



Want to learn more about NASA's plans to return humans to the Moon and explore Mars?

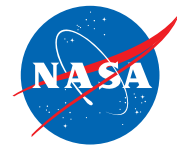
Check out <https://www.nasa.gov/artemis>

Each activity is rated by difficulty:

- ★ Ages 5 and up
- ★★ Ages 8 and up
- ★★★ Most challenging

Joshua Tree National Park





Space Tech in Your Campsite

Did you know NASA space technology is around you all the time? NASA spinoffs are products that started as NASA technology, or were worked on by NASA, that are now used for other purposes here on Earth. Spinoffs are even with you in your national parks!

ACTIVITY Find the NASA Spinoffs

★ Find and circle the spinoffs in the campsite picture.



Freeze-Dried Food



Space Blanket



UV-Reflecting Sunglass Lenses



Water-Filtering Bottle



Camping Trailer



Digital Camera

Ready to explore your national parks?
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Seaman Junior is named after the large Newfoundland dog that traveled with Lewis and Clark.



Space Tech in Your Campsite

☆☆☆ Read more.



1 Freeze-Dried Food

Astronauts have to be ready for long missions away from home, so NASA researched different ways to preserve food. Freeze-dried foods are lightweight and long-lasting and can be prepared quickly and easily.



2 Space Blankets

The shiny “space blankets” in many first aid kits are just one of many uses for the lightweight, multi-layer reflective insulation invented by NASA. The technology traps your body’s heat, keeping you warm.

3 Camping Trailers

A NASA researcher who helped design a living space for the International Space Station used this experience to design a camper that makes the most of a small space.



4 UV-Reflecting Sunglass Lenses

NASA scientists invented lenses that filter out harmful blue, violet, and ultraviolet light to protect astronauts’ eyes in space. Based on oil droplets in the eyes of hawks and eagles, the lenses both protect eyes and improve eyesight.



5 Water-Filtering Bottles

Much like in the parks, clean water is critical for humans in space. Make sure your drinking water is safe by using a water bottle with a special filter, created with the help of NASA, which traps and removes pollution from drinking water.

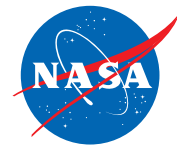


6 Digital Cameras

Take pictures and videos of your adventure using your cell phone, or pretty much any other digital camera, thanks to a digital image sensor created by a NASA engineer and his team.

There are thousands of NASA spinoffs all around you, every day! Want to learn more? Check out <https://homeandcity.nasa.gov> and <https://spinoff.nasa.gov>.

Photo credits: Freeze-dried strawberries: Wikimedia/Savant-four; Space blanket: <https://www.anypromo.com/>; Trailer: TAXA Outdoors; Sunglasses: Rich Niewirowsk, Jr.; Water bottle: OKO H2O; Camera: Bridget Coila.



How Space Tech Supports Your Parks

NASA creates new technology to explore space, protect astronauts, and much more. Many of these same technologies help us study and stay safe on our planet, Earth. NASA spinoffs are products that started as NASA technology, or were worked on by NASA, that are now used for other purposes. Through spinoffs, NASA technology is also used to protect our national parks and outdoor explorers.

ACTIVITY Match the Spinoff to the Park

★ ★ In the boxes, write the letter of the spinoff that could be best used by each national park.

SPINOFFS

A Forest Fire–Fighting Drones



Drones can spot and map forest fires and send data to firefighters on the ground.

B GPS in Tractors



Farmers can use self-driving tractors thanks to highly accurate GPS made possible by NASA data.

C Laser Imaging for Archaeologists



Lidar technology uses laser light to detect features on Earth covered by plant life, helping archaeologists uncover and study ancient sites.

D Search-and-Rescue Satellites



Satellites can detect and locate emergency signals. This technology makes it easier to rescue people, including those stranded in water or on boats.

E Mineral Analyzer for Geologists



A portable x-ray instrument can tell geologists a lot about rocks and minerals they find in the field.

NATIONAL PARKS

Hawai'i Volcanoes National Park HAWAII



With two active volcanoes, the park is a great place to study geology. Visitors can learn about how the volcanoes, rocks, and minerals affect Hawaii's unique ecosystems and native history.

Cape Lookout National Seashore NORTH CAROLINA



The park covers three barrier islands surrounded by salt water. While most visitors enjoy the waters in the park safely, park rangers can perform search and rescue when needed.

Cuyahoga Valley National Park OHIO



Along the Cuyahoga River, the park has historic trails, forests, rolling hills, and open farmland. In fact, some farmers use park land to grow crops and raise animals.

Effigy Mounds National Monument IOWA



Over thousands of years, many different Native American groups built mounds in the earth. Archaeologists study the historic mounds and their shapes, like circles, bears, birds, panthers, and snakes.

Yellowstone National Park IDAHO, MONTANA, & WYOMING



Fire is a key factor in shaping the park's healthy ecosystem. Among other things, natural wildfires help cycle nutrients. Park rangers monitor natural wildfires to make sure visitors are safe.

Photo credits: Drone: NASA; Tractor: John Deere; Lidar image: NPS; Satellites: NOAA; Mineral Analyzer: Olympus Scientific Solutions America; Hawai'i Volcanoes National Park: NPS/Janice Wei; Cape Lookout National Seashore: NPS; Cuyahoga Valley National Park: Jasperdo; Effigy Mounds National Monument: NPS/Kristen Maxfield; Yellowstone National Park: NPS/Diane Renkin.

DIFFICULTY LEVEL
★ ★ Ages 8 and up

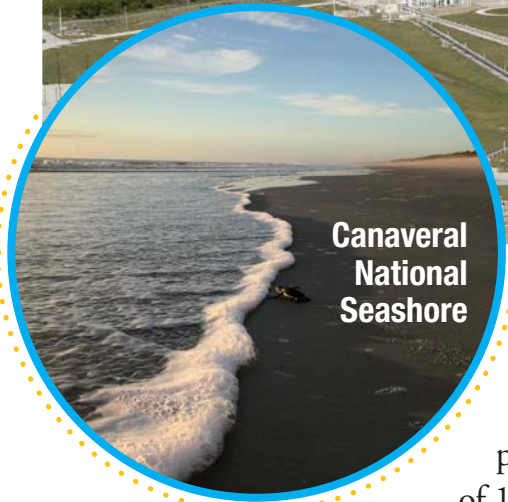


How Space Tech Supports Your Parks

☆☆☆ Read more.

DID YOU KNOW that NASA's Kennedy Space Center works with Canaveral National Seashore to manage about two-thirds of the park's land and waters?

Ready to explore your national parks?
Find Your Park at <https://www.nps.gov>



Canaveral National Seashore

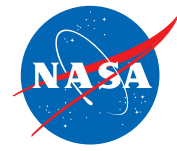
The launch pads at Kennedy Space Center have seen a lot of history, including serving as the starting point for all of the Apollo missions. Apollo is the name of the NASA program that resulted in American astronauts making a total of 11 spaceflights and walking on the Moon. During the Apollo program, the chemicals used to clean rockets while on the launch pads soaked into the surrounding soil and groundwater. These chemicals could have been harmful to the nearby wildlife. Canaveral National Seashore, located at the northernmost end of Kennedy Space Center, is home to many threatened and endangered animals, including marine turtles.

To help protect the environment and precious wildlife, NASA developed a mixture of iron, water, and oil to remove the toxic chemicals from the groundwater. This method is now used to clean polluted groundwater around the world!



Photo credits: Kennedy Space Center: NASA; Canaveral National Seashore: Kenneth Millar; Baby sea turtle: U.S. Air Force/Jerron Barnett; Bald eagle: NPS/Welch.

 **Want to learn more?**
Check out <https://homeandcity.nasa.gov> and <https://spinoff.nasa.gov>.



Living Off the Land (and the Moon)

During the 1800s, millions of Americans migrated west. Life on the prairie was not easy. Settlers needed to use what they could find around them to survive. The land was largely treeless, filled with grasses. Many settlers built homes using the top layer of dirt and grass, called sod.

Today, NASA is getting ready for humans to live on the Moon and eventually Mars. Like previous settlers, we need to use what we can find. NASA is also exploring how to use regolith, a loose layer of rock and minerals, found on the surface of Moon and Mars to build shelters.



ACTIVITY Design a Habitat

★ ★ Draw your lunar or Martian habitat in the space provided below.

Photo credits: Settlers: Solomon D. Butcher; 3-D printing robot on the Moon: Behnaz Farahi/NASA.

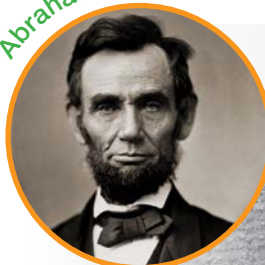


Living Off the Land (and the Moon)

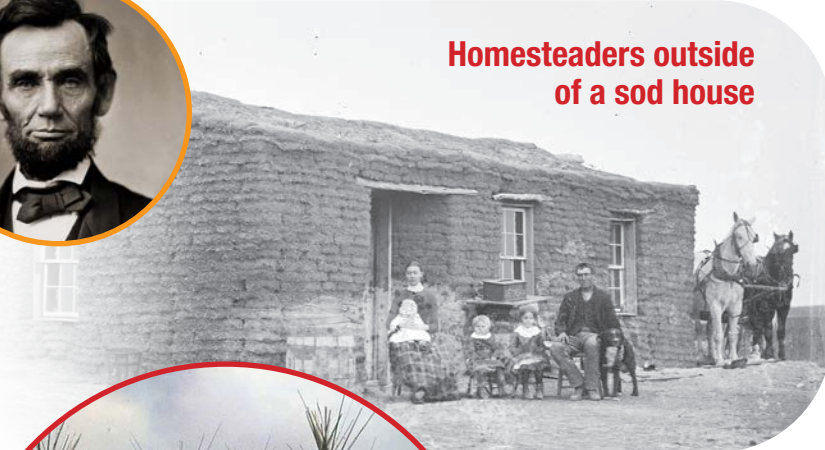
☆☆☆ Read more.

In 1862, President Abraham Lincoln signed the Homestead Act into law. This allowed settlers to claim 160 acres of public land in the American West as their own. If the settlers, also called homesteaders, farmed and lived on the land for five years, then they owned it. Homesteaders faced difficult challenges, like needing shelter. Since wood was not easily available, they used local sod to build their homes.

Abraham Lincoln



Homesteaders outside of a sod house



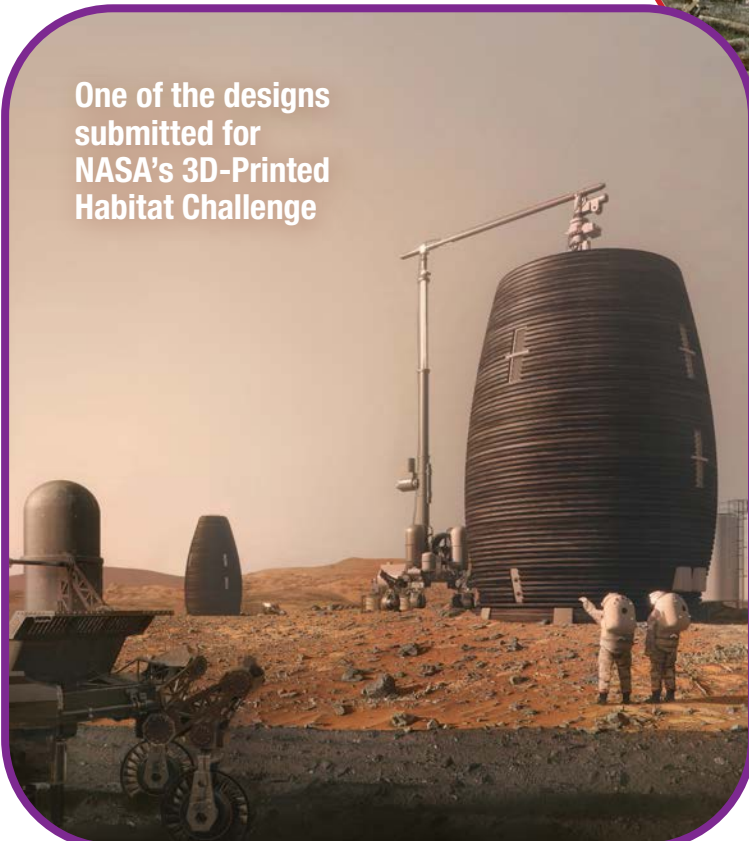
The Blackfoot Tribe of Montana built tipis using local resources



As homesteaders claimed western land, many Native Americans were forced to leave their homelands, even killed. NPS works with tribal communities to support cultural and traditional sites.

Explore more national park history and find your park at <https://www.nps.gov>

One of the designs submitted for NASA's 3D-Printed Habitat Challenge



Using local resources is important for deep space NASA missions too. Launching supplies from Earth is expensive and can take a long time to arrive—even months! Whereas homesteaders used sod bricks to construct homes, NASA is exploring using regolith, a loose layer of rock and minerals, to 3D print shelters on the Moon and Mars!

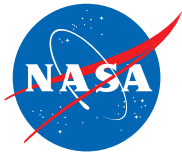
DIFFICULTY LEVEL

☆☆☆ Most challenging



Junior Ranger Space Tech Explorer Pledge

As a Junior Ranger, I promise to explore science, nature, and history at our national parks and science and space centers, teach others about what I learned today, and help preserve and protect these places for future generations to enjoy them.



JUNIOR RANGER CERTIFICATE



This is to certify that



has completed the requirements and is a
Space Tech Explorer Junior Ranger

Park Ranger Signature



The fun doesn't stop here!

You can find more information and activities online at <https://www.nasa.gov/stem> and <https://www.nps.gov>.



Vocabulary

NASA Spinoff: A product that started as NASA technology, or was worked on by NASA, that is now used for other purposes.

Ultraviolet Light: A type of energetic light humans cannot see, but some birds and insects can. It is part of the electromagnetic spectrum, which is the name for all the different kinds of light in the universe.

Lidar Technology: Short pulses of laser light that reflect off surfaces and objects to detect features and locations.

Regolith: Dust, soil, broken rock, and other related materials found on the surface of Earth, the Moon, Mars, and other planetary bodies.

Sod: Top layer of dirt and grass found on Earth.

Homestead Act: Law signed in 1862 that allowed settlers to claim 160 acres of public land in the American West if they could farm and live on the land for five years.

Answer Key

Space Tech in Your Campsite



How Space Tech Supports Your Parks

Hawai'i Volcanoes National Park: **E**

Cape Lookout National Seashore: **D**

Cuyahoga Valley National Park: **B**

Effigy Mounds National Monument: **C**

Yellowstone National Park: **A**