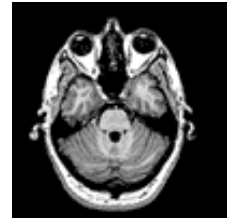


Civil Air Patrol's ACE Program

NASA Spinoffs

Grade 4 Academic Lesson #8



Topic: technology (science, language arts)

Lesson Reference: NASA Explores

Length of Lesson: 30 minutes



Objectives:

- Students will make predictions.
- Students will define NASA spinoffs.
- Students will identify NASA spinoffs.
- Students will evaluate the importance of NASA spinoffs.



Next Generation Science Standards:

- 3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved
- 3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

CCSS ELA Standards:

- RI.4.1-Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.
- RI.4.3-Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.

- RI.4.10-By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4-5 text complexity band proficiently, with scaffolding as needed at the high end of the range.

Background Information: (from NASA Explores)

Dental braces, rechargeable batteries, cordless power tools, and cardiac monitoring equipment—every day, we use products and services that originated from space technologies. We have better means of detecting and treating cancer and cardiovascular disease because of our space programs. Space programs also taught us about the large ozone hole in our atmosphere, the hazards of solar radiation, the path of killer hurricanes, and how to more effectively manage crops and our national forests. If not for America's continued investment in space exploration, we wouldn't have wireless telephones, satellite television, or global positioning systems. Our technology has even been used to help law enforcement put criminals behind bars and to protect firefighters. The technologies that led to the computer bar codes in retail stores, the quartz watch you are wearing, and household smoke detectors that help you sleep soundly at night were originally developed for NASA. One thing that you use often is a product of our space program. Cell phone cameras were developed by engineers at the Jet Propulsion Laboratory. The technology for small, digital cameras was needed in order to have high quality pictures from cameras that were small enough to fit in a spacecraft.

The benefits of aerospace technology to mankind are becoming more and more commonplace thanks to scientists involved in the space program, and to private companies that transfer aeronautics and space technology into products and services for everyday living. When aerospace technology is adapted for commercial use, it is called technology transfer (spinoffs). NASA investments in space have yielded more than 1,200 spin-offs used to enrich lives on Earth every day. Each year three-technology transfers are inducted into the U.S. Space Foundation's Technology Hall of Fame.

Through exploring space, we improve our lives, boost our economy, inspire future generations, and lift our national spirit—all this for less than one percent of the Federal budget!

In this lesson, students will predict which items are NASA spinoffs, and then they will learn the correct answers to their predictions.

For more background information, you may wish to watch the following videos (or show them to your class): [27 NASA Inventions You Use EVERYDAY](#), or [Did You Know That's a NASA Technology?](#)

Materials:

- dry erase board with marker (or chalkboard and chalk)
- "More NASA Spinoffs" copy for each student (copy included)
- "Why Space? - Crossword Puzzle" (optional)
- Teachers will need a free account with [Newsela](#). Any of the articles below can be used to meet the ELA standards attached to this lesson:
 - "Long After Challenger Space Shuttle Exploded, People Can Learn From It"
 - "Famous Speeches: Ronald Reagan's Challenger Disaster Address"

NOTE: You may choose to allow students to discover not only the meaning of NASA spinoff, but also information about spinoffs by substituting the enrichment activities for the lesson presentation below. (Also, please note that Tang and Velcro are NOT NASA spinoffs.)

Lesson Presentation:

1. Ask students if they have ever thought about the importance of space exploration. Should we try to visit other moons and planets? Is it worth spending millions and billions of dollars to send people, spacecrafts, satellites, and space stations into space? After all, we have many things here on Earth that need our attention and money. Allow students to share their thoughts.
2. Write the term "NASA spinoff" on the board. Ask students if anyone knows what the term "NASA spinoff" means.
3. Explain that a NASA spinoff is a device or piece of technology that was originally created for or by NASA, but is now used by many people around the world in some way or another. According to NASA ([STMD: Technology Transfer](#)), "a spinoff is a commercialized product that incorporates NASA technology or NASA 'know how' and benefits the public, while a NASA success is a NASA technology that is not available on the market but still yields benefits to the public. For example, a NASA technology that was used to restore valuable artwork that was damaged in a fire is considered a 'success' because it is not available for sale on the commercial market."

4. Provide students with the example of temper foam that they may have seen advertised on TV. Originally, the development of this memory foam was under NASA contract with the goal of improving airplane cushions and providing better crash protection for those onboard a plane. Today, it is used in many mattresses and pillows! Tell students that they will see how many spinoffs they can identify.
5. Distribute the "More NASA Spinoffs" sheet to each student. Have them circle all of the items that they think are NASA spinoffs.
6. Once students have finished indicating their predictions by circling the items they think are NASA spinoffs, go over the information for each item. Have students keep a tally of the number they missed at the top of their page.
7. Discuss the results. Which student made the most correct predictions? Ask students to explain which spinoffs surprised them. Ask students to explain which spinoffs they think are best.
8. Ask students to pretend that they are designers or engineers and have to meet the criteria below to design a product that we could use in space but that could also be used in our everyday life.
 - a. The product needs to cost less than 100 dollars.
 - b. The product needs to monitor anything that's left plugged in in your house that shouldn't be (iron, curling iron, coffee pot).
 - c. How long would it take to make this product?
 - d. How would this product help us on earth and in space?
9. Pass out a copy of the Challenger disaster article. Tell the students a little bit about the Challenger.

[Duckster: Space Shuttle Challenger Disaster](#)

[KidzSearch: Space Shuttle Challenger Disaster](#)

[Remembering the Challenger: 25 Years Ago, Space Shuttle Exploded After Liftoff](#)

Let children read the article about the Challenger and talk through what we've learned from the Challenger disaster. How has the space program improved?

Summarization:

Ask a student to explain what a NASA spinoff is. Ask students how today's lesson affected their opinion of whether or not space exploration is important. Tell students

that the spinoffs they learned about today are just a few of the many NASA spinoffs. Ask students to think through how our lives would be different without the NASA spinoffs. Ask students how constraints in the final activity affected the product they could produce (or think of)?

Character Connection: Remind students that we enjoy many conveniences and better health today because people were curious and wanted to improve living and working conditions for others. Encourage students to always look for ways to help others. Remind students that curiosity and teamwork are ways that we can continue to grow and help others.

Assessment:

- teacher observation
- completed "More NASA Spinoffs" sheet
- "Why Space? - Crossword Puzzle" and/or "NASA Spinoffs" enrichment worksheets (optional)
- Newsela article

Additional activity ideas to enrich and extend the primary lesson (optional):

- Allow students to [Play the Spinoffs Memory Game](#) (You must have a browser that supports Java to play the Spinoffs Memory Game.)
- Have students complete the "Why Space? - Crossword Puzzle" that can be used with the [Play the Spinoffs Memory Game](#) site.
- Have students complete the "NASA Spinoffs" worksheet.
- With a specific list of NASA spinoffs from which to choose, students can vote on which one they feel is the best. With the data, help students create a bar graph or pie chart that illustrates which NASA spinoff students think is the best (or most important).

More NASA Spinoffs

Name _____

Look at each picture. Circle the pictures that show a NASA spinoff. Source: NASA Explores



Bicycle Helmets



Cordless Vacuums



Smoke Detectors



Joysticks



Foam Gliders



Pool Cleaners



Wheelchairs



Swimsuits



Golf Balls



Sun Glasses



Baby Formula



School Buses

"More NASA Spin Offs" ANSWERS:

Bicycle Helmets

Yes! Who would have thought? Technology used to cut drag on the wings of planes can be used to make riders safer. Old bike helmets were ugly. They made your head hot. The new helmets don't weigh as much. They have air vents in the front and back. This pulls cool air into the helmet and moves it around the biker's head.

Cordless Vacuums

Yes! Astronauts needed tools that were small. The tools needed to be light and they needed to run on batteries. "NASA did not invent cordless power tools, however. The first cordless power tool was unveiled by Black & Decker in 1961. In the mid-1960s, Martin Marietta Corporation contracted with Black & Decker to design tools for NASA. As a result of their work, Black & Decker created several spin-offs, including a cordless miniature vacuum cleaner called the Dustbuster."

Smoke Detectors

Yes, but NASA did not invent the smoke detector. "NASA did not invent the smoke detector. NASA's connection to the modern smoke detector is that it made one with adjustable sensitivity as part of the Skylab project. Honeywell made the device commercially available. The consumer could use it to avoid 'nuisance' alarms while cooking."

Joysticks

Yes! Joysticks help people play their best game. Astronauts used them to practice things like runway landings.

Foam Gliders

Yes! Toy designers at Hasbro wanted to make a foam glider that a child could fly. At first, their gliders didn't fly so well. They asked NASA for help. The engineers gave them a few science lessons. This helped them make a better glider.

Pool Cleaners

Yes! This space technology was made to clean water on long flights. It can be used in swimming pools to clean the water.

Wheelchairs

Yes! Robot technology was used to help make chairs move. The wheelchair can respond to 35 words.

[\(NASA Space Place: Spinoffs\)](#)

Swimsuits

Yes! Swimmers can wear a suit that makes them faster swimmers! Very small grooves were put on the outside of planes to make them go through the air faster. The grooves were put in swimsuits, too. They help the swimmer move through the water faster.

Golf Balls

Yes! Space Shuttle technology was used to make golf balls go farther.

Sunglasses

Yes! The sunglasses protect your eyes. They let good light in and keep bad light out! They don't scratch or break like other lenses. This helps them last longer, too.

Baby Formula

Yes! NASA made an oil to help astronauts on long space flights. This oil can be added to baby formula, too. It helps their brains and eyes grow better.

School Buses

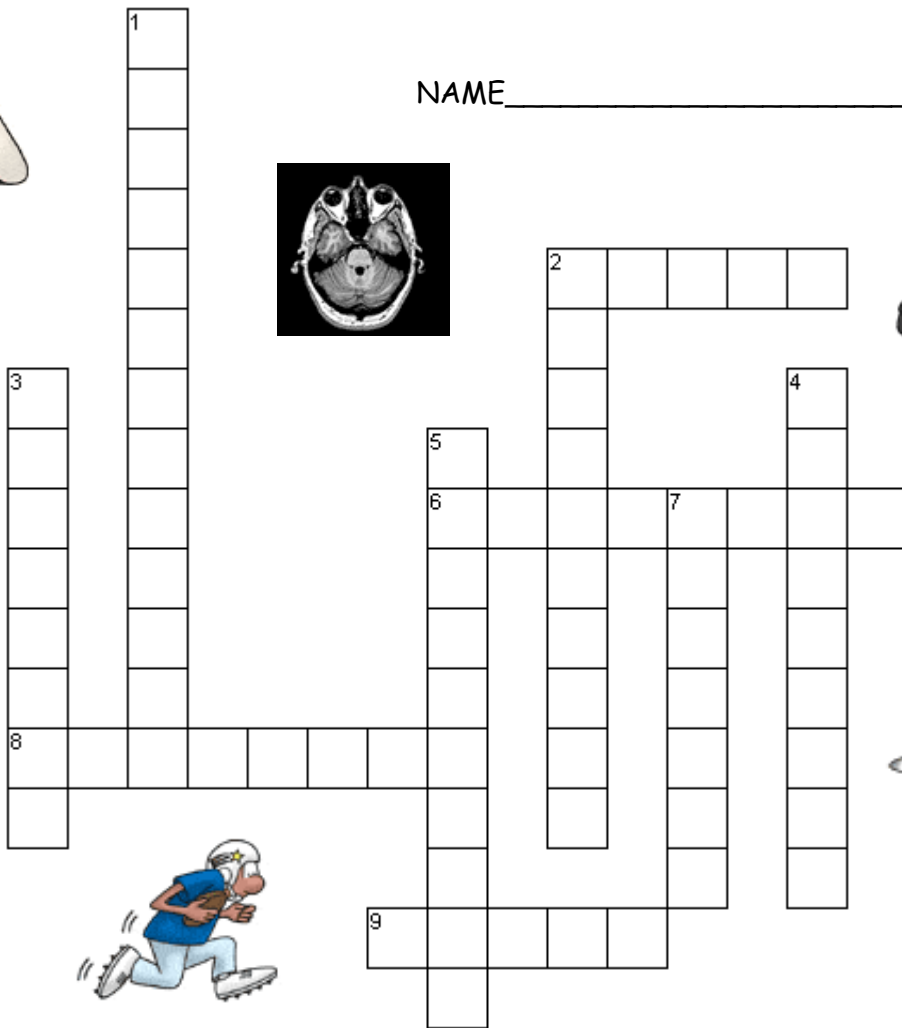
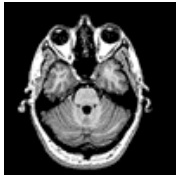
Yes! The ride to school and back home is smoother and safer because of NASA technology. A stronger and safer bus frame was made. NASA testing was used to see how the frame would hold up, too.

NOTE: (from NASA [NASA: Innovative Partnerships Program](#))

Are Tang, Teflon, and Velcro NASA spinoffs?

Tang, Teflon, and Velcro, are **not** spinoffs of the Space Program. General Foods developed Tang in 1957, and it has been on supermarket shelves since 1959. In 1962, when astronaut John Glenn performed eating experiments in orbit, Tang was selected for the menu, launching the powdered drink's heightened public awareness. NASA also raised the celebrity status of Teflon, a material invented for DuPont in 1938, when the Agency applied it to heat shields, space suits, and cargo hold liners. Velcro was used during the Apollo missions to anchor equipment for astronauts' convenience in zero gravity situations. Although it is a Swiss invention from the 1940s, it has since been associated with the Space Program.

NAME _____



Across

- 2. Temper foam was originally developed for use in aircraft seats. The foam has better _____ absorbing ability.
- 6. What helps push the ink toward the ball point in space pens?
- 8. These kinds of tools developed as a result of designing tools for Apollo astronauts.
- 9. The ear thermometer detects infrared heat. This technology was originally developed to detect the birth of what?

Down

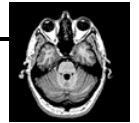
- 1. This was first used on Skylab to help detect any toxic vapors.
- 2. The material in invisible braces is a spinoff of NASA's advanced ceramic research to develop materials for _____ and aircraft.
- 3. This evolved from research to design a controller for the lunar rover
- 4. This was originally developed to help NASA keep track of millions of spacecraft parts.
- 5. Thermal gloves and boots and fire fighter equipment use material developed for what?
- 7. A NASA _____ has technology or material that was originally developed for space.

Source: Space Camp at the U.S. Space & Rocket Center in Huntsville, AL. Printed here with permission.

NASA SPINOFFS



NAME _____



What is a NASA spin-off? _____



Name 5 NASA spin-offs. 1. _____ 2. _____



3. _____ 4. _____ 5. _____



What do you think is the least important spin-off? _____



What do you think is the best NASA spin-off? _____

Write a paragraph that explains your choice for the best spin-off. Why do you think it is the best?











