Astronauts

Can you think of any job more exciting than being an astronaut? Any astronaut will tell you that the work is long and hard, but it is definitely exciting and rewarding.

Have you ever thought about who the astronauts are? Is there something special that makes someone "astronaut material"? NASA has gathered information about astronauts and, perhaps, the most amazing thing about the astronauts is their different traits.

NASA has over 300 current and former astronauts. NASA's astronauts come from nearly every state in the United States, and 23 other countries. The first astronaut group was selected in 1959. Since then, there have been many firsts, lasts, and other notable achievements, including:

- The first person to fly in space was a Russian Cosmonaut named Yuri Gagarin. The first American was Alan Shepard in 1961.
- The first American in orbit was John Glenn. He orbited Earth three times in 1962.
- The first astronaut to become a teacher was Neil Armstrong.
- The first woman to fly in space was a Russian Cosmonaunt named Valentina Tereshkova in 1963. America's first female astronaut to fly in space was Sally Ride in 1983.
- The first man on the moon was Neil Armstrong who landed with Apollo 11 in 1969. The last man on the moon (so far) was Gene Cernan in 1972.
- The first African-American astronaut in space was Guion Bluford. The first African-American woman astronaut in space was Mae Jemison.
- The first teacher selected to fly in space was Christa McAuliffe. She died in the Space Shuttle Challenger explosion in 1986. Her back-up was Barbara Morgan who was selected by NASA as a mission specialist in 1998.

All Astronauts have a few things in common. While in school, they were very good in mathematics, science, and communications. An astronaut must have a college degree with three years' experience in a related field. Leadership and good citizenship are also important. For example, many astronauts have participated in scouting. These same skills help foster an appreciation of our culture and history. Since astronauts come from many different countries and cultures, it's recommended they know at least one additional language. The study and appreciation of other cultures are the keys to success in space.

There are several types of astronauts. The commander is the captain of the ship. The commander gives orders and makes decisions affecting the crew and mission. The pilot has the same level of training. Most commander/pilot astronauts have served in the military. Another type of astronaut is the mission specialist who is a scientist, engineer, or educator. NASA has selected educators with expertise in K-12 classrooms to train to become fully qualified astronauts. NASA will send educators to space so that they can use their skills and experiences as classroom teachers to connect space exploration to the classroom. By utilizing their talents as educators and the unique platform of spaceflight, these astronauts can offer a new avenue for imagination and ingenuity for teachers and their K-12 classrooms. Mission specialists bring expertise in experiments or procedures to a spaceflight. All astronauts go through years of training and their classroom education includes foreign language, and scientific and engineering instruction. Their mission training involves emergency precautions and simulations of what they could encounter in space. Astronauts have to be in great physical shape, so physical fitness is also an important part of astronaut training.

Mission specialist Barbara Morgan has been called the "teacher in space." Christa McAuliffe's plan was to fly in space once and then return to the classroom. Before coming to NASA, Morgan taught reading, mathematics and science. Morgan is a fully trained member of the astronaut corp and is expected to fly in space on STS-118 in 2007.

Astronauts stress that their keys to success have been to do well in many areas of school, to always be involved, to be a team player, and to never stop learning. Are they describing your keys to success?

Related resources

NASAexplores Article: All About Astronauts
http://www.nasaexplores.com

International Measurement

Objective

To complete math problems involving U.S. and metric conversions.

Grade Level: 5-8

Subjects: Science, Mathematics

National Education Standards

Science (NSTA): Personal and social perspectives

Mathematics (NCTM): Numbers and operations, measurements, problem solving

Background Information

On the International Space Station (ISS), two or three people from different countries, who speak different languages and have only recently met each other, live in a confined space by themselves for up to half a year. They must work together well enough to operate one of the most high-tech science labs ever. How do they do it? They train in Houston at Johnson Space Center's Language Education Center (JLEC) to learn each others' languages. This makes working together much easier.

Another difference between the cultures on the ISS is the systems they use for measurement. While the United States uses the English system of measurement, most other countries use the metric system. These two systems use very different units, and, in some cases, it can seem like a different language. For example, if you live in the United States, you may not know how heavy a 50 kilogram (kg) weight is. Could you pick it up?

Materials

• Calculator • Scrap paper

Procedure

Answer the following problems about conversions on the International Space Station. Check the table below for conversion factors. Use scrap paper if necessary.

Conversion Factors

1 inch (in) = 2.54 centimeters (cm)
1 mile (m) = 1.6 kilometers (km)
°Fahrenheit (°F) = (9/5)°C + 32
°Celsius (°C) = (°F – 32) x (5/9)
1 pound (lb) = 0.45 kilograms (kg)
1 foot (ft) = 12 inches (in)
1 meter (m) = 3.28 feet (ft)

1. Cosmonaut Yuri likes to keep the temperature of the ISS at 25° C. If the thermostat on the ISS reads in Fahrenheit, what is the temperature?
2. An experiment on the ISS requires the astronauts to measure out 45 cm of string. How many inches is this?
3. Astronaut Eileen weighs 120 pounds. How much does she weigh in kilograms?
4. Cosmonaut Alexander is 1.8 meters tall. Convert his height to feet.
5. Astronaut Ed wants to take a picture of his crew mate Cosmonaut Yuri. The camera he's using says that he must be at least 152 centimeters away from Yuri to get a good picture. How far is this in feet?
6. The ISS travels at 17,500 miles per hour. How fast is this in kilometers per hour?
7. Crews onboard the ISS have consumed more than 6,804 kilograms of food in the past three years. Convert this weight to pounds.
8. Astronaut Katherine likes to keep her space suit temperature at 76° F when she's doing a space walk. Cosmonaut Sergei likes his suit to be at 24° C. Whose space suit is warmer?
9. Astronaut Jeremy is 67 inches tall, and cosmonaut Nikolai is 175 centimeters tall. Who is taller?
10. Astronaut Michael weighs 140 pounds, and cosmonaut Mikhail weighs 65 kilograms. Who weighs more in space?

Related Resources

Automatic Conversions—Convert Almost Anything
http://www.onlineconversion.com/
U.S./Metric Conversion Tables—AllMath.com
http://www.allmath.com
NASAexplores Article: The Language of Space
http://nasaexplores.com

Lesson Source and Answer Key

NASAexplores Article: Foreign Measurements
http://www.nasaexplores.com

International Games On Moon And Mars

Objective

To explore the cultural significance of a sport or game from a different culture and to modify this game for play during space travel, on the moon, or on Mars.

Grade Level: 9-12

Subjects: Earth Science, Social Studies, Geography, Language Arts,

National Education Standards

Science (NSTA): Earth and space science,
Geography (NGS): places & regions & human systems

Background Information

Recreation is an important part of a balanced life and that applies to life in space, too. Astronauts work long hours when they're on the space shuttle or the International Space Station. However, when they're not working, they find creative ways to liven up their lives. Astronauts bring their interests and hobbies with them into space. Their curiosity makes them wonder if those same activities will work in a microgravity environment.

Think about your hobbies and interests; would you be able to still do these things in space or on the surfaces of moon and Mars? On Earth, man has entertained himself from the beginning of time with sports and games. Different cultures have developed a variety of team games and sports.

Task

Your mission is to form a team of four and research a sport from a particular culture. Your team will write and illustrate a game book about the sport on Earth, and then as a group, you will write modifications to the game so that it could be played on a trip through space or in a new space colony on the moon or on Mars.

Materials

- Pens/pencils • Paper • Classroom board
- Resources about different cultures that include information about sports and recreation (social studies textbooks, books about specific cultures, computers with Internet access)

Procedure

1. Arrange your desks into groups of four.
2. Each group of four will form a team.
3. Decide on a team name for your group.
4. As a group, choose a culture that interests everyone. Suggested cultures include ancient Greek, tribal African, Gaelic, Australian Aboriginal, Mayan, Native American, Russian, or Japanese. Your group will be researching a sport or athletic event popular in the chosen culture. Groups should choose sports that are unusual and special to their cultures in some way rather than sports that are common, such as baseball or soccer.
5. Using all available resources, find answers to following questions:
   - What is the name of the sport?
   - What are the rules of the sport?
   - Where is the sport played? Does it need a special "court" or field?
   - What equipment is required?
   - What is the cultural significance of the sport?
   - Are there any stories or legends associated with the sport?
6. Using the information from your group's research, create a "game book" for the sport. The book should include clear explanations of the history of the game, the role that the game plays in the culture in which it was or is popular, how the game is played, and important rules. Your game book should include Illustrations.
7. A newly formed colony on the moon and another on Mars has read your game book. They wish to play this game on the moon and on Mars. As a group, brainstorm on the modifications to the game that will be necessary in order to play it in an environment of reduced gravity. Write an appendix to the game book with the modifications of the game or sport included for play in colonies in outer space.
8. Present your sport or game to your classmates.

Questions

1. What can you learn about a culture from the sports created or popular there?
2. Why do you think sporting or athletic events are such a large part of so many cultures throughout time and around the world?
3. What do you think it means to be part of a team?
4. What types of cultural events take place in your community? What is your favorite event and why?

Related Resource(s):

NASAexplores Article: Astronauts Need to Have Fun, Too
http://www.nasaexplores.com
International Toys in Space Kit and Video available from NASA CORE
http://education.nasa.gov/edprograms/core/home/index.html

LESSON SOURCE

NASAexplores Article: Let the Games Begin http://www.nasaexplores.com

Back to the Moon

Objective

To design the next generation of spacecraft for NASA to use in launching, landing, and returning to the moon.

Level: 9-12

Subject(s): Space Science, Technology

Prep Time: Less than 10 minutes

Duration: One class period

Materials Category: General Classroom

National Education Standards

Science (NSTA): Unifying concepts, science as inquiry, science and technology

Technology (ITEA): Relationships among technologies, role of society in the development and use of tehcnology, attributes of design, engineering design, the role of troubleshooting in problem solving, apply the design process.

Background Information

NASA's answer to going to the moon was the Apollo Program. Apollo was a three-part spacecraft. The command module (CM) was the crew's quarters and flight control section. The service module (SM) was used for the propulsion and spacecraft support systems. When the CM and SM were together, the combined modules were called CSM. The lunar module took two of the 3 crew members to the lunar surface, provided support for them on the moon, and returned them to the CSM in lunar orbit. The boosters for the program were the Saturn IB for Earth orbit flights and the Saturn V for lunar flights.

Task

Your group is part of the Back to the Moon (B2M) team. NASA has given your B2M team the assignment to develop a next generation spacecraft that can fly astronauts safely to the moon, land on the moon, and return to Earth. You must also select a safe, yet interesting, lunar landing site for the spacecraft. Some considerations for your team: size of ship (inside and outside), weight (of ship and cargo capacity), propulsion (for launch, transit, and return), number of crew, life support systems, and methods of takeoff and landing (from Earth and the moon). Geology, terrain, safety, and length of stay should be considered for the lunar landing site.

Team Members and Responsibilities

1. Chief Engineer
   - Oversees the entire project • Helps design spacecraft
   - Makes critical decisions for the team
2. Scientist
   - Designs spacecraft
   - Oversees the construction of the model or diagrams of the spacecraft
3. Lunar Geologist
   - Studies maps of the moon
   - Oversees selection of a place to land the spacecraft
4. Public Relations Manager
   - Helps scientist and geologist present information about the spacecraft and landing site to the class

Your B2M team will present your designs and plans to the rest of the NASA engineering groups to get their feedback.

Procedure

1. Decide which person in your group will take the duties of the chief engineer, scientist, lunar geologist, and public relations manager. If you have fewer than four people, have one person double his or her duties. If you have more than four people, split the duties of one of the designated group members.
2. Design a spacecraft with all the necessary systems that can go to the moon, land on the moon, and return to Earth. Explain how it will be launched, what it will do or need to do to get to the moon, how it will land or split apart when reaching the moon, how the crew will return, and how the crew will land on Earth.
3. Study maps of the lunar surface and use your knowledge of the moon to determine a safe and interesting lunar landing site.
4. Make a presentation to the class:
   - Describe your spacecraft and its special features using diagrams and/or models.
   - Describe and justify the landing site.

LESSON SOURCE

NASAexplores Article: The Next Moon Walker http://www.nasaexplores.com

Complete lesson plan can be found at NASAexplores Article:
Back to the Moon http://www.nasaexplores.com

Languages and Flags of Space Exploration

Objective

To identify the 16 space agencies and the countries involved with the International Space Station.

Grade Level: K-4

Subject(s): Technology, Geography

National Education Standards

Technology (ISTE): Students are proficient in the use of technology

Geography (NES): How the forces of cooperation and conflit among people inluences the division and control of the surface of Earth.

Background Information

Language training is nothing new for astronauts. The NASA crew of the Apollo-Soyuz Test Project in 1975 had to learn Russian, as did the crews of the Shuttle-Mir program from 1995-1998. However, the International Space Station program made language training a much larger issue at NASA and led to the establishment of the Johnson Space Center's Language Education Center (JLEC) in 1998. Jane Clarke-James teaches at JLEC and states, "The International Space Station is all about unity in diversity, as it involves the work and collaboration of space professionals from 16 different countries." As a result, language skills are very important to the space program. Interpreters and translators provide constant support to the ISS astronauts from the Mission Control Center (MCC).

The 16 agencies involved with the station are:

- Austrian Space Agency
- Belgian Space Agency
- Brazilian Space Agency
- British National Space Center
- Canadian Space Agency
- Danish Space Agency
- European Space Agency
- French Space Agency
- German Aerospace Center/ German Space Agency DLR
- Italian Space Agency
- Japanese Space Agency
- Netherlands Space Agency
- Norwegian Space Agency
- Russian Space Agency
- Spanish Space Agency
- Swedish Space Agency

Materials

- Copy of flag page
- World map
- Crayons
- Internet access

Procedure

- Research websites and books to learn about the different countries and their flags.
- Color in the flags with the correct colors.
- Read the astronaut and cosmonaut biographies at http://www.jsc.nasa.gov/Bios
- Choose the name of at least one astronaut on the poster and list his/her country of birth. If your astronaut was born in the United States, list the state of his/her birth.

Related Resource(s)

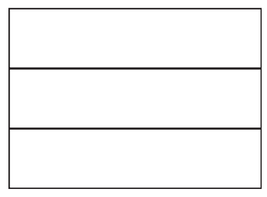
NASA Marshall Space Flight Center—International Space Station
http://www.nasa.gov/mission_pages/station/science/partners.html
U.S. Central Intelligence Agency (CIA)—The World Fact Book
http://www.cia.gov/cia/publications/factbook/index.html
NASAexplores Article: The Language of Space
http://www.nasaexplores.com

LESSON SOURCE

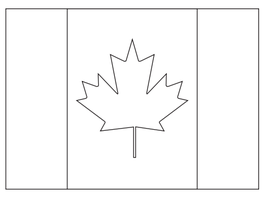
NASAexplores Article: Sixteen Countries
http://www.nasaexplores.com

Flags

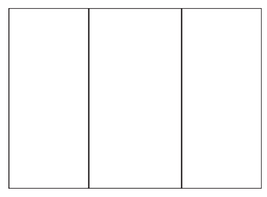
Austrian Space Agency
Name of country: Austria
Language: German



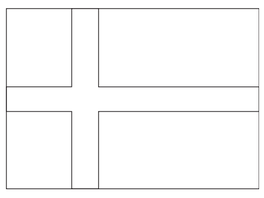
Canadian Space Agency
Name of country: Canada
Languages: English/French



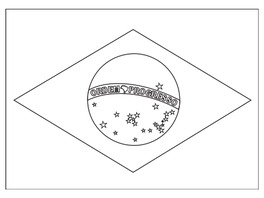
Belgian Space Agency
Name of country: Belgium
Language: Dutch



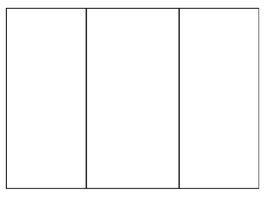
Danish Space Agency
Name of country: Denmark
Language: Danish



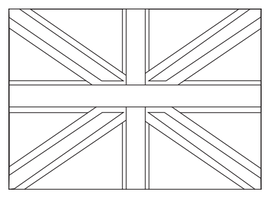
Brazilian Space Agency
Name of country: Brazil
Language: Portuguese



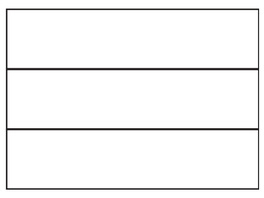
French Space Agency
Name of country: France
Language: French



British National Space Center
Name of country: United Kingdom
Language: English

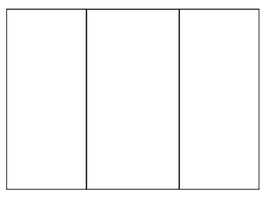


German Aerospace Center/ German Space Agency DLR
Name of country: Germany
Language: German

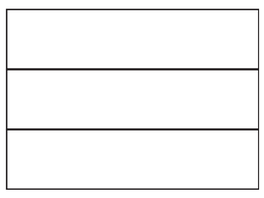


Flags

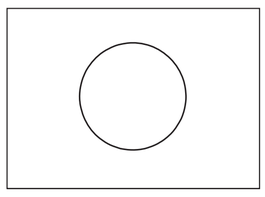
Italian Space Agency
Name of country: Italy
Language: Italian



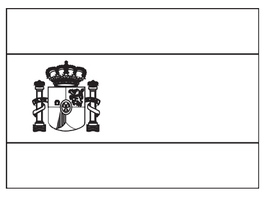
Russian Space Agency
Name of country: Russia
Language: Russian



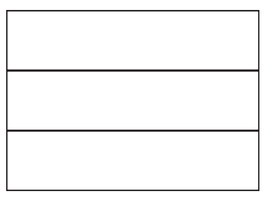
Japanese Space Agency
Name of country: Japan
Language: Japanese



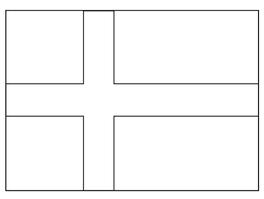
Spanish Space Agency
Name of country: Spain
Language: Spanish



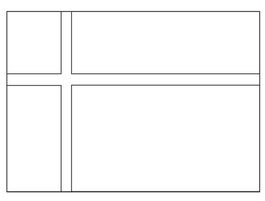
Netherlands Space Agency
Name of country: Netherlands
Language: Dutch



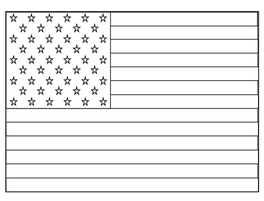
Swedish Space Agency
Name of country: Sweden
Language: Swedish



Norwegian Space Agency
Name of country: Norway
Language: Norwegian



National Aeronautics and Space Administration
Name of country: United States of America
Language: English



NASA Resources For Educators

NASA Portal

This is the definitive site for information about NASA.
http://www.nasa.gov

NASA Education Home Page

NASA's education home page serves as the education portal for information regarding educational programs and services offered by NASA for the American education community.
http://education.nasa.gov/home/index.html

Educator Resource Center Network (ERCN)

ERCNs are located on or near NASA Field Centers, museums, colleges, or other nonprofit organizations. They provide educators with inservice and preservice training, demonstrations, and access to NASA instructional products.
http://education.nasa.gov/about/contacts/ERCN_Field_Center_Listing.html

Liftoff to Learning Video Series

Meet the men and women of NASA via this video series. There are written education guides to accompany the Liftoff to Learning video series.
http://quest.arc.nasa.gov/space/teachers/liftoff/

Central Operation of Resources

The Central Operation of Resources for Educators (CORE), established in cooperation with Lorain County Joint Vocational School, serves as the worldwide distribution center for NASA-produced multimedia materials.
http://education1.nasa.gov/edprograms/core/home

NASAexplores

This NASA Web site enriches existing, classroom curriculum by providing standards-based lesson plans for grades K-4, 5-8 and 9-12. Topics are selected from each of NASA's four mission directorates.
http://www.nasaexplores.com/

Science@NASA

Learn about microgravity research, earth system science, physics, and astronomy from the scientists who create the experiments that fly in space.
http://science.nasa.gov/

Educational Programming

Digital Learning Network

Learners at all levels have the opportunity to interact directly with NASA scientists to gain a new appreciation for the importance of science and education.
http://nasadln.nmsu.edu/dln/

NASA CONNECT — These educational programs establish the "connection" between the mathematics, science, and technology concepts taught in the classroom and NASA research. NASA Connect airs on PBS stations and NASA-TV.
http://connect.larc.nasa.gov/

NASA SciFiles — This is a series of instructional programs constisting of broadcast, print, and online elements targeted for grades 3-5.
http://scifiles.larc.nasa.gov/treehouse.html

NASA's Kids Science News Network (KSNN) — This standards-based program uses the Web, animation, and video to introduce science, technology, engineering, mathematics, and NASA concepts to students in grades K-2 and 3-5. NASAexplores is collaborating with NASA's KSNN team to offer many of the NASAexplores topics on NASA's KSNN Web site.
http://ksnn.larc.nasa.gov/home.html

NASA-TV

NASA TV provides educational programming to teachers, students, and the general public.
http://www.nasa.gov/multimedia/nasatv/

National Education Standards

Science NSTA
http://www.nsta.org/standards
Mathematics NCTM
http://standards.nctm.org
Technology ISTE
http://www.iste.org
Technology ITEA
http://www.iteaconnect.org
Geography NGS
http://www.nationalgeographic.com/xpeditions/standards/

Additional Resources For Living And Working In Space

How Do I become an astronaut?
http://astronauts.nasa.gov/
http://spaceflight.nasa.gov/outreach/jobsinfo/astronaut101.html

Humans In Space

Since 1961, more that 400 human beings have ventured into space. Now aboard the International Space Station, astronauts are working to improve life on Earth and extend life beyond our home planet.
http://www.nasa.gov/vision/space/features/index.html

Astronaut Biographies

http://www.jsc.nasa.gov/Bios

Living in Space Website

http://spaceflight.nasa.gov/living/index.html

Saturday Morning Science with Expedition 6 NASA ISS science officer, Don Pettit

http://spaceflight.nasa.gov/station/crew/exp6/spacechronicles.html

Brain Bites

Have you ever wondered what space is really like, how astronauts overcome gravity to train for weightlessness or how you'd turn a bolt in space? NASA Brain Bites will give your mind something to munch on!
http://brainbites.nasa.gov

Amateur Radio on the International Space Station

This program provides students with the unique opportunity to talk directly with astronauts on the station while the astronaus orbit Earth
http://www.arrl.org/ARISS/

Biological and Physical Research

This office conducts research to address the opportunities and challenges to NASA that are provided by the space environment and the human exploration of space.
http://exploration.nasa.gov/

Life Sciences

This program studies how the unique environment of space affects living systems from cells in culture to physiological studies in animals and humans.
http://lifesci.arc.nasa.gov/

Exploration

Moon, Mars and Beyond
http://www.nasa.gov/mission_pages/exploration/mmb/index.html
Mars Millennium Project
http://www.mars2030.net/
NASA's Mars Exploration Program
http://mars.jpl.nasa.gov/
Engineering Design Challenges
http://edc.nasa.gov/
Mars Settlement Design Challenge
http://www.wstf.nasa.gov/Assoc/Space/History.htm
Homesteading Mars
http://www.wested.org/pblnet/exp_projects/homesteading.html
Exploring the Moon Educators Guide
http://solarsystem.nasa.gov/educ/docs/Exploring.The.Moon.pdf
http://www.nasa.gov/pdf/58199main_Exploring.The.Moon.pdf
Destination Mars Educators Guide
http://solarsystem.nasa.gov/educ/docs/Why_Explore.pdf
Space Science Education Resource Directory
http://teachspacescience.stsci.edu/cgi-bin/ssrtop.plex
Marsbound
http://marsbound.asu.edu/

The astronaut poster, as well as other Space Flight Awareness mission posters, can be downloaded from the Space Flight Awareness website: http://sfa.jsc.nasa.gov/products.cfm