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Aerospace Connections in Education (ACE) Program
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2010-2011 ACE Curriculum

Grade 3 Table of Contents

***The foam flyer plane kits provided by CAP to the third-grade students are to be used with academic aerospace lesson #4, "Foam Flyer."**

Civil Air Patrol's ACE Program

Bernoulli's Tongue
Grade 3 Academic Lesson #2

Topic: air (science)

Lesson Reference: The paper bag mask activity is from NASA's *Aeronautics: An Educator's Guide.*

Length of Lesson: 45 minutes

Objectives:

- Students will construct a device that demonstrates Bernoulli's principle.
- Students will understand the effect of air flowing over a curved surface.
- Students will compare Bernoulli's principle to working as hard as they can in school to be able to "fly high in life!"

National Standards:

Science

- Content Standard A: Science as Inquiry
- Content Standard B: Physical Science
  - Motions and Forces
- Unifying Concepts and Processes

Math

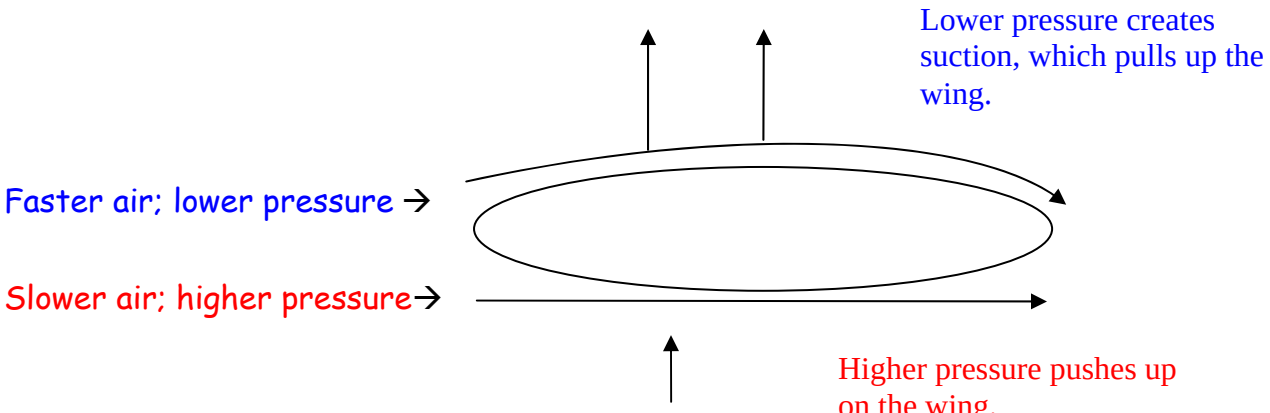
- Geometry and measurement
- Problem solving

Background Information:

A change in the speed at which air is flowing will cause a change in air pressure. Daniel Bernoulli, a Swiss scientist in the 18th century, discovered what is now called Bernoulli's principle: "the pressure in a fluid (gas and liquids) decreases as the speed of the fluid increases."

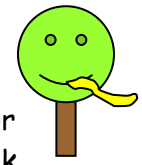
The wing of an airplane is a device that creates changes in the speed of airflow, thus creating a change in air pressure. Air moving over the curved top portion of a wing will travel at higher speed and produce lower pressure than the air moving past the smooth bottom portion of a wing, thus, creating lift. Lift is a force caused by the equalization of pressures. Equalization always occurs from areas of high pressure to low pressure. An inflated balloon has higher air pressure inside than outside. The balloon will pop when the pressure difference becomes too great for the material.

Another example of Bernoulli's principle can be seen using the paper bag mask. When the student blows through the hole in the paper bag mask and over the curved surface of the "tongue," unequal air pressure will lift the tongue, just like an airplane is lifted off the ground.



Materials:

- *large paper grocery bags
- scissors
- crayons or markers
- gift bag tissue paper or copier paper
- tape or glue
- metric ruler
- fan (optional)



* If grocery bags are not available, use posterboard to cut out a face shape (or rectangle shape). Attach a wooden craft stick to the bottom to create a mask. Students can make the face mask look like one that belongs to a human, animal, or even an alien! See examples.

NOTE: A timesaving tip is to have "tongues" already cut for the students. To make the tongue, cut a strip of gift bag tissue paper or copier paper approximately 3 cm wide and 20 cm long.

Lesson Presentation:

1. (optional) Attach a lightweight streamer or strip of paper to a fan or air conditioning vent. Ask the students to observe and describe what happens.

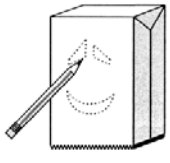
2. Tell students that they will do a fun experiment to understand how and why a streamer seems to float in the air when air flows over it. Tell them that they are going to make paper bag masks, and they must make a tongue for the mouth on the mask. Distribute "tongues" to students or have them make one at this time. To make the tongue, cut a strip of gift bag tissue paper or copier paper approximately 3 cm wide and 20 cm long.

3. Have students crumple the tongue a bit to make it a bit softer and more flexible.

4. Tell students to hold one end of the tongue just a bit below their bottom lip and create a stream of air by blowing straight over the end of the tongue that is near their mouth. Ask students to observe what happens. (The tongue rises and seems to float in the air just like the streamer.)

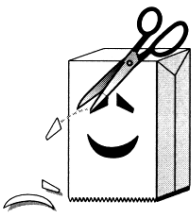
5. Ask students to try to explain why that it happens. Tell them that blowing over the top of the tongue causes the air to move quicker over the top of the tongue than under the tongue. When air moves fast enough over the top of some curved surfaces, the object gets lifted up. The person who realized this was a man named Daniel Bernoulli. The idea of something getting lifted up because air is moving fast enough over the top of it was named for him. It is called "Bernoulli's principle." Have students say that with you, "Bernoulli's principle." Tell them that they can remember his name by breaking it up into three small words: burr (like being cold), new (as in a new bike), and lee (as in someone's name). Put them together and you have the pronunciation for Bernoulli. Have students practice saying the three small words to remember Bernoulli's name. Tell them that when air moves fast over the top of the tongue, there is high pressure underneath the tongue that helps push the tongue up. There is low pressure on the top, which helps the tongue get "sucked" up, like drinking with a straw. There is a push on the bottom, and a pull on the top. To explain pressure, have students press on their leg with their hand. That's an example of more pressure on one's leg.

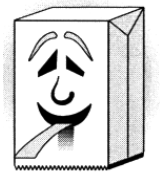
6. Tell them that they are now ready to make their paper bag masks. Show students a finished example and how the tongue lifts when you blow through the mouth whole of the mask.



7. Place a bag over the head of one student and have a second student carefully draw small dots where the eyes, nose, and mouth are located (or the teacher can do each one).

8. Remove the bag from the head and draw a face around the marks made in step 7.





9. Cut out two holes (approximately 2 cm diameter) for the eyes.
10. Cut a hole (approximately 4 cm diameter) for the mouth.
11. Tape or glue one end of the tongue inside the bag at the bottom of the mask's mouth. Allow the tongue to droop through the mouth on the outside of the bag.
12. Place the bag over the head and blow through the mouth hole. Observe the movement of the tongue.

Summarization:
Ask students what they learned today. (You may encourage the correct ideas by asking these two questions: *What caused the tongue to lift? What special name is given to the idea that faster moving air over the top of a surface like a wing can cause it to lift up?*)

Character Connection: Tell students that what people say using their tongues can help to "lift" people's spirits. When we say nice things to people, we help people feel good. The opposite is also true. If we do not think about what we say and just let ugly things fly out of our mouths, we can cause someone's feelings to crash and be splattered on the ground. Tell students that you want their paper bag mask to remind them of two things: Bernoulli's principle and to not let ugly things fly out of their mouths, but rather say good things that lift up people.

Assessment:
- teacher observation
- student answers to class discussion questions
- construction of paper bag masks

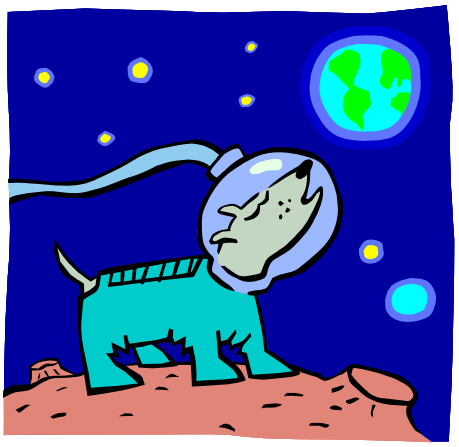
Additional activity ideas to enrich and extend the primary lesson (optional):
- Have students experiment with different tongue lengths.
- Have students experiment blowing over the tongue fast and slowly. Observe the effects and discuss.
- Inflate two balloons. Attach a piece of string to each balloon. Hold the end of each piece of string so that the balloons are about 5 inches apart from one another. Ask students what they think will happen if someone blows a steady stream of air between the two balloons. Invite a volunteer to blow a steady stream of air between the two balloons. Students should observe that the balloons move closer to one another. This is another example of Bernoulli's principle.

Civil Air Patrol's ACE Program

Animals in Space
Grade 3 Aerospace Lesson #6

Topic: animals, sequencing (science, language arts)

Lesson Reference: modified lesson from NASA Explores



Length of Lesson: 40 minutes

Objectives:

- Students will identify animals that have flown in space.
- Students will explain why animals have flown in space.
- Students will place events in order.

National Science Standards:

- Content Standard C: Life Science
  - Characteristics of organisms
  - Organisms and environments
- Content Standard F: Science in Personal and Social Perspectives
  - Changes in environments
  - Science and technology in local challenges
- History and Nature of Science
  - Science as a human endeavor

Background Information: (from NASA Explores)
Animals have been used in space research. Many animals have traveled to space. In the 1950s and 1960s, the Russians and Americans sent dogs and monkeys into space in prototype craft that ultimately developed into what humans used for the manned missions to the moon. In 1957, a Russian dog named Laika was sent aboard the second Sputnik satellite. This launch proved that living animals could survive in space, and further hastened the race between the United States and the Soviet Union to send manned craft into orbit around Earth, and ultimately to the Moon.

Many shuttle missions have carried scientific experiments involving animals, from rats and mice to bees and jellyfish. The experiments are used to test the effects of microgravity and other conditions in space on how animals behave, grow, and reproduce in this altered environment. Taking animals into space requires special considerations. NASA maintains the highest standards for the humane care and treatment of its laboratory animals. In addition to complying with all applicable regulations and guidelines, the agency has internal policies that govern the care and use of research animals for all activities, including activities at foreign institutions.

In this lesson, students will identify different animals that have been launched into space and place them in chronological order.

Materials:

- copies of "Animals in Orbit"
- copies of "Space Mission Events" for each student
- glue or paste
- scissors
- paper or construction paper

Lesson Presentation:

1. Write the following terms on the board: orbit, gravity, astronaut, Russia, recovery, and Skylab. Discuss the definitions. (In 1973, Skylab was the first U.S. space station. A space station is a "home" or "workplace" in space.) Ask students if they have an idea what today's topic is based on the vocabulary words.

2. Distribute and read aloud the article, "Animals in Orbit." If time is an issue, you may want to read the article aloud and have students follow along.

3. After reading, discuss why animals were sent into space.

4. Tell students that they will learn more about animals and humans that have gone into space by placing some space missions in order. Tell students to take out five sheets of paper (or give students some construction paper). Also, have them take out their glue/paste and scissors.

5. Distribute the "Space Mission Events" sheets.

6. Provide directions for the students by telling them that they are to cut out the mission event cards, place them in the order in which they occurred, and then glue them in order across their papers. Ask students what they will need to know in order to place the mission cards in order. Remind students that they have to look at more than just the year. They need to look at the month and day too!

7. Have students complete the task. Monitor and assist students as needed.

Summarization:

(Once students have finished, you may collect the students' work for a grade.) Go over the answers by placing the events in order on the board.

Discuss the students' thoughts and ideas regarding the mission events.

Character Connection: Remind students that that in life, some things must be done in a certain order. For example, they must complete third-grade before going to fourth-grade. Encourage students to make good choices each day so that they may successfully take another step forward to achieve their goals.

Assessment:

- teacher observation
- student pages displaying mission events in order

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

- Lead students in a discussion that allows them to explore their feelings on sending animals into space. Ask students to explain why they think sending animals into space was good or bad idea, especially since scientists couldn't be sure what would happen to them. You may remind students that NOT all of the animals made it back to earth alive, such as Laika (pronounced "like uh"). Make a list of "Pros" and "Cons" on the board to document student thoughts to the question, "Should we send animals into space?"
- Make a classroom timeline displaying the mission event cards. Explain to the class that a timeline shows the sequence, or order of events. Display the timeline on the wall or the board. Have the class call the dates out as you point to them (1950, 1955, 1960, 1965, etc.). Tell the class that they will help place the mission event cards in the correct place on the timeline. Monitor to ensure cards are placed correctly on the classroom timeline.
- Have students use their mission cards to complete the worksheet "Mission Events."
- Have students design a postage stamp commemorating the flight of one of the animals.

Associated Literature and Websites:

- *Pupniks: The Story of Two Dogs in Space* by S. Ruth Lubka ISBN: 0761451374
- *Animals in Orbit, Monkeynauts & Other Pioneers in Space* by Katherine M. Marko ISBN: 0531200035
- *Curious George Gets a Medal* by H.A. Rey
- Learn more about animals in space
  http://history.nasa.gov/animals.html
  http://ham.space.umn.edu/kris/animals.html
  http://teacher.scholastic.com/space/space_firsts/index.htm
  http://history.nasa.gov/printFriendly/animals.html
- Article about Laika: http://www.space.com/news/laika_anniversary_991103.html
- Read more about Arabella the space spider
- http://www.smithsonian.kids.us/sos/secrets_of_the_smithsonian/spiders_in_space.html
- Learn more about Russian dogs in space
  http://www.spacetoday.org/Astronauts/Animals/Dogs.html

Animals in Orbit

Can fish swim in orbit? Do bees make honey in space? NASA hopes to find out by taking animals into space.

NASA wants to know what the body does in less **gravity**. Many tests can be done on people while they work in space. Some tests on people get in the way of their work. That is why NASA wants to use animals.

Animals would only go when they were needed. NASA likes to use computer models or **astronauts**. Only animals will work for some tests. People would not want to eat the same thing each day. But, animals don't mind! NASA can test how that will make them feel in space.

In the past, no one knew if people could stay alive on a trip to space. So, animals were used to find out. In 1948, a monkey named Albert flew in a V2 **rocket**. In 1957, a dog was sent into orbit. This let us know that people could stay alive on a trip to space. In 1973, several mice were sent up to the **Skylab**. They were used to check the animal's body clocks.

Which animals go into space? It's based on the **science** to be done in the test and what the animals need to live. Snails, fish, and mice are just a few that have gone on the shuttle.

Animals in space need special things. Everything floats in space. Mice cages have wire all around so they can grip with their feet. Food and water bottles have to be changed to keep them from floating.

Do animals like living in space? There are lots of rules when they go in space. NASA makes sure they take very good care of them.

Courtesy of NASA's Space Operations Mission Directorate
Published by NASAexplores: April 25, 2002

Space Mission Events

Cut out the 10 cards and paste them in chronological order on paper.

LAIKA

First Living Animal to Orbit Earth

Launch Date:
November 3, 1957

Country launched from:
Russia

Capsule Name:
Sputnik 2

HAM

First Chimpanzee In Space

Launch Date:
January 31, 1961

Country Launched From: USA

Rocket Name:
Redstone

ALAN SHEPARD

First American Man In Space

Launch Date: May 5, 1961

Country Launched From:
USA

Capsule Name: Freedom 7

ABLE & BAKER

First Successful Recovery

Launch Date: May 28, 1959

Country Launched from:
USA

Rocket Name: Jupiter

YURI GAGARIN

First Human In Space

Launch Date:
April 12, 1961

Country Launched From:
Russia

Capsule Name: Vostok

ARABELLA

First Spider In Space

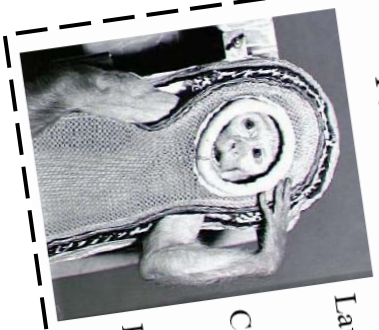
Launch Date:
July 28, 1973

Country Launched From: USA

Name Of Space Station:
Skylab

SAM

First Animal To Go To Space Twice



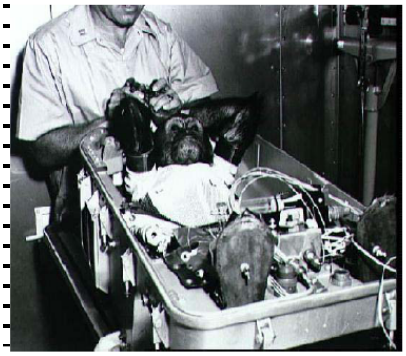
Launch Date:
December 4, 1959

Country Launched From:
USA

Rocket Name:
Little Joe

ENOS

First Chimpanzee To Orbit The Earth



Launch Date:
December 21, 1961

Country Launched From: USA

Rocket Name:
Atlas

JOHN GLENN

First American Man To Orbit The Earth

Launch Date: February 20, 1962

Country Launched From:
USA

Capsule Name: Friendship 7

Number of Orbits: 3

BELKA & STRELKA

First Safe Recovery Of Dogs From Space

Launch Date:
August 19,1960

Country Launched From:
Russia

Capsule Name: Sputnik 5

Mission Events

NAME _____

for use with "Animals in Orbit" Space Mission Events

1. What was the name of the first living dog to orbit Earth? _____

2. From what country was the first living dog to orbit Earth? _____

3. What animals were the first to go into space and return to Earth alive? (In other words, they were the first animals ever to be successfully recovered.) Circle the correct answer below.

   A. Dogs B. Monkeys C. Spiders

4. Who was the first human in space? _____

5. From what country was the first man in space? _____

6. Who was the first American man in space? _____

7. When did the first American man go into space? _____

8. Who was the first American man to orbit Earth? _____

9. What was the name of John Glenn's capsule? _____

10. What was the name of the rocket that launched Sam into space?

    _____

11. What was the name of the first spider in space? _____
    (She actually spun a web in space!)

12. How many orbits did John Glenn make around the Earth? _____

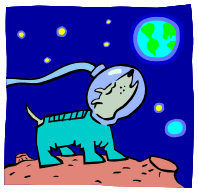
13. Did Belka and Strelka's trip to space happen BEFORE OR AFTER Yuri Gagarin's? _____

14. Would you want to send a pet that belonged to you into space? Why or why not?

    _____

    _____

    _____



Mission Events ANSWERS

for use with "Animals in Orbit" Mission Events

http://www.nasaexplores.com/show_k4_student_st.php?id=021223114852

1. What was the name of the first living dog to orbit Earth? __**Laika**_____

2. From what country was the first living dog to orbit Earth? ___**Russia**____

3. What animals were the first to go into space and be rescued alive back on earth? (In other words, they were the first animals ever to be successfully recovered.) Circle the correct answer below.

   A. Dogs B. **Monkeys** C. Spiders

4. Who was the first human in space? _____**Yuri Gagarin**_____

5. From what country was the first man in space? ___**Russia**____

6. Who was the first American man in space? ___**Alan Shepard**___

7. When did the first American man go into space? ___**May 5, 1961**___

8. Who was the first American man to orbit Earth? ___**John Glenn**___

9. What was the name of John Glenn's capsule? ___**Friendship 7**___

10. What was the name of the rocket that launched Sam into space?

    _____**Little Joe**_____

11. What was the name of the first spider in space? ___**Arabella**___
    (She actually spun a web in space!)

12. How many orbits did John Glenn make around the earth? __**3**__

13. Did Belka and Strelka's trip to space happen BEFORE OR AFTER Yuri Gagarin's? __**BEFORE**__

14. Would you want to send your pet into space? Why or why not?
    Answers will vary.

Asteroid Field
Grade 3 Character Lesson #6

Topic: trust

Length of Lesson: 30 minutes

Objectives:
- Students will define trust and trustworthy.
- Students will practice trusting and being trustworthy.

National Character Education Partnership (CEP) Standards:
- Principles 1, 2, 3, 4, 5, 6, 7, 9

Background Information:
Trustworthiness, when used as a noun, refers to the quality of being trustworthy. As an adjective, it describes someone who is honest and dependable. In fact, honest, dependable, and reliable are all synonyms for the term trustworthy. Being trustworthy is important. If we cannot trust one another, then relationships will be damaged, as well as one's integrity. Each individual should learn early in life to be trustworthy, as it will affect his/her character and reputation for a lifetime.

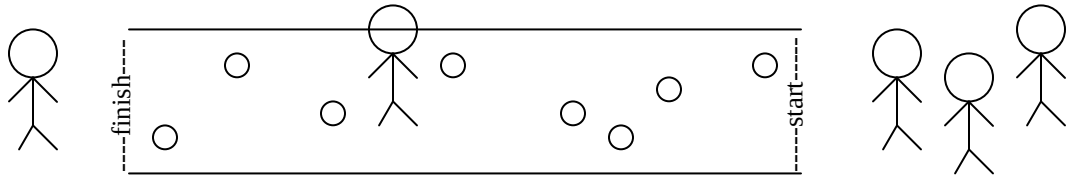
Materials:
- 24 – 30 plastic cups
- at least 3 blindfolds

Lesson Presentation:
1. Ask students to clear their desks. Tell them that because they have followed your directions, they are proving that they are trustworthy. Ask students to explain what being trustworthy means. (Trustworthy is a combination of being responsible and honest. Someone who is trustworthy is honest and does his or her best with the tasks that he or she has. People know they can depend on someone who is trustworthy.)

2. Tell students that in order to accomplish tasks, we trust other people to do their part. For example, in order for you to learn, you trust that your teacher will be responsible and teach you well. In order to keep you healthy, you trust that the person who takes care of you at home will take you to the doctor if you get sick, and you trust the doctor to help make you well. If your teacher, your mom, and your doctor do what they are supposed to, you realize you can trust them.

3. Explain that students also need their classmates to be trustworthy. Ask students why it is important for them to be trustworthy to one another. (no one will take someone's belongings, have a good friends, safety – no pushing/shoving – follow rules, etc.)

4. Tell students that they will play a game that requires them to trust the members of their team. Divide students into 3 groups. Create three wide walkways/paths in the room. Explain how to play Asteroid Field, and then play.



Asteroid Field Game Explanation

- For each playing area, distribute plastic cups in random places along the path as shown by the small circles in the illustration above. Tell players that the cups represent asteroids, so it is important that as they make their way from one end of the path to the other, they want to avoid knocking over the cups.
- Have one person stand at one end of the path. The remaining members are behind a line at the other end of the path.
- Blindfold the first person who must walk from their end of the path to the other end. The person at the other end will act as a guide and guide them to the other side using voice commands only.
- If the blindfolded person knocks over a cup, the guide must go set the cup up again, lead the blindfolded person back to the starting line, and begin again.
- Once the first blindfolded person makes it across, he/she becomes the new guide and repeats the process with the next team member that needs to walk across. (The first guide goes to the other side to wait his turn to be lead across. He/she will be the last person to cross.)
- Continue the process until the original guide is safely across the path. The first team to get all their members across safely wins. Allow other teams to finish.

5. Once all teams have successfully completed the game, discuss it using the following questions.
   - Why was it important to have a trustworthy guide?
   - Why was it important to have trustworthy teammates?
   - Could this task have been accomplished with people who were not trustworthy? Why or why not?
   - How can you relate this activity to something in real life? (If we trust people to do something, like keep their eyes on the road when they are driving us to school, and they are trustworthy, they can help keep us safe. If they are not

trustworthy, they may cause someone to be injured. Parents trust their children to be honest. This helps parents make good decisions regarding their children, etc.)

- Would you have done anything differently in this game if you played it again? Why or why not?

Summarization:

Explain to the kids that being trustworthy is being honest and doing your best. Just like each person walking through the asteroid field area needed a trustworthy guide, we need to be trustworthy guides to the people around us. Not only do we trust others, but others trust us, and if we do a good job, we can keep others from getting hurt (feelings or physically) or injured. Thank students for doing a good job, and encourage them to be trustworthy.

Assessment:

- student answers to class discussion questions
- participation in game

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

- Allow students to play again. This time, have each guide lead two blindfolded people through the path at a time. Discuss how playing this way was different.

- Divide students into small groups. Give each group an important leader to research. Leaders to research may include George Washington, Abraham Lincoln, Helen Keller, Mother Teresa, Martin Luther King Jr., Wernher Von Braun, Nelson Mandela, etc. Allow students to use the library and Internet to gather information. Have students share what they learned about the leader, and have them explain why the leader was considered trustworthy.

Associated Literature:

Twenty and Ten , C. Bishop

After the Goat Man , B. Byars

Some Friend! , C. Carrick

Courage of Sarah Noble , A Dalgliesh

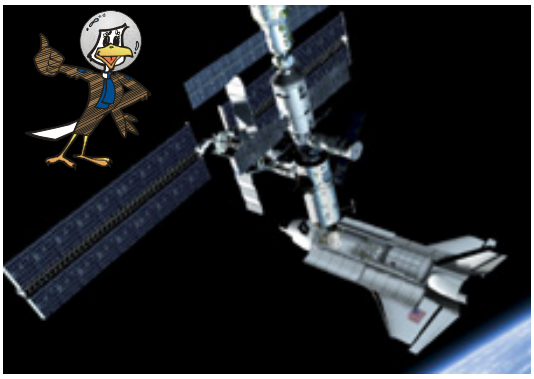
Tread Softly , C Gerson

Mr. McFadden's Halloween , R. Godden

Striped Ice Cream , J . Lexau

One to Grow On , J. Little

Docking with the ISS
Grade 3 Physical Fitness Lesson #3



Topic: communication, coordination
(PE, science, language arts)

Lesson Reference:
This is a modified lesson from NASA Explores.

Length of Lesson: 30 minutes

Objectives:
- Students will simulate the orbiter of the space shuttle docking with the International Space Station (ISS).
- Students will define space shuttle, orbiter, ISS, and docking.
- Students will use teamwork and problem-solving skills.

National Standards:
Physical Education
- Standards 1, 2, 3, 4, 5, 6

Science Standards
- Content Standard B: Physical Science
  - Position and Motion of Objects
- Content Standard D: Earth and Space Science
  - Objects in the Sky
- Content Standard E: Science and Technology
  - Understanding science and technology

Background Information:
(from NASA Explores)

NASA has learned that practice makes perfect. Making a mistake in space can be disastrous. Since astronauts are so far from home, a mistake could cost them their lives. Astronauts use training simulators to practice many of the skills they must perform in space. One of the games the crew plays on the International Space Station (ISS) is the simulator program, which is also the real docking tool used to dock with the shuttle. The tool provides a way for the crew to have fun during their free time, as well as to practice their docking skills. Make no mistake—docking the shuttle with the ISS is no game. If an astronaut makes a mistake, there's no reset button to start the process over again. Often, astronauts discuss their practice sessions and go over any problems that occurred.

Materials:

- at least 4 easily adjustable belts (If dividing students into more than 2 teams, provide 2 additional belts for each additional team. If you cannot get belts, you may extend the amount of string being used in order to make a loop at each end of the long string, and use a slip knot in order to make the loop adjustable for students to put on and remove. Another idea is to connect the ends of the string to a key ring, and put the key ring on a carabineer. The students can clip the carabineer onto their belt loop or a piece of yarn that is tied around them.)
- string or yarn – approximately 2.5 meters long for each team
- string or yarn – approximately 6 inches long for each team
- cut-out copy of shuttle for each team (one copy attached)
- a pencil for each team
- a cup for each team
- cones, rope, or other item to distinguish starting and stopping line (optional)

NOTE: Prior to students conducting the activity, create the equipment needed for each team. First, tie the ends of the long piece of string (approximately 2.5 meters in length) to a belt in order to create two belts connected by a long piece of string. Find the center point of the long piece of string. Tie one end of a small piece of string (approximately 6 inches in length) to the center point of the long string.

Next, create the orbiter attachment to attach to the small dangling piece of string. To do this, cut out the orbiter pictures showing the front and back of the orbiter. Tape the front of the orbiter to a pencil with the nose of the orbiter toward the tip of the pencil. Tape the back of the orbiter on the other side of the pencil so that the pencil itself is sandwiched between the two orbiter cut-outs. Attach this to the small piece of string hanging in the middle between the two belts.

Lesson Presentation:

1. Write the following words on the board, or have them written on sentence strips: space shuttle, orbiter, ISS, dock. Ask volunteers to remind the class of the meaning of the words.
    - space shuttle: The space shuttle is a spacecraft that has reusable parts such as rockets (solid rocket boosters) and the part that houses the astronauts. The space shuttle is like a big bus that carries stuff to and from space. NASA began using the space shuttle in 1981 to carry astronauts and other materials into space.

- orbiter: This is the part of the space shuttle that looks similar to an airplane. It is where the astronauts stay.
- ISS: ISS stands for International Space Station. This is like a home and workplace in space where astronauts live, gather information, and do experiments.
- dock: Dock means to connect or join. If I shake hands with someone, our hands connect. When a spacecraft, such as the space shuttle, connects and joins the ISS, we say it docks.

2. Discuss the importance of all the training the astronauts do before they go into space. Share the background information with the students to make sure they understand that astronauts must practice in simulators on Earth before they try to do it for real in space. Practice makes perfect, and if you don't get it right in space, you probably cannot try it again like you can when you practice using a computer here on Earth.

3. Explain to the class that they will be astronauts in training. They will simulate a docking procedure for the space shuttle with the International Space Station.

4. Have students get a partner. Then, create at least two teams. (No more than 7 pairs per team – or a total of 14 individuals – are recommended.)

5. Supply each team with the two belts connected with the string and the orbiter attached in the middle.

6. Show students a cup. Tell them that this represents the place on the International Space Station where the orbiter is supposed to connect, or dock.

7. Place a cup about 7 meters in front of each team. (You may desire to have a cone, line, or some other marker to designate the starting line for teams and the ending point where the cups are to be located.)

8. With one set of partners, have them demonstrate how to put on the belt with the orbiter hanging between them. Have them make their way to the cup and carefully try to get the orbiter in the cup without knocking the cup over. If they knock the cup over, they must run back to the starting line and try again. Explain that it is very important not to knock the "space station" over! Have the demonstrators return to their team, and tell the class that when partners return to the team, they take of the belts and let the next pair have a turn. The first team to successfully have all its members dock with the station wins.

9. Once the demonstration is over, have the first pair of each team to put on their belts so that the orbiter is dangling between them. Ask if there are any questions.

If there are no questions, allow students to engage in the docking with the ISS relay race!

Summarization:

Ask the following questions to summarize the lesson:

- What does it mean to dock with the ISS?
- How do you think this activity is really like docking in space? (You have to communicate and pay close attention to what you are doing. Just like you slow down to get the orbiter in the cup, the orbiter slows down when it is close to latching on to the ISS. Also, when you were carefully getting the orbiter into the cup, you were making small movements and adjustments. The same is true in space.)
- How do you think this activity is different from docking in space? (You are not traveling as fast as the space station or orbiter, which travel at 17, 500 miles per hour! The cup stays in place and is not actually moving like the ISS. The orbiter and ISS weigh much more than you and the cup.)
- What worked best to dock the orbiter with the station in this activity?
- Why is teamwork important on Earth and in space?

Assessment:

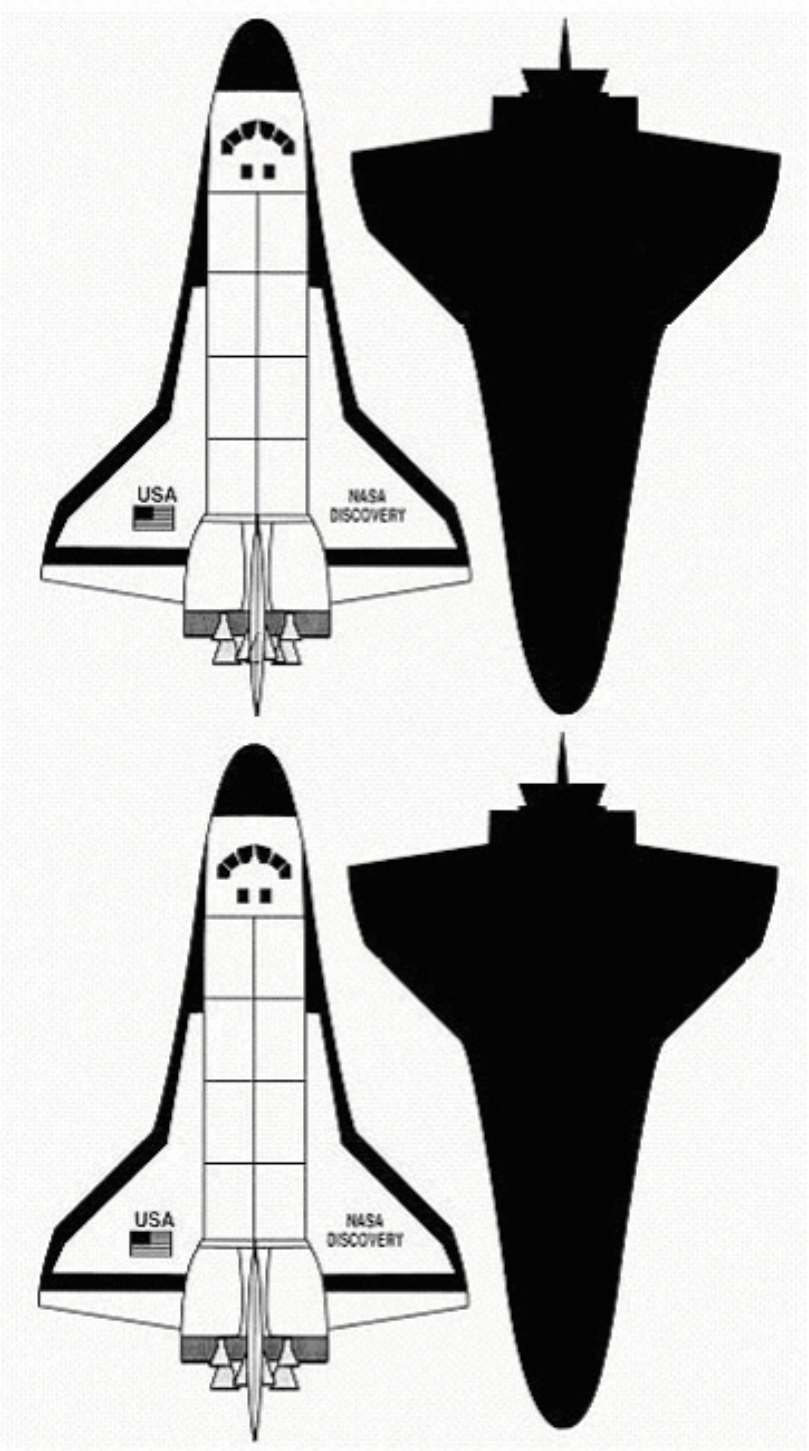
- teacher observation
- student answers to class discussion questions

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

- Try the activity again with one of the partners wearing a mask or headband over his/her eyes to impair the student's vision. (Emphasizes planning, communication, and teamwork.)
- Have students read the NASA Explores article "Docking with Precision." (included at the end of this lesson plan) Have students draw a Venn diagram to compare and contrast the PE docking simulation activity on Earth compared to actually docking in space. (See 2nd and 3rd summarization questions.)
- Have students practice capturing and docking a module to the ISS at http://www.nasa.gov/externalflash/Buzz_Lightyear/web/ (Select mission game #4.)

Associated Websites:

- See an animation of an orbiter docking with the ISS http://www.youtube.com/watch?v=8reKmhWhyH4
- Read to learn more about how the orbiter docks with the ISS http://www.nasa.gov/missions/shuttle/f_docking.html



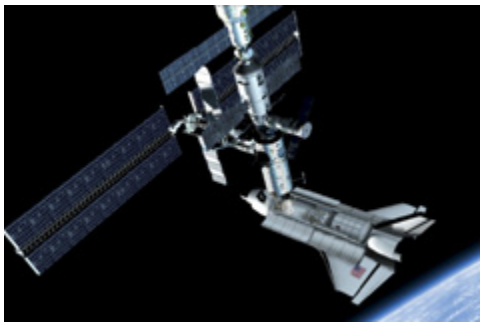
Note: Two copies of the Shuttle orbiter are provided for ease in duplication.

Docking With Precision

Do you like to play video games? If so, you might be a great **astronaut**! Astronauts must practice what they do in space. They use training **simulators** to do this. These are like video games. To play a video game, you must have quick **reactions**.

When **docking** the shuttle with the International Space Station, you have to keep track of lots of things at one time. There is no room for a mistake.

The shuttle must line up with a docking ring. Docking goes slow. It takes 90 minutes to dock when the shuttle gets close. Once they touch the target, they **latch** on to the International Space Station. The astronauts go back and forth between the shuttle and International Space Station. When it's time to leave, they do the steps backwards.



When astronauts have free time in space, they read, check their e-mail, and practice docking on the simulator. Remember, astronauts do not spend all their time playing.

Courtesy of NASA's Space Operations Mission Directorate
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