

# SPACE

## FRAMEWORK

I. Scientific and Engineering Practices

II. Cross-Cutting Concepts

III. Physical Sciences

## SKILLS/OBJECTIVES

- Complete mission objectives using three activities
- Collect enough fuel to launch a rocket, discover the code word needed to operate the liftoff voice command countdown, and discover the astronaut's secret lucky charm that he needs to have before liftoff

## MATERIALS

- Blindfold (If schools don't want the kids to use a blindfold then ask the kids to cover their eyes)
- Clear bucket
- Green food coloring
- Jars filled with water
- Large poster boards (18X24)
- Normal printer paper
- Masking tape
- Boxes without cardboard lids
- Paper to cover each box
- Skewers
- Colored markers
- Rulers
- Mystery objects to place in boxes (One shoe in each box)

## NOTES

N/A

## BACKGROUND

- Today we will learn about robots, giant sound cones, and radar
- These are just three technologies used to explore space

Activity # 1	Robot Game
Materials	<ul style="list-style-type: none"><li>• Blindfold (If schools don't want the kids to use a blindfold then ask the kids to cover their eyes)</li><li>• Clear bucket</li><li>• Green food coloring</li><li>• Jars filled with water</li></ul>
Worksheet	N

- Split kids into teams of three
- One student gets on hands and knees with a blind fold on
- One student stands next to the first facing in one direction
- The third student stands facing the second student
- The three students stand close together creating one robotic team unit
- Place the covered jars of green water randomly in an open space. The kids have to work together to find the rocket fuel.
- The students work together, one as the eyes, one as the ears, and one as the collector
- **Game instructions:**
- Two students stand facing each other
- The third is on the ground and should not be able to see. The two standing students are essentially guiding the one on the ground to try and find the fuel
- Volunteers place the dyed water in an open space once the kids are ready to play

- The “eyes” student stands facing the direction of the water (They are allowed to see where it is placed, but they are not allowed to talk). This student points in the direction of the water.
- The “voice” student facing away from the water now shouts out which direction the third student should move. (For those who don’t know right from left or get confused have a volunteer help “steer” the third student in the right direction, just enough help to get them moving in the right direction)
- The “ears” student on the ground has to listen to the directions and move through the space trying to find the fuel
- If you have any questions about this game ask one of the science class members and they will demonstrate
- \*\*\*Depending on the size of your space and the group size you can have one group go at a time or spread out and have up to three groups go at the same time\*\*\*
- Make it work! This game could get hectic, but embrace the giggles and have fun!
- The students will find a jar filled with green liquid (food coloring and water)
- Explain that the jars are rocket fuel and we need to collect enough to launch the rocket (For small groups you can just collect a couple jars and tell them that they found enough to launch the rocket! For larger groups collect all the jars and pour them into one large container).
- Once the jars are found, congratulate the kids and tell them the first phase of the mission is complete

Activity # 2	Giant Sound Cones
Materials	<ul style="list-style-type: none"> <li>• Large poster boards (18X24)</li> <li>• Normal printer paper</li> <li>• Masking tape</li> </ul>
Worksheet	N

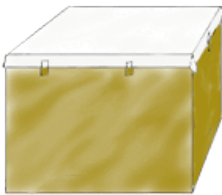
- Keep the same teams as the previous activity
- Give each group of kids a poster board and enough pieces of printer paper for each student
- Help each group roll their poster boards into giant cone shapes and make smaller cones out of the printer paper

- Tape the posters' edges so they maintain large cone shapes
- Have only one big cone per group, the kids can take turns using it and the smaller cones
- Have a volunteer go across the room and make a soft noise that is difficult to hear
- Have the kids listen without cones and then with the cones and have them explain what sounds became clearer from across the room. Have them compare how well they can hear the sounds using the smaller cones and the larger cones.
- The larger cone works better, and this is part of the reason dishes are so large
- After the kids have experimented with the cones have one volunteer go across the room and say the secret phrase that is needed to complete objective two. The phrase is BLAST OFF!! The volunteer should have each group use the cones to hear the phrase even when it is said very softly. Start by saying it very softly and seeing which group can guess the phrase first.
- Now we have enough rocket fuel and the code phrase to launch the rocket. The last thing needed is the astronaut's lucky items. The items are inside boxes and the next activity will show how to find out what they are!
- Keep all cones you make for the next day's science club, just leave them next to the box in the office
  
- What is happening:
  - Like waves in the ocean, sound makes waves in the air. Air moves back and forth as the sound energy waves pass
  - If you put something like paper in the path of the sound wave, it will also vibrate quite a lot. If you give this paper surface the right shape, the sound waves will be funneled to a point. So your super sound cone is a sound funnel
  - The same sort of idea makes NASA's giant dish antennas work. These antennas listen for signals from the planetary spacecraft now exploring space far from Earth

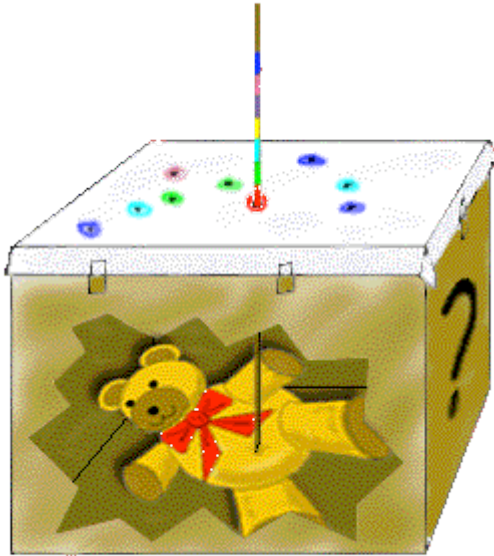
Activity # 3	<b>Radar</b>
Materials	<ul style="list-style-type: none"> <li>• Boxes without cardboard lids</li> <li>• Paper to cover each box</li> <li>• Skewers</li> <li>• Colored markers</li> </ul>

	<ul style="list-style-type: none"> <li>• Rulers</li> <li>• Mystery objects to place in boxes (One shoe in each box)</li> </ul>
Worksheet	N

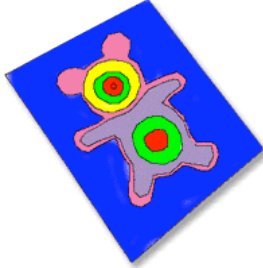
- For Younger Students – This activity should be done as one large group. Volunteers should help each younger student take a turn using the skewers and marking the paper cover.
- For Older Students – This activity can be done in small groups of 5-7 with volunteers to help if they have any issues. A volunteer should demonstrate the procedure while all of the students watch in order to answer questions and show how the activity works. Explain that the students are creating a topographical map (a picture) of what mystery item is inside the box.



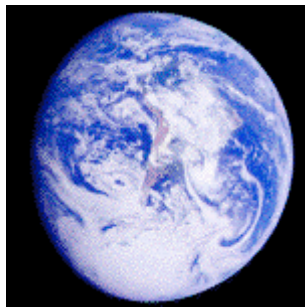
- Poke the Skewer straight down into the box until it touches something
- Mark with your fingers how far the stick went in
- Take out the stick and measure how far it went into the box
- Mark that hole with that measurement. Use colored markers to mark how far the skewer went in. For example, 5 inches deep is blue, 6 inches is purple, 7 inches is red.



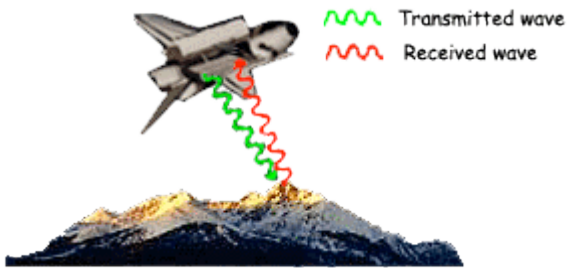
- After you have almost covered the paper with color-coded holes, you can color in the areas with same-colored holes. You would then have a topographical map of the object inside the box.
- You might not be able to tell exactly what the object is even from its "topo" map. But, if you know what colors stand for what heights, you could imagine how the object might look in three dimensions.



What is happening?



- Like the paper that hides the mystery objects, clouds often hide large areas of the Earth's surface. But, just as we can map the objects through the paper, we can use radar to make detailed maps of Earth right through clouds or darkness.
- Radar is a kind of light energy, but we can't see it. It also acts like sound, because it bounces off surfaces making "echoes," which are "heard" by the radar antenna.



- When radar bounces off the ground, only some of the signal gets back to where it started. Much of the signal scatters in other directions. How much of the signal scatters depends on how smooth or rough the surface

is--whether it is covered with smooth water or rough trees, for example--or whether the surface is flat or slanted--like deserts or mountains, or farmlands or cities.

\*This activity is courtesy of NASA for kids. The full website can be found at [http://spaceplace.nasa.gov/en/kids/srtm\\_action1.shtml](http://spaceplace.nasa.gov/en/kids/srtm_action1.shtml)\*

## CONCLUSIONS

- Used teams of three in order to demonstrate how robots “hear”, “see”, and move to accomplish missions and collect information from objects in space
- Constructed sound cones in order to hear sounds from far distances. This technology is used in NASA’s giant space antennas to receive radio waves from spacecraft.
- Explored how radar can be used to outline object formations and create a map of planet surfaces.