



Summer of Discovery “Better Living through Space” Virtual Field Trip June 2020

Space technology is all around us. Whether we rely on satellite imagery, GPS, novel materials or medical advances, space technology impacts our daily life. This month’s field trip is focusing on how satellites “see”. We use satellite data and images all the time. From forecasting weather to analyzing our changing climate to exploring distant places in space, satellites “see” things that we can’t for ourselves.

Activity 1: “Pennies from Heaven”

Materials needed: empty egg cartons, tape, number and letters cut out, 100 small items like pennies or Skittles or beads, 6x6 graph printed out

Steps:

1. Cut the top off 3 egg cartons or 2 18-count egg cartons.
2. Tape the bases together so you create a grid of 6 cups by 6 cups.
3. Tape labels to the outside edge of the cups so that A-F is on the top of the grid and 1-6 is on the side of the grid.
4. Prepare 100 pennies, M&M’s, buttons, or any other small object that can be dropped into the cups.
5. Place the egg carton grid on the floor. This is the satellite detector.
6. Drop your pennies or 100 other items from arm’s length above the egg carton detector. These are light photons hitting the satellite detector.
7. After all items are dropped, count how many landed in each cup. Record the number on the graph below. Younger participants may need help recording numbers on the chart.

Follow up: Satellites do not see in color. Rather, they interpret an image based on how many of a certain wavelength of light hit their detector. The more times a detector is hit, the stronger that image source is. The strength of the image can be displayed in different shades of gray or different colors. Scientists add color to images *after* the data is received from the satellite. *You* can add color by designating numbers with colors. For example if no objects landed in a cup, the cell stays white. If 1-3 pennies landed in a cup it is gray, 3-5 pennies equals dark gray, and

black would be for anything over 5 pennies. You will not get a recognizable image, but you will understand how satellites “see” and why we can give any color we want to satellite images.

Satellites do not have just 36 detector cups. They have millions of detectors. Each cup could be called a pixel. In fact, 1 million “cups” per unit of measurement = 1 megapixel.

A B C D E F

1 2 3 4 5 6

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						

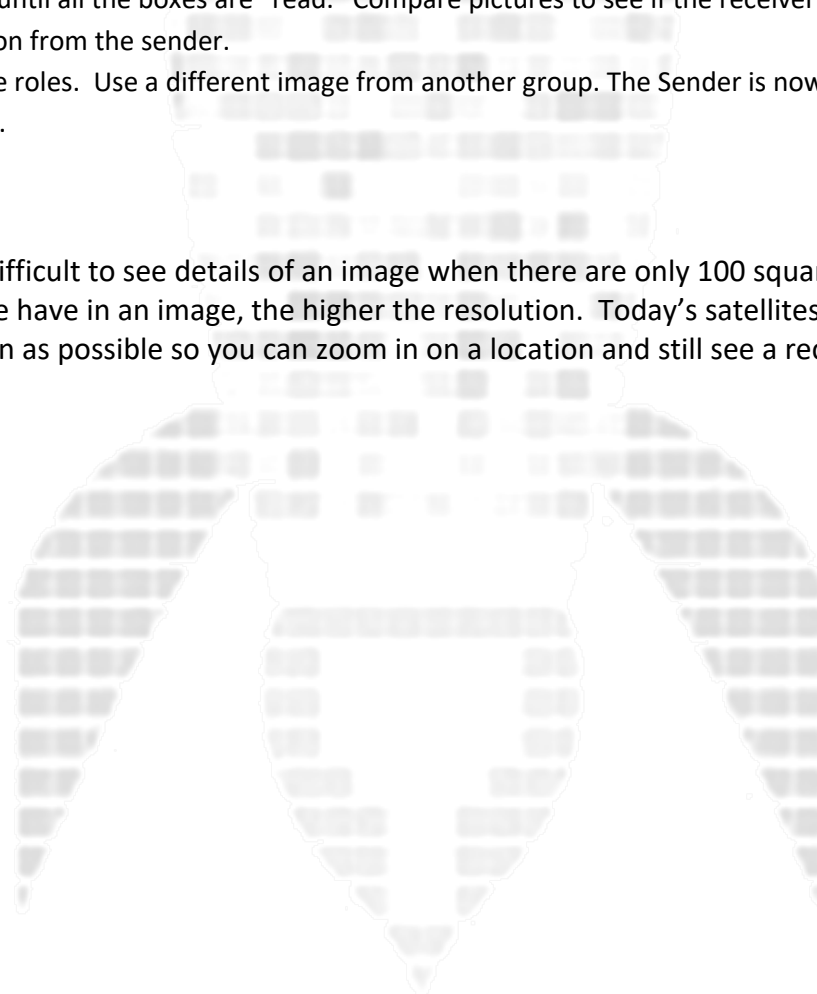
	A	B	C	D	E	F
1						
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	A	B	C	D	E	F
1						
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Activity 2: “Pixel Pictures”

1. Print out several blank graphs (sheets below) — enough for each participant to do it at least once. Print enough picture graphs for at least half of the group.
2. Participants work in pairs to “send” and “receive” images. One will be the sender (the one with the pictured graph) and one the receiver (the one with the blank graph).
3. Line by line, the sender should tell the receiver which squares to color in. Just like a satellite, the sender should communicate a blank square or a black square using only the numbers “0” and “1”. Zero means the square is left white. One means the square is colored black.
4. The sender should NOT let the receiver see the picture. The receiver should say, for instance, “A1” and the sender should say zero if the box is empty, or 1 if the box should be colored in.
5. Continue until all the boxes are “read.” Compare pictures to see if the receiver got the correct information from the sender.
6. Now trade roles. Use a different image from another group. The Sender is now the Receiver and vice versa.

Follow up: It is difficult to see details of an image when there are only 100 squares “pixels”. The more squares we have in an image, the higher the resolution. Today’s satellites try to have as high of resolution as possible so you can zoom in on a location and still see a recognizable image.



	A	B	C	D	E	F	G	H	I	J
1										
2				■			■			
3				■			■			
4				■			■			
5										
6										
7		■							■	
8			■					■		
9				■	■	■	■	■		
10										

	A	B	C	D	E	F	G	H	I	J
1	■			■				■		
2		■			■		■			
3				■						
4	■	■	■	■	■	■	■	■		
5	■							■	■	
6	■							■	■	
7	■							■	■	
8	■							■	■	
9		■					■			
10			■	■	■	■				

For the young ones that need a little more help:

	A	B	C	D	E	F
1						
2						
3						
4						
5						
6						

	A	B	C	D	E	F
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4						
5						
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