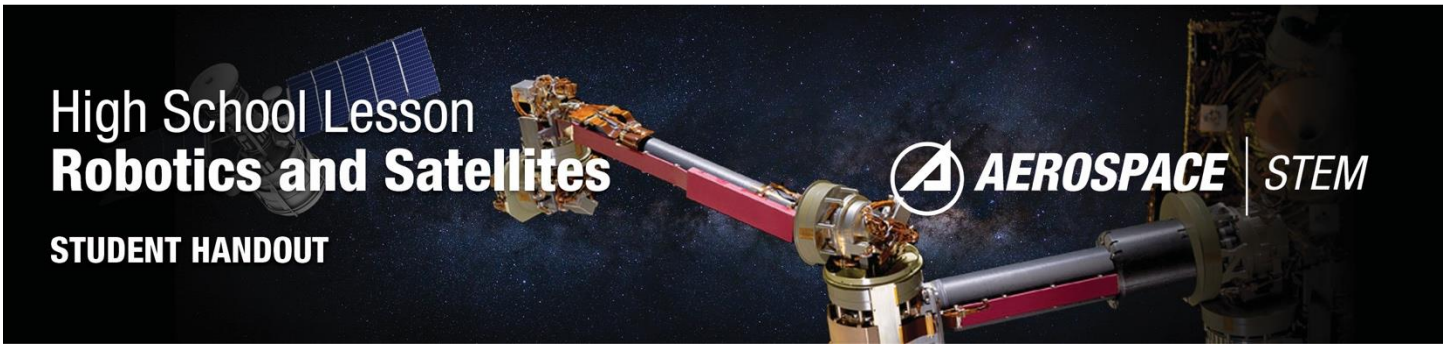


Name		Date	

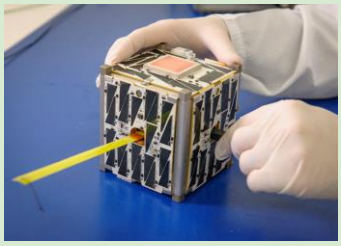
Directions: Students read the prompts and answer in complete sentences in the box to the right.

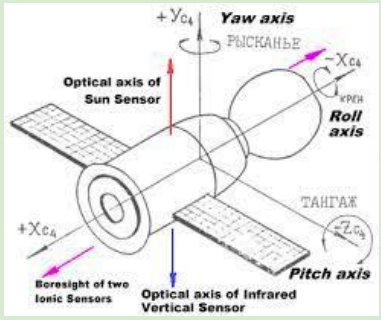
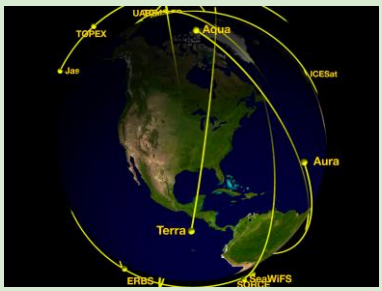
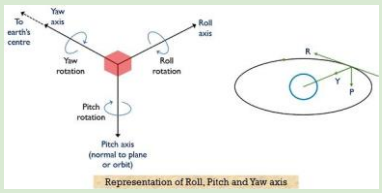
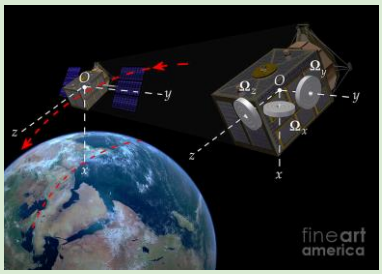
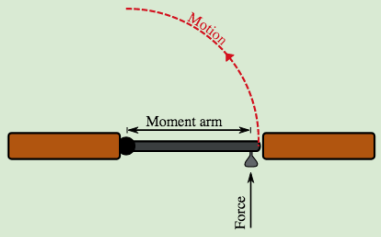
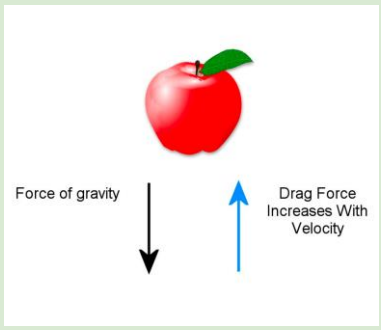
Part 1: Understanding Orientation

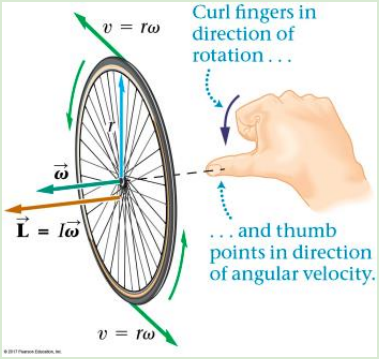
Section A: Dizzy Bat	
Record the dizzy bat time.	**Student A:** **Student B:**
Record the dizzy bat time with cones. *5 second penalty for each cone hit.*	**Student A:** **Student B:**
Record the dizzy bat time with cones and while blindfolded. *5 second penalty for each cone hit.*	**Student A:** **Student B:**
Section B: Dizzy Bat Class Data	
Class average for regular dizzy bat	
Class average for dizzy bat with cones	
Class average for dizzy bat with blindfold	
Section C: Strategies for Orientation	
Which round was easiest for you? Why?	
What senses did you rely on to navigate to your partner?	

With fewer senses (when you were blind folded), how did that change your ability to navigate toward your partner? Use data to tell this story.	
What additional data would you have wanted to collect?	

Day 2: General Concepts

Section D: Vocabulary Development			
Word	**Definition**	**Image**	**Description in Own Words**
Satellite	An object that orbits around Earth or another planet.		
CubeSat	An artificial satellite typically designed with inexpensive components that fit into a cube with sides 10 cm in length.		
Navigation	The science of getting ships, aircraft, or spacecraft from place to place.		

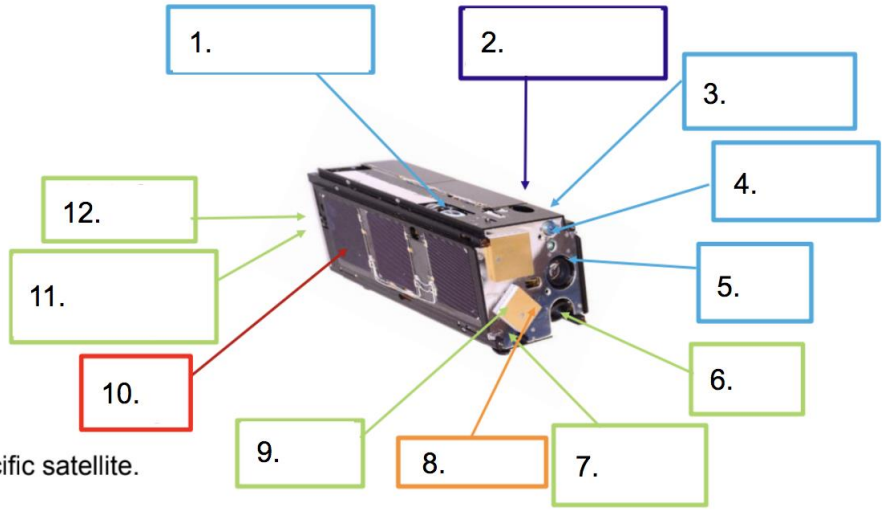
Orientation	The relative physical position or direction of something.		
Trajectory	The curved path an object follows when it is thrown into the air or space.		
Attitude	The relationship of the moving axis of the craft with respect to the horizon or direction of movement.		
Control	The ability to manage a machine, vehicle, or other moving object.		
Torque	A force that produces rotation from a pivot point.		
Drag	A force acting opposite to the relative motion of any moving object with respect to a surrounding fluid.		

Gyroscope	A device with a spinning disc or wheel mechanism that harnesses the principle of conservation of angular momentum.		
Angular Momentum	Rotation of the product of a mass, its rotational radius and velocity from a pivot point.		

Section E: What are Attitude and Control?	
Answer after watching the video:	
1. What are the two primary external forces acting upon the ISS that require us to continually change its attitude?	
2. What are the two methods of orienting a satellite and maintaining its attitude?	
Answer after the class discussion:	
3. What are some differences between CubeSats and the current research satellites employed by scientists?	
4. What benefits do CubeSats have over older, larger research satellites?	
Section F: How CubeSats Transmit Information	
Discuss as a class.	

Describe the successes you experienced during this activity.	
Describe the challenges you experienced during this activity.	

Day 3:

Section G: Labeling Parts of a CubeSat	
1. Name the part of the CubeSat that performs each function.	
Power Batteries Solar Cells Communication with the ground Radio Laser Comm Attitude Knowledge (Navigation) Star Trackers GPS Attitude Control Reaction Wheels Torque Rods Propulsion Payload/Mission What is the purpose of this specific satellite.	
1. 2. 3. 4. 5. 6.	7. 8. 9. 10. 11. 12.
Section H: CubeSat Transmission Process	
1. Identify which of the five main components of a satellite (power, communications, attitude knowledge, attitude control, or payload/mission) were used in the activity.	
2. What did the command for "number of shapes," "shapes," "location of shapes," "size of shapes,"	

"orientation of shapes," or "color of shapes" represent?	
Section I: Satellite Case Study Webquest	
1. Satellite name: James Webb Space Telescope https://webb.nasa.gov/content/observatory/instruments/index.html	
a. What does this satellite observe?	
b. What sensors does this satellite use?	
c. How do these individual sensors come together to provide information to scientists that tell the entire story?	
2. Satellite name: ICESat-2 https://nsidc.org/news-analyses/news-stories/mission-and-support-icesat-2-data	
d. What does this satellite observe?	
e. What sensors does this satellite use?	
f. How do these individual sensors come together to provide information to scientists that tell the entire story?	
3. Satellite name: Soil Moisture Active Passive https://www.nasa.gov/jpl/smap/satellite-data-help-farmers-facing-drought-20140814/	
g. What does this satellite observe?	
h. What sensors does this satellite use?	

i. How do these individual sensors come together to provide information to scientists that tell the entire story?	
4. Satellite name: Mars Cube One https://www.jpl.nasa.gov/missions/mars-cube-one-marco	
j. What does this satellite observe?	
k. What sensors does this satellite use?	
l. How do these individual sensors come together to provide information to scientists that tell the entire story?	
5. Satellite name: Educational Launch of NanoSatellites https://www.nasa.gov/mission_pages/smallsats/elana/index.html	
m. What does this satellite observe?	
n. What sensors does this satellite use?	
o. How do these individual sensors come together to provide information to scientists that tell the entire story?	
6. Satellite name: Double Asteroid Redirection Test https://www.nasa.gov/feature/dart-gets-its-cubesat-companion-its-last-major-piece	
p. What does this satellite observe?	
q. What sensors does this satellite use?	

r. How do these individual sensors come together to provide information to scientists that tell the entire story?	
7. How do these case studies relate to the transmission process activity?	

Day 4 & 5: Orientation and Control

Section J: Programming the Orientation of a Satellite	
Answer the questions below as an engineer.	
1. Map out the trajectory of your satellite from the launch pad to the target. Draw this in the space to the right.	
2. Write out the code that you will use to move your satellite from the launch pad to the target. Test this out before transferring to the Commander Notes	
Section K: Reflection	
1. What did you notice about the notes that were provided to you by your other teammates?	
2. What changes did you need to make to your code?	
3. What happened if your Satellite was not at the correct orbital distance from the object it was trying to capture?	
4. How did your team work together to achieve the	

mission? If the mission was not successful, what additional resources would your team have needed to accomplish this task?	