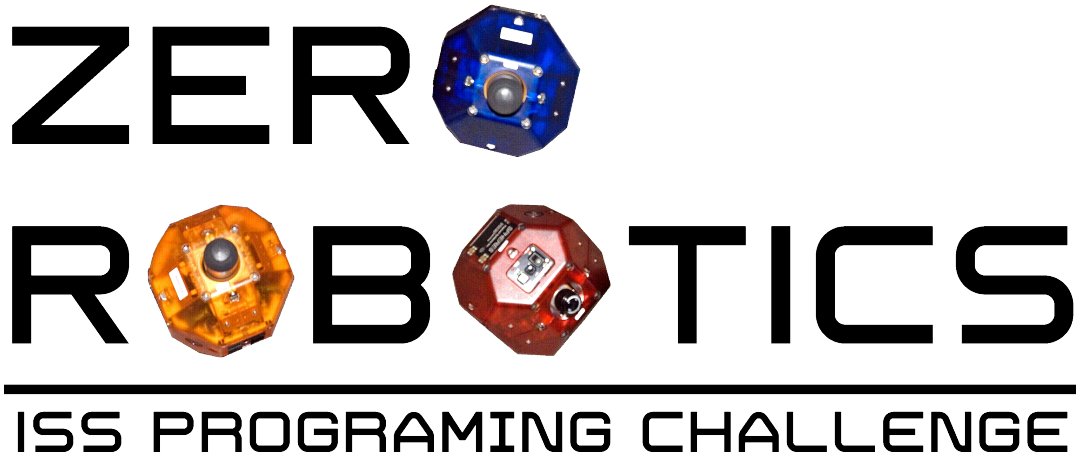
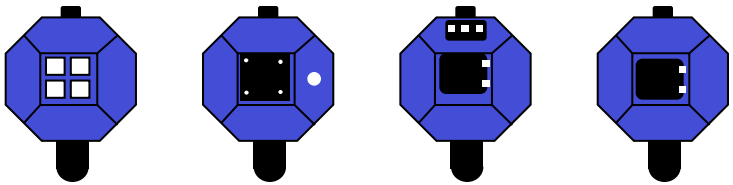


More Simple Arrays—Another Way to Initialize Variables

Goals

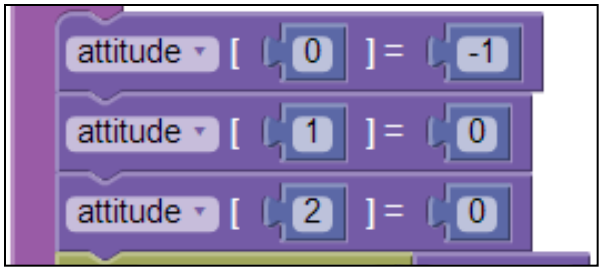
- In this tutorial you will:
  - Learn how to edit a project
  - Learn another way to initialize variables
  - Create multiple variables in order to accomplish a challenge!
  - Learn more about rotating the satellite to face different directions

- Remember: Attitude describes the direction the satellite is facing



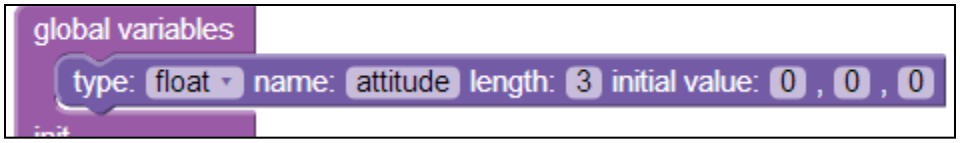
More on Assigning Values to Variables

- There is more than one way to assign a value to a variable in the graphical editor
- So far you have assigned the values of an array individually, as shown on the right



vs

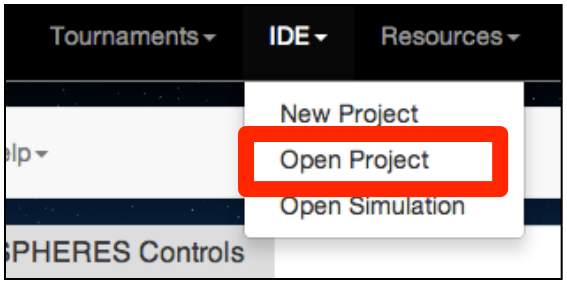
- Next we will show you how to assign the values of the array when the variable is declared.



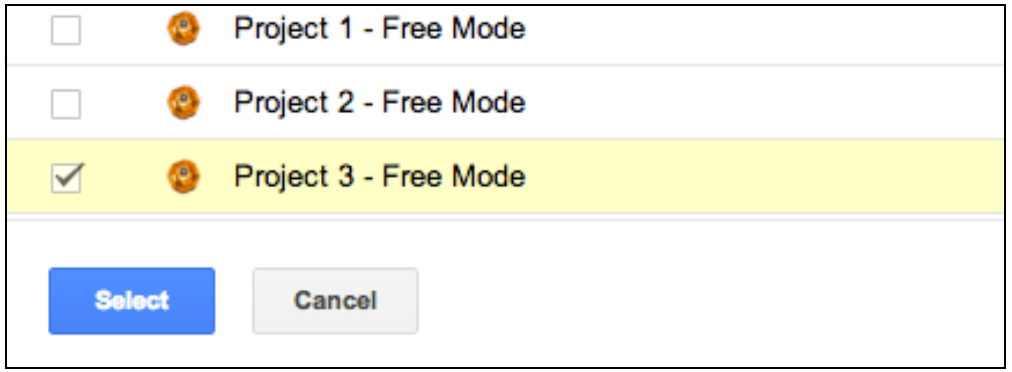
- **But first** we will show you how to edit a project so you can see that the two methods give the same results.

Open your Project

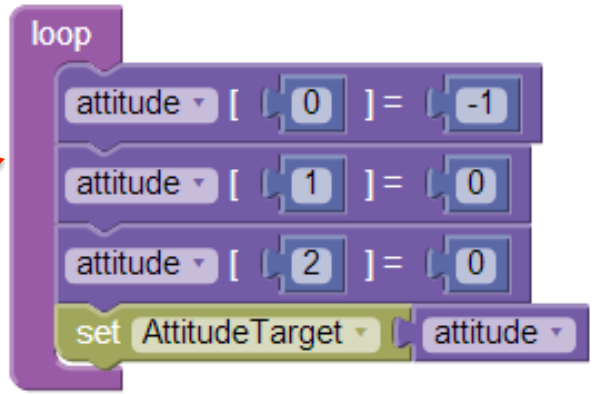
- Open the project you just created when learning about arrays. (“Project 3”)



- If the project is not already open
  - Select Open Project from the IDE Menu
  - Click on “ Project 3” and then “Select” to open the project

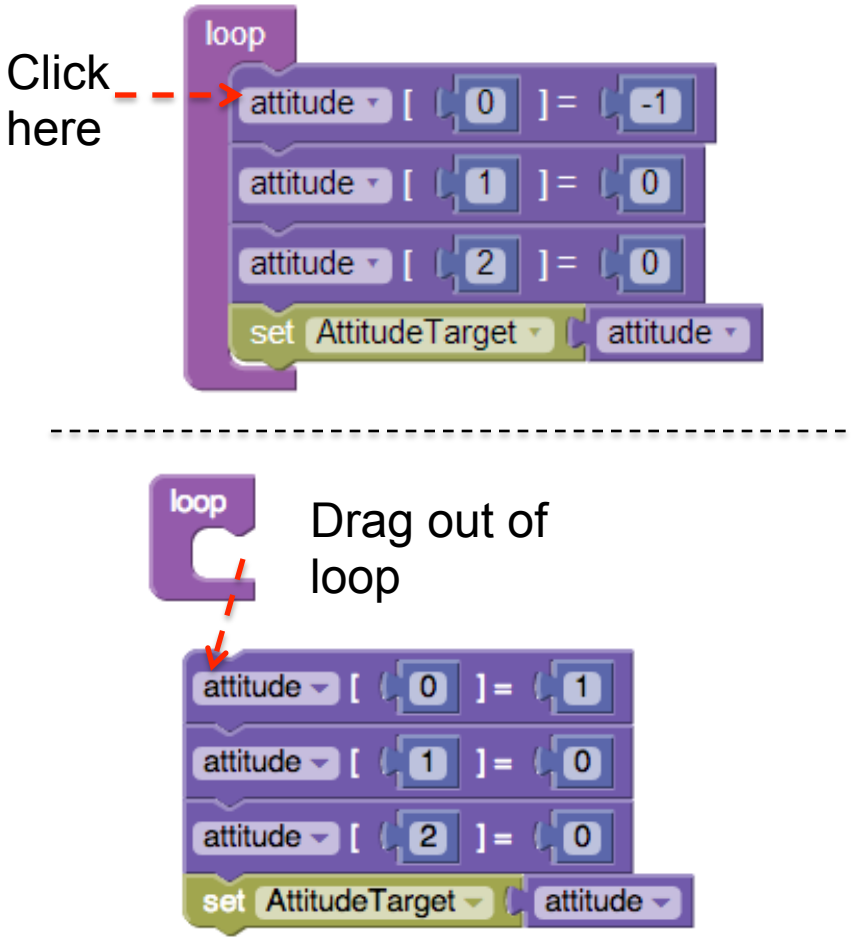


- You should see the project shown here.



Edit your Project

- To remove a **group** of blocks from your loop:
  - Click on the **topmost** block in the group
  - Drag the group of blocks out of the loop.

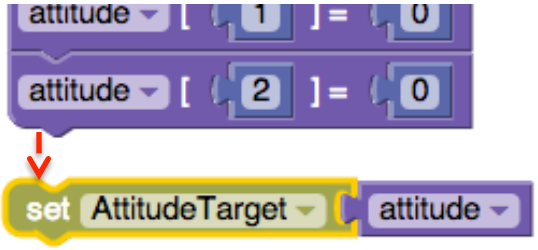


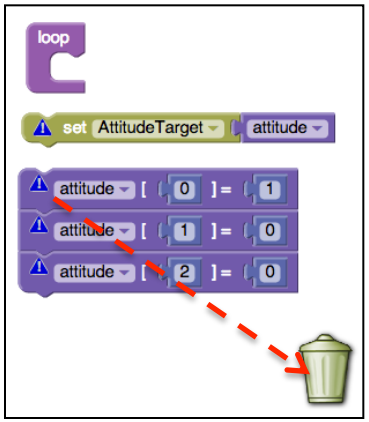
Edit your Project, cont.

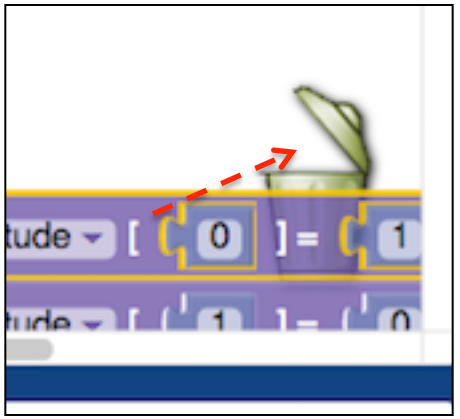
- To remove a **single** block from a group of blocks
  - Peel blocks off from the bottom
  - Save this block for later
- To delete a **group** of blocks:
  - Click on the **topmost** block in the group
  - Drag them into trash (watch for trash can lid to open)

Click here

Drag away from bottom



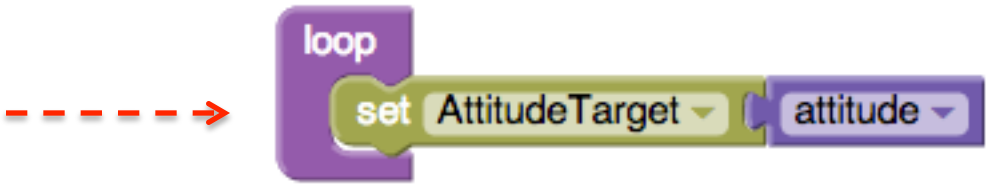




Edit your Project, cont.

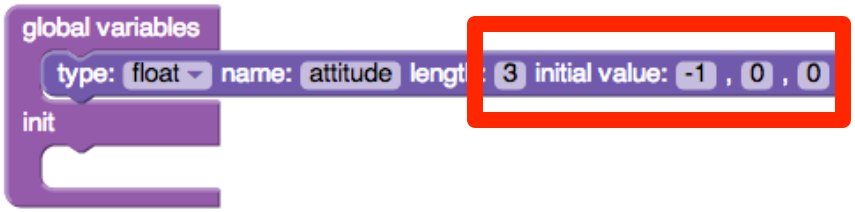
- Now you can drag the remaining "setAttitudeTarget" block back into the loop

- Your program should look like this:



Initializing Arrays

- Go to the Init page
- When you created the array “attitude [3]” you entered:
  - “float”
  - “attitude”
  - “3”
- This time **initialize the array here** by typing in the values of the array into the initial value spaces
  - For the satellite to point in the positive x direction- type: -1,0,0
    - The first value sets [0]
    - The second value sets [1]
    - The third value sets [2]



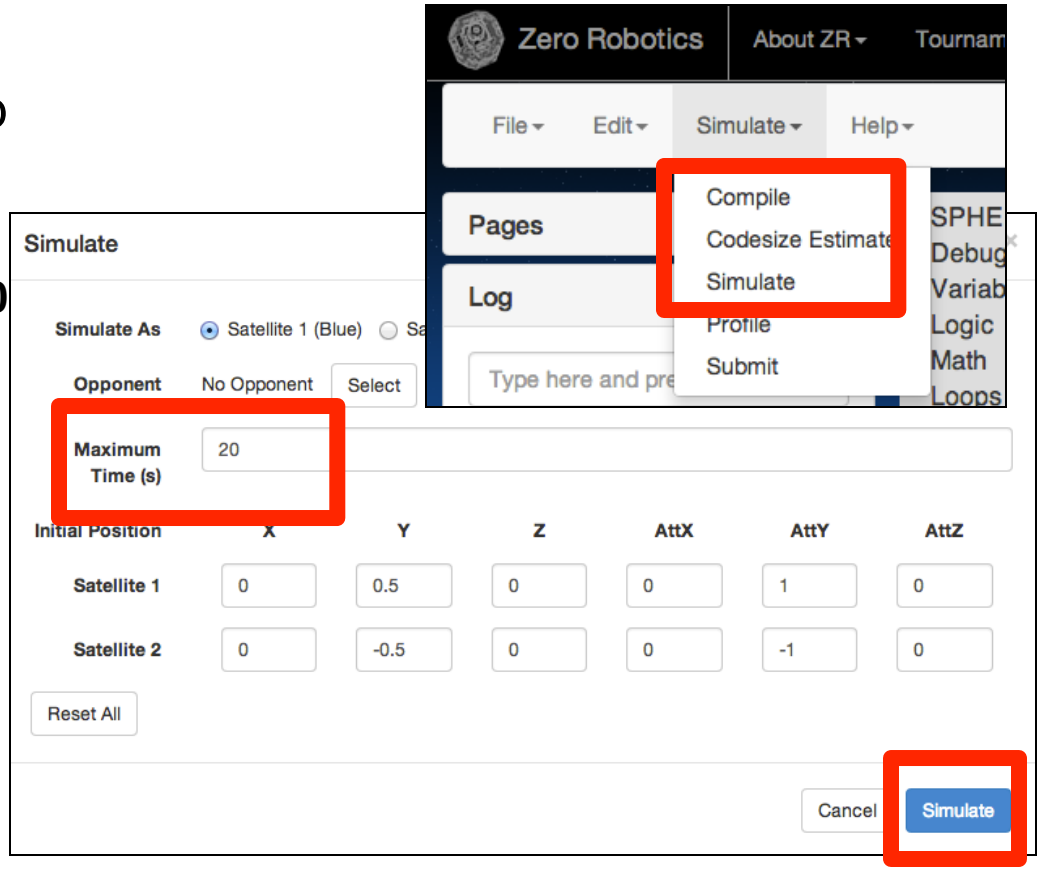
To point the satellite in the following directions:			
	+/- x direction	+/- y direction	+/- z direction
set: [0] =	+/-1	0	0
set: [1] =	0	+/-1	0
set: [2] =	0	0	+/-1

Compile, Simulate

- Compile, Simulate
- In the Simulation Settings pop-up box:
  - " "Maximum Time":
    - **Change from 90 seconds to 20 seconds**
- Click "Simulate" button

- View simulation
  - The SPHERE will rotate just as it did before when you set the values individually within the program

- Select "Back to Project" to return to the Graphical Editor



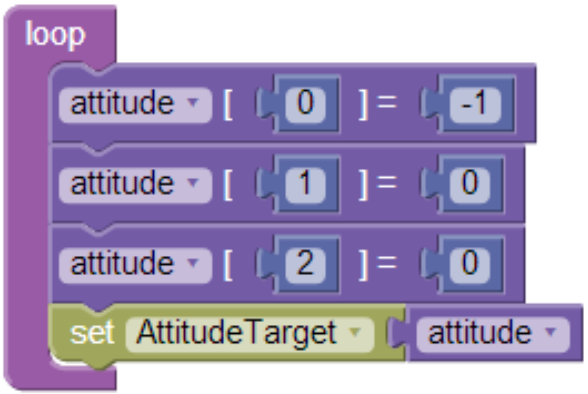
Look at your code

- Here is your program with the array values initialized on the init page


```
1 void init() {
2   attitude[0] = -1;
3   attitude[1] = 0;
4   attitude[2] = 0;
5 }
```

```
1 void loop() {
2   api.setAttitudeTarget(attitude);
3 }
```

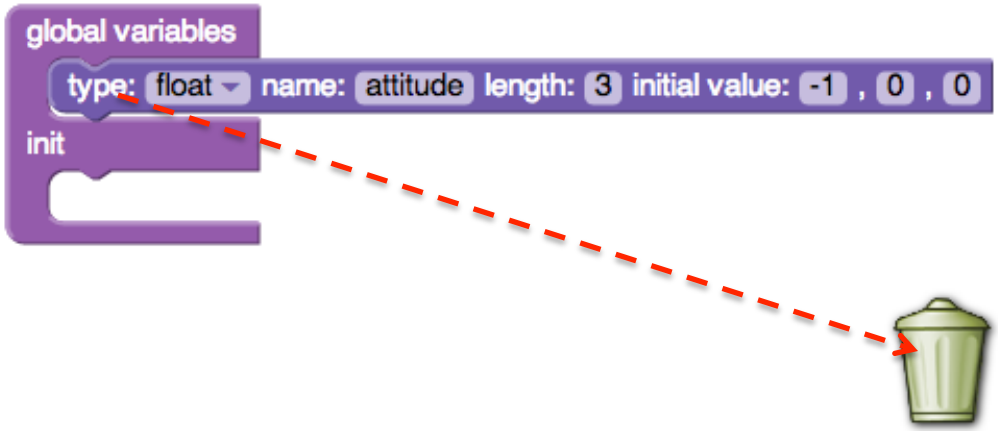
- Compare to your program with the array values defined separately




```
1 void loop() {
2   attitude[0] = -1;
3   attitude[1] = 0;
4   attitude[2] = 0;
5   api.setAttitudeTarget(attitude);
6 }
```

Declare Specific Pointing Direction Arrays

- Next go to the Init page and delete the array attitude[3] by dragging it to trash



- On the next few slides you will create and name arrays for specific pointing directions
  - For example:

    you will initialize one array with the name:

    pointposx (to **point** in the **pos**itive **x** direction)

    and initialize another array with the name

    pointnegy (to **point** in the **nega**tive **y** direction)
- This will make it easy for you to recognize and use your arrays

Declare Specific Pointing Direction Arrays, continued

- First declare two separate arrays that point the SPHERE in +/-x direction
- For the +x direction create "**pointposx**" which will be initialized to:
  point in the **pos**itive **x** direction:
  - Select purple array initialization block
    - Type: select "float"
    - Name: "**pointposx**"
    - Length: 3 (=array size)
    - Set Initial value to: **1,0,0**
- For the -x direction create "**pointnegx**" which will be initialized to: **point** in the **neg**ative **x** direction as follows:
  - Select purple array initialization block
    - Type: select "float"
    - Name: "**pointnegx**"
    - Length: 3
    - Set Initial value to: **-1,0,0**

To point the satellite in the following directions:	
	+/- x direction
set: [0] =	+/-1
set: [1] =	0
set: [2] =	0

Declare Specific Pointing Direction Arrays, continued

- Use the table as a guide and declare 4 more variables which point in the
  - +/-y directions (pointposy, pointnegy)
  - +/-z directions (pointposz, pointnegz)

- Remember:
  - Select purple array initialization block
    - Type: select “float”
    - Name: enter name
    - Length: 3 (=array size)
    - Set Initial value (as shown in the table)

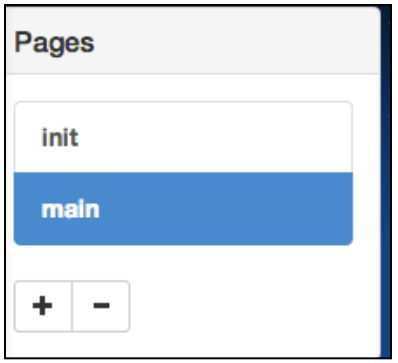
- The +y direction should be initialized to: 0,1,0

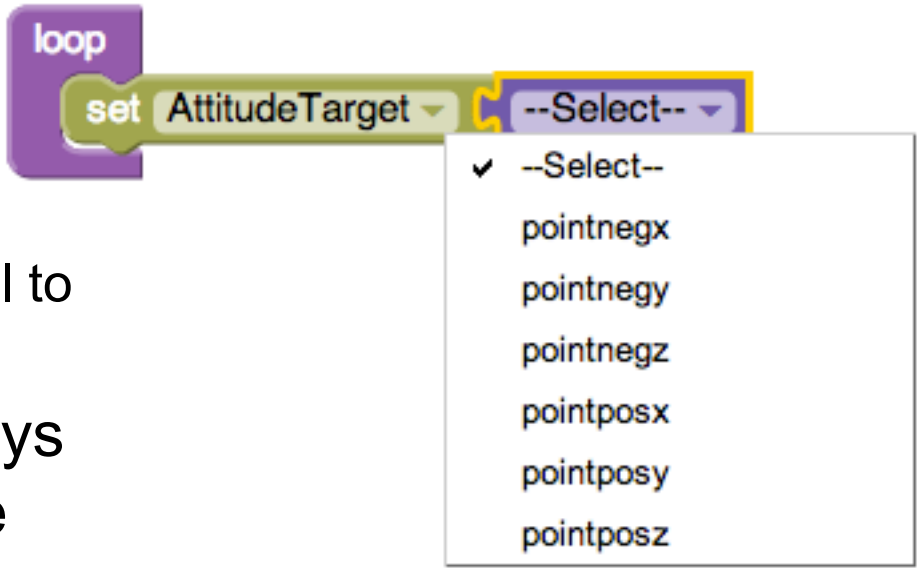
- Can you figure out the rest?

To point the satellite in the following directions:			
	+/- x direction	+/- y direction	+/- z direction
set: [0] =	+/-1	0	0
set: [1] =	0	+/-1	0
set: [2] =	0	0	+/-1

Declare Specific Pointing Direction Arrays, continued

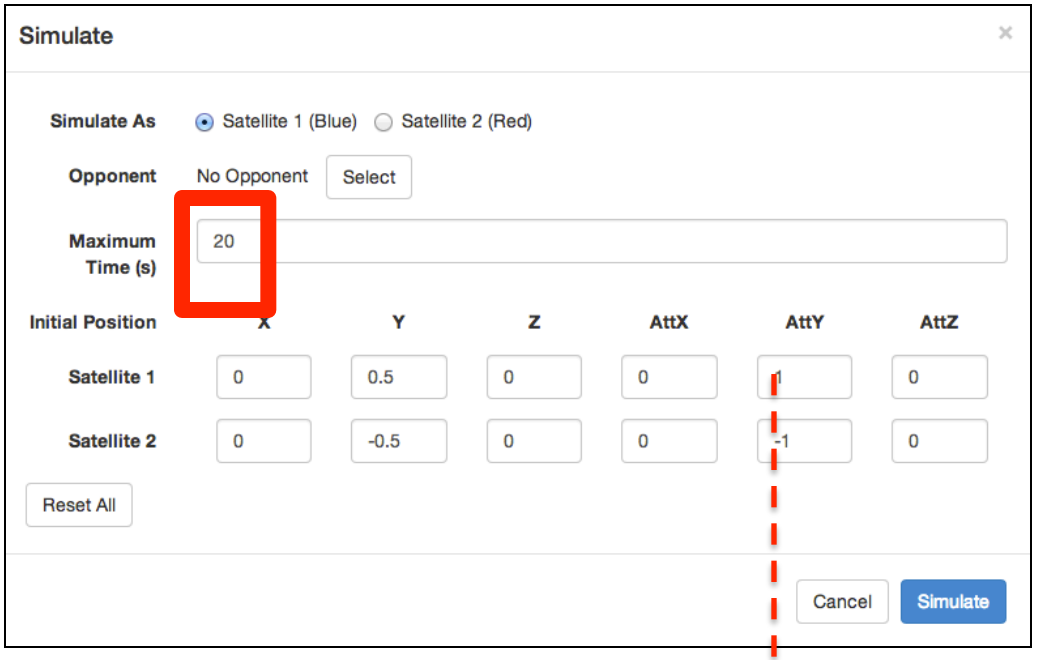
- Return to the **main** page
- Now in the “setAttitudeTarget” block you can choose the array which sends the satellite to any of the pointing directions
- Pick one and try it!
- Compile, simulate and view simulation.
  - Remember to use the zoom-in tool to look at the satellite
- Next you will use your new arrays to try to accomplish a challenge
- Click “Back to Project”





Preparation for the Challenge

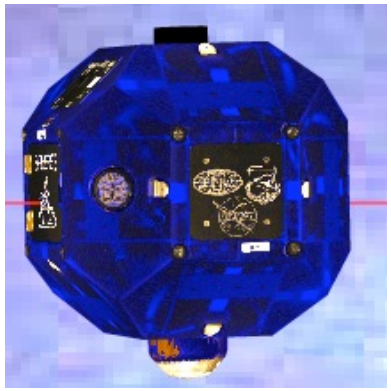
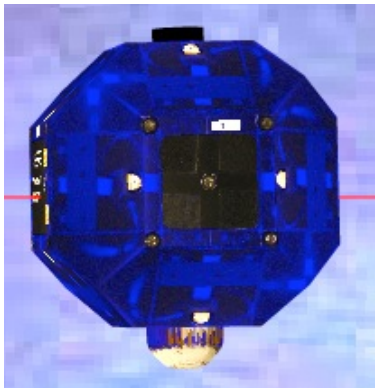
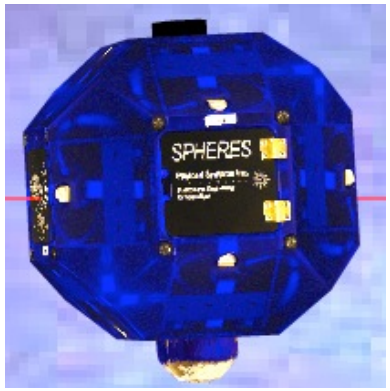
- First you will need to change the initial attitude of the satellite in the simulation setting window.
- Select Simulate
  - * “Maximum Time”:
    - Change from 90 seconds to **20** seconds
  - *Initial Position and Attitude
    - For this challenge, SPH1 should start pointing in the negative x direction
    - Set SPH1 to (you may need to enter this each time!)
      - **Attx = - 1**
      - **Atty = 0**
      - **Attz = 0**

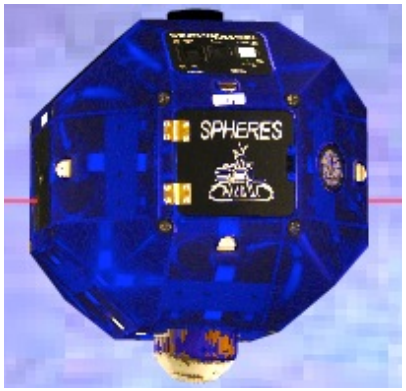


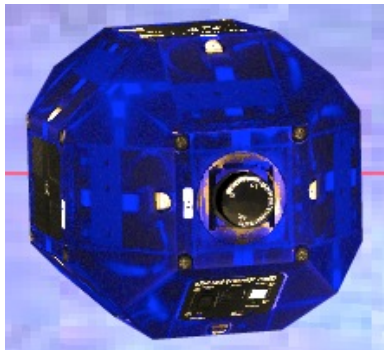
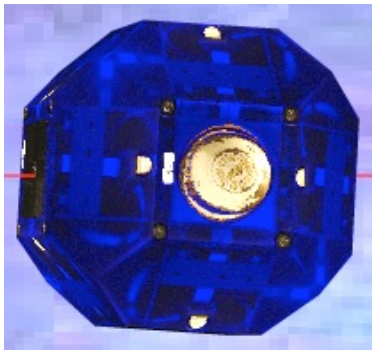
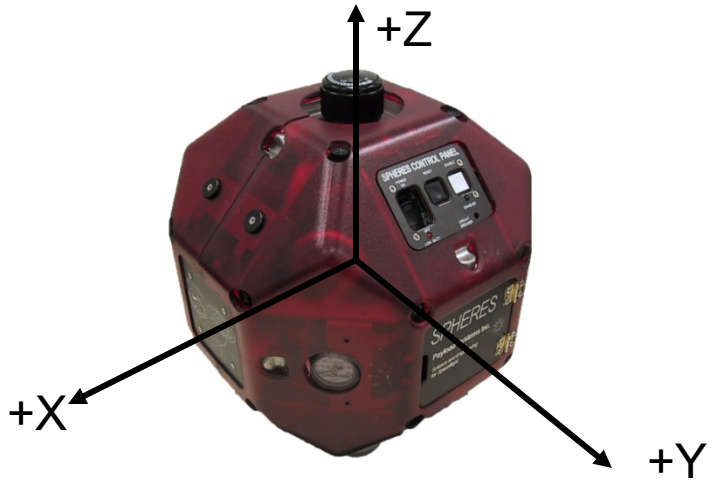
Initial Position	X	Y	Z	AttX	AttY	AttZ
Satellite 1	0	0.5	0	-1	0	0
Satellite 2	0	-0.5	0	0	-1	0

The Challenge

- Use your new arrays and try to rotate the satellite so that you can see all the different sides shown below.



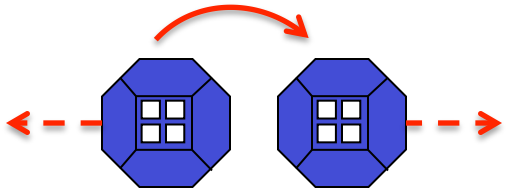




Rotating the Sphere

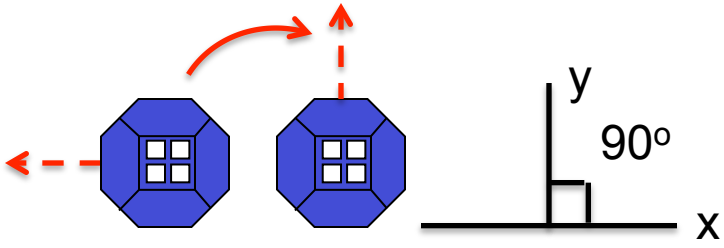
- If you completed the Challenge, congratulations!

- Here is another question for you:
  - Suppose you wanted to rotate the satellite 180 degrees?
    - How would you do that?
  - What if you wanted to rotate the satellite 90 degrees?
    - How would you do that?

180 degree rotation

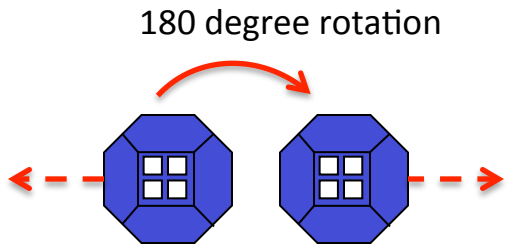


90 degree rotation

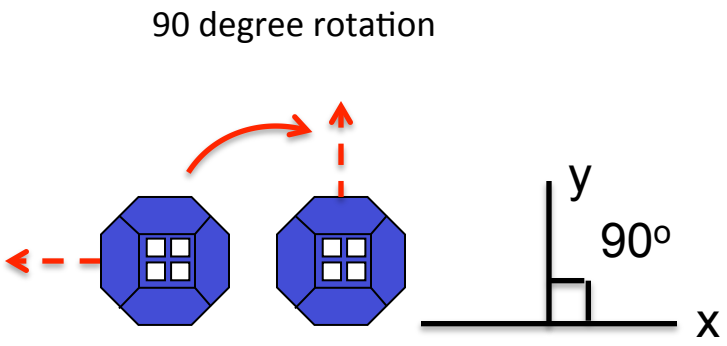


Rotating the Sphere, continued

- To rotate the satellite 180 degrees
  - Simply change the pointing direction from positive to negative or negative to positive
  - For example:
    - If the satellite starts pointing in the negative x direction
    - Then set the attitude target to pointposx



- To rotate the satellite 90 degrees
  - Change the pointing direction from the x axis to the y axis
  - For example :
    - If the satellite starts pointing in the negative x direction
    - Then set the attitude target to pointposy



Review

- Congratulations!
  - You know how to edit a project by deleting blocks, and deleting arrays
  - You have learned another way to assign values to your arrays
  - You learned more about rotating the satellite to face different directions
  - Maybe you even solved the Challenge!