

# Engineer a Satellite

Select the scientific instruments for your satellite, calculate the power requirements for all the subsystems, and construct a scale model of your very own Earth observing satellite.

## 1 PICK YOUR INSTRUMENTS:

What would you like your satellite to observe about the Earth system? Review the instrument cards and select up to 3 instruments you would like onboard your satellite.

## CALCULATE POWER REQUIREMENTS

### 2a Record and total the amount of power required for all subsystems:

Every satellite needs systems to operate and maintain the satellite. Record the power required for each subsystem and instrument you choose. Total the power required.

**Attitude Control subsystem** Power \_\_\_\_\_

**Communications subsystem** Power \_\_\_\_\_

**Data Handling subsystem** Power \_\_\_\_\_

**Thermal Control subsystem** Power \_\_\_\_\_

**Propulsion subsystem** Power \_\_\_\_\_

**Instrument Package (select up to 3)**

1: \_\_\_\_\_ Power \_\_\_\_\_

2: \_\_\_\_\_ Power \_\_\_\_\_

3: \_\_\_\_\_ Power \_\_\_\_\_

**Total power required for all subsystems and instruments:**

### 2b Calculate the Electrical Power subsystem:

The solar array must generate twice the total power required to power the satellite and recharge the batteries for half of each orbit where the satellite is exposed to the sun.

**Solar Array:** 1 cm<sup>2</sup> of solar array on your model = 50 Watts of power generated

Total power  x2 =  / 50 =  cm<sup>2</sup> of solar array needed.

**Battery:** 1 cube = 800 Watts of power stored

Total power  / 800 =  battery cubes needed.

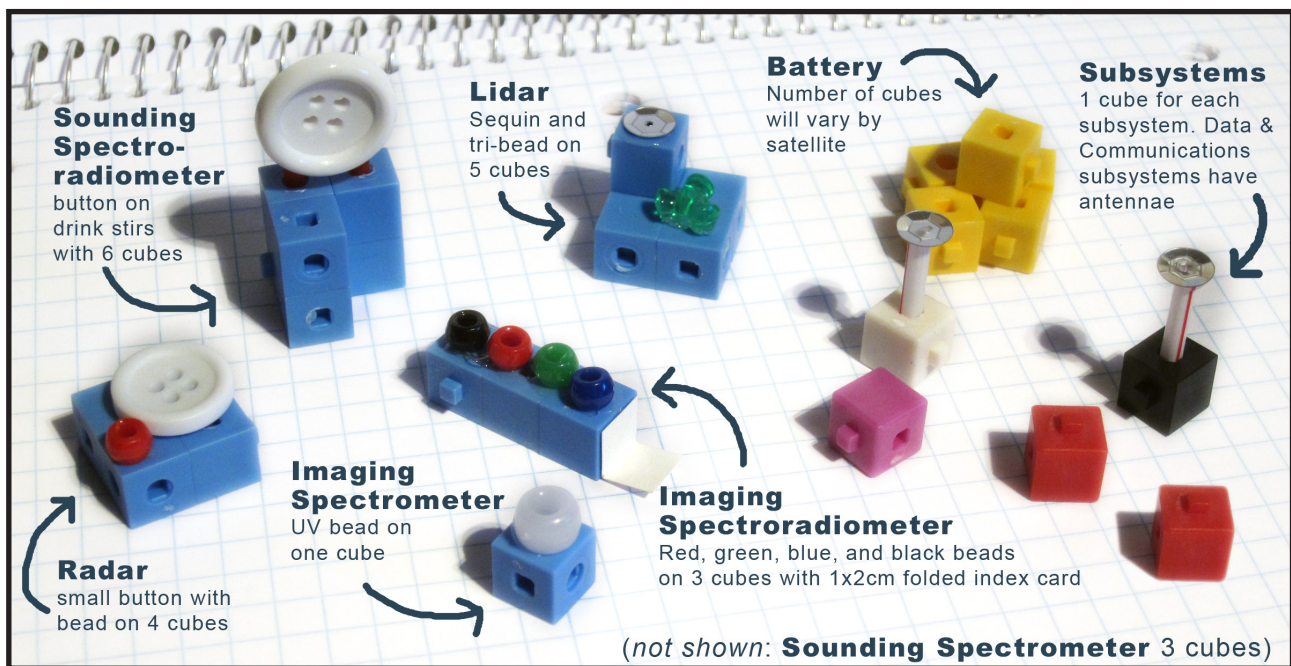
### 3a Collect supplies for your scale model:

- 2 drink stirrs (about 3mm in diameter)
- 3 sequins
- 2 buttons: 1 large (2cm) and 1 smaller
- 7 beads: 2 Red, 1 Green, 1 Blue, 1 Black, 1 UV sensitive, and a Triangle-bead
- 10 cm square of blue paper
- 27 interlocking gram centimeter cubes - (15 of one color for the instruments, 8 of one color for the batteries, 5 for the subsystems)
- 3cm x 10cm piece of cardboard or foamcore
- Scissors, ruler, tape, glue or Glue Dots

### 3b Construct your satellite:

Construct the instruments by attaching beads, buttons, sequins, and drink stirrs to the cubes using Glue Dots (see photo below). The communications and data handling subsystems each require an antenna (short drink stir with sequin).

Use the information on the worksheet to calculate to required solar array size and number of batteries. The cardboard will serve as the satellite bus - the platform to which all the subsystems are attached. Construct the satellite by connecting all the cubes and attaching to the cardboard with glue dots. Finally, tape the solar panels to drink stirrs and connect to any cube.



### 4 Are you Ready for Launch?

Weigh your satellite. If your satellite weighs between 18 and 25 grams, congratulations! Your satellite is ready to launch!

### 5 Go further!

1. Name your new satellite and describe how the data from the instruments will help benefit society.
2. Learn more about the electromagnetic spectrum and Earth observing satellites at:
  - Aura mission: <http://aura.gsfc.nasa.gov/outreach/>