

NAME _____ DATE _____

Construct a Satellite

Your mission is to design and build a satellite that will gather information about the Earth's surface. Before engineers at NASA can build the satellite, they need to see a model. The model must be homemade, no LEGO or other building toys permitted. Using the information provided below, design and build a model satellite.

SCALE: 1 cm = 25 cm (1 cm on your model = 25 cm in actual size)

Six subsystems of the Satellite (measurements are given in actual size)

1. Instrument package & computer

The instrument package contains all the sensors used to gather information about the Earth's surface including a data recorder and calibration instruments. The computer receives instructions from ground control and tells the instruments when to turn on and off. The actual size of the instrument package & computer will be a one meter cube. The instruments require 500 watts of power and the computer requires 75 watts of power per orbit.

2. Receiving antenna

The receiving antenna is required to receive instructions from scientists on the ground. The scientists plan to send 1 signal per orbit, which requires 25 Watts of power for each reception. The antenna is .25 meters in diameter. Note: the antennas are dish antennas similar to the dish antennas people use for cable and TV reception.

3. Sending antenna

The sending antenna is used to send information collected by the sensors back to Earth. This transmission of data will happen twice per orbit and require 25 Watts per transmission. The antenna is .25 meters in diameter

4. Data Recorder

The data collected by the sensors are recorded and saved until the data can be transmitted to Earth. The actual recording of the data requires 100 watts per orbit. The playback of the data for transmission requires 50 watts per send. (The data recorder is included in the instrument package.

5. Battery (power source)

Two batteries are needed to power the satellite. Every .5 meter cube of battery can store up to 850 watts per orbit. The battery can fully recharge in 90 minutes. Batteries must be large enough to store two times the amount of energy required to

run the satellite for one orbit.

6. Solar Array

A solar array is a collection of solar panels that work together to collect energy from the sun. The solar array must produce twice the amount of energy needed to run the satellite in order to charge the batteries. Each solar panel is .25 meters square. Each square can produce 17 watts of energy to charge the battery.

Hint: Figure out how much energy is required to operate the satellite for one day. Use that number to figure out what size to model the batteries and solar array. One orbit is approx. 90 minutes.

Construct a Satellite - Answers

Energy required:

1. Instrument and computer require 575 watts
2. The receiving antenna requires 25 watts per orbit
3. The sending antenna requires (2 x 25) 50 watts per orbit
4. The data recorder requires 100 watts to record + (2 x 50) 100 watts to playback making 200 watts needed for the data recorder

The satellite requires 850 watts per orbit to function.

1. Two batteries are needed to store twice the required energy for the satellite. Therefore, each battery must hold 850 watts of power. Each battery is 1.7 meters in actual size.
2. The solar array must produce (850 x 2) 1700 watts of power.

17 watts per square 1/4 meter

68 watts per square meter

1700 watts / 68 watts = 25

Actual size of solar array is 25 square meters