AlbertaSat

Drafting a Cubesat

Grade Level	8	**Workable grades**	7, 8, 9, 10
Recommended Time	1 hour		
Curriculum Alignment	Science Unit D-2: Analyze machines by describing the structures and functions of the overall system, the subsystems and the component parts **SHAPE AND SPACE (3-D Objects and 2-D Shapes)** **General Outcome:** Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them. **Specific Outcomes:** 5. Draw and interpret top, front and side views of 3-D objects composed of right rectangular prisms. [C, CN, R, T, V] [ICT: C6–3.4]		

Background Information (Science required for the lesson) :

Basics of Technical Drawings (Drafting):

- Purpose of drafting: to communicate specific information about a product/design to other technical people such as engineers, architects, etc.
- General information required on drawings:
    - Title
    - Name
    - Date
    - Scale
- Lines: different types of lines allow us to communicate different aspects of an object (eg. visible vs hidden edges)
    - Continuous lines (the only line you will be using) = used to represent the physical boundaries of an object; outer boundaries use thicker lines, inner use thinner
    - Lines MUST be straight and parallel to the edges of the page
- Views: presenting different views of an object conveys clearer information of an object
    - Core group of views = front, top, and right-side views
- Names of different parts and the distances between them should be included after the drawing is complete

Basics of Ratio Conversion:

- Scale ratios are used to compress measurements to provide a guide for things that can't be drawn to size
- To find actual length: drawing length x 1/scale
    - Example = map of Banff with a 1:50000 scale; how far is 10cm of the map in real life? 10cm x 1/scale = 10cm x 50000/1 = 500000cm or 5km
    - Convert resulting length to appropriate units based on context of drawing
- To find drawing length: actual length (in cm or mm) x scale
    - Example = drawing of a 50m rocket with a 1:100 scale; how large is the drawing? 5000cm x 1/100 = 50cm

Overview of Ex-Alta 2:

- Purpose = a 3U cubesat that will be used to assess and track wildfires, and to predict the behavior of future wildfires
- Icarus = frame of the satellite; made out of aluminum and holds all the components together; strong, light, 30x10x10 cm
- Arke = the UHF antenna is responsible for communication over ultra-high frequencies (435 - 438 MHz); converts electrical signals from the satellite into radio signals to transmit to the ground station; omnidirectional, meaning it sends the signals in all directions so that communication is possible regardless of the satellite's orientation
    - UHF = Ultra High Frequency; type of frequency used for TV broadcasting, GPS, Wi-Fi, and Bluetooth
- UHF Transceiver = the radio; UHF antennas feed into the transceiver and work with it to allow communication between us and the satellite; operates between 300 MHz - 3 GHz
    - Ex-Alta 2 is using a commercial component developed by EnduroSat (Bulgaria); AlbertaSat allocated 437.785 MHz by IARU, meaning we need to always operate at this frequency
- Charon = GPS that allows the satellite to know its location and the time; it checks the satellite's temperature using sensors located throughout the satellite and can also receive commands to reset parts of the satellite if necessary
- Athena = the onboard computer that controls basic functions and stores data, primarily done by its microcontroller unit, which is the main part of Athena; it can tell different parts to turn on or off, collect certain data at certain times, etc.
    - Also contains an inertial measurement unit that keeps track of the satellite's movements, and a clock that keeps time on the satellite so that we can tell the satellite to do certain tasks at certain times
    - Athena was designed completely by members of AlbertaSat
- DFGM = the digital fluxgate magnetometer; one of the scientific payloads and is used to measure Earth's magnetic field in the auroral zone in low-earth-orbit
    - 3-axis vector magnetometer, meaning it measures the magnetic field in three axes
    - Deployed on a deployable boom (at the back of the satellite) to get the sensor as far away from the Ex-Alta 2 spacecraft as possible; this ensures that the magnetic field detected by the sensor is not from Ex-Alta 2, but rather natural signals

- Was also flown on Ex-Alta 1
- Iris = the multispectral imager, AKA the camera; the main scientific payload that will be used to collect data for studying wildfires and protecting us from their impact; will capture the forests in visible and invisible (infrared) light (hence a multispectral imager)
    - Images of high risk zones highlight vegetation growth which can indicate the time and area a wildfire will start

Explanation of Activity:	**Notes:**
A step-by-step guide for your activity: 1. Students work alone 2. Hand out engineering paper (1 sheet to start) and hand out writing utensils 3. First, the students must determine their mission. This includes their payload, importance of the payload, what it will be doing, and how big it will be. 4. Explain the other requirements outlined in the presentation (scale, marked distances, labels, etc.) 5. Ask students if they have any questions 6. Tell students they may start 7. Presenters should walk around to answer questions and encourage students	- Students sometimes have trouble thinking up payloads. Encourage them to be creative and offer some suggestions such as: a DFGM, a camera (Google Image Satellites), communication devices (Starlink), James Webb Space Telescope etc. Ask them to think about and/or write down what they would like to study/learn about if they went to space.

Materials Required (INCLUDE ALL MATERIALS NEEDED EVEN PEN AND PAPER)

- Pens/Pencils
- Ruler
- Engineering Paper or Graph Paper, 1-2 sheets per student

Changes to the activity for COVID-19

Send the teacher the materials and have AlbertaSat members present the slide remotely.