CubeSat Structure

Topic	CubeSat Structure
Subject	Science
Grade Level	4-6
Time	1 hour
Curriculum Alignment	Science 6-1,3: Construct, with guidance, an object that achieves a given purpose, using the materials that are provided Math 5-3 (Space and Shape Measurement): Demonstrate an understanding of measuring length by selecting and justifying referents for the unit mm Math 5-3 (Space and Shape Measurement): Demonstrate an understanding of measuring length by modelling and describing the relationship between mm and cm units, and between mm and m units.

Hook: 2 minutes	**Notes**
Show Ex-Alta 1 3D Model Video	https://m.youtube.com/watch?v=Ew2N9OqL-F4

Introduction:	**Notes:**
What is AlbertaSat? ● AlbertaSat is a student group at the University of Alberta that builds CubeSats ● CubeSats are small (like a loaf of bread) satellites made up of standardized cubes. These cubes (known as units) are 10cm x 10cm 10cm ● Ex-Alta 1 (Experimental Albertan 1) is a 3U (3 unit/3 cube) CubeSat. It was the first satellite built by AlbertaSat. ● Ex-Alta 1 was built as part of an international project, QB50. This project was lead by the European Space Agency (ESA) to study space weather.	● Our Satellite has 3 scientific payloads: Multi-Needle Langmuir Probe, dosimeter, and a magnetometer. These allow us to study charged particles, what happens during reentry radiation, magnetic waves, the northern lights, and space weather. We're doing this because space agencies around the world are interested in re-entry, we want to make reusable reentry vehicles, and we want to be able to predict solar storms and know more about the northern lights. Space Weather - esp. solar storms can be really devastating. If one happened today, it could destroy

• Ex-Alta 1 was launched to the International Space Station (ISS) in April of 2017 and into orbit in May of 2017. • Show Map of QB50 Satellites • Ex-Alta 1 includes the following payloads: MNLP (Langmuir Probes), Dosimeter (studies radiation), Athena On-board Computer, Magnetometer	power grids and cause trillions of dollars in damage. • Our fourth payload, Athena, is an open source onboard computer. This will be its test flight and if it is successful we will use it on our next CubeSat as the only onboard computer. We want to make a CubeSat as open source as possible to reduce costs and make space more accessible to groups like us. • Currently working on Ex. Alta-2, in the planning stages.

Background Information:	Notes:
CubeSats are made up of 10x10x10 Cubes. Each Cube represents 1U. Ex Alta-1 is a 3U CubeSat and is 30x10x10. • The Langmuir Probes are on the top of the CubeSat, Athena is inside, the Magnetometer is inside until the CubeSat is in orbit, then it unfurls and the dosimeter is attached to the outside. All CubeSats have an antenna, a gps, a computer, and solar panels • Some Cubesats have mini rockets • Solar Panels are sometimes attached (like ours), or stick out like wings (like the ISS)	

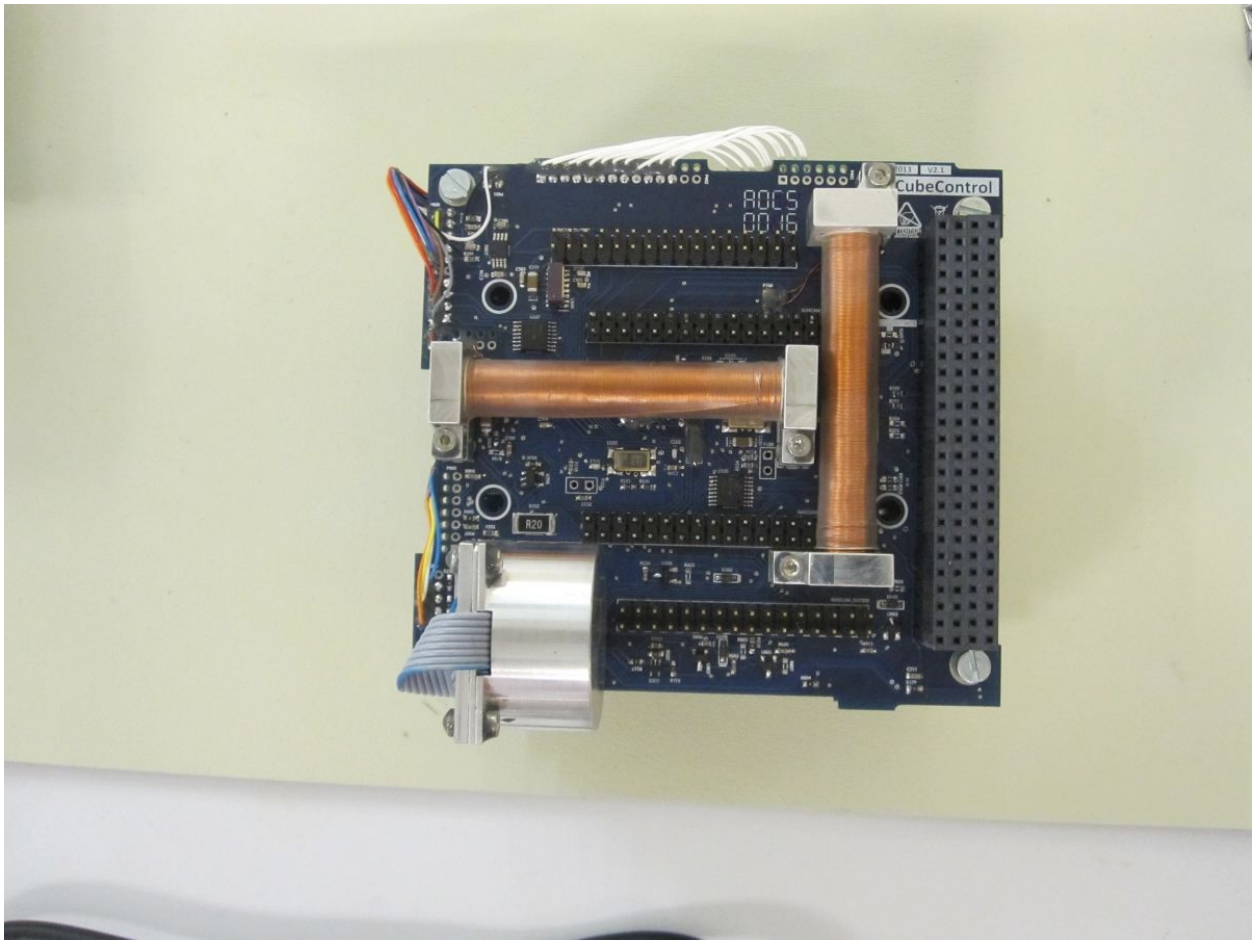
Explanation of Activity:	**Notes:**
1. Students may work alone or in pairs 2. Hand out attached worksheets for 1U, 2U, or 3U CubeSats 3. Instruct students to create a 3D-model of a CubeSat. Remind students that they will be cutting out the image and folding it to make a cube or rectangular prism.	1. Students sometimes have trouble thinking up payloads. Encourage them to be creative and offer some suggestions such as: a magnetometer, a plant, a camera, their favourite food, favourite toy etc. Ask the students to think about and/or write down what

4. Tell students that their designs must include an antenna, a GPS, a radio, a payload (an experiment), an onboard computer, and solar panels. Write these requirements on the board. Suggest that students label these. 5. Students should create 'internal pieces' for their satellite out of paper or a similar lightweight material. This could be done by drawing or labelling square pieces of paper for the GPS, Radio, and Computer. Solar panels can be drawn on the outside of the model. An antenna could be made out of paper, pipe cleaners, or a similar lightweight material. 6. Presenters should walk around to answer questions and encourage students. 7. When students have finished designing their models, check their work and then have them cut the outline out and fold it to create a 3D-model. Tape or glue the model so it stays together but ensure at least one side is not taped/glue so students can open it and see the pieces.	they would like to study/learn about if they went to space. 2. Extension Activity: Have students research a CubeSatellite and create a 3D model of that CubeSatellite. 3. Potential Assessment: Have Students compare the similarities and differences between their design and that of a real satellite. This could be done in point-form, full sentences, or using a graphic organizer. This could be combined with the above extension activity.

Materials Required
● Pens/Pencils ● Pencil Crayons or similar (optional) ● Worksheet ● Pipe cleaners ● Tape and/or glue sticks

AlbertaSat

Ex-Alta 1 ADCS Board (Example Printed Circuit Board)



Inside of Ex-Alta 1