<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Mass</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CubeSat Equipment and Specifications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Frame</strong></td>
<td>1U 3d Printed version of the real structure of SUSat Satellite</td>
<td>160</td>
<td>The camera will be positioned as shown and the electronic and the GPS will be places behind the camera. There will be 4 frames in one launch, and 4 in another one (2 balloons)</td>
</tr>
<tr>
<td><strong>Camera: Go Pro 3 Hero White</strong></td>
<td>Battery BacPac™ Limited Edition and Anti-Fog Inserts</td>
<td>110</td>
<td>Each satellite will have a camera and its components. The school can decide where they would like to position the camera (what directions in the stack)</td>
</tr>
<tr>
<td><strong>GPS: U-blox NEO-6M GPS module</strong></td>
<td>Standalone GPS receiver Operating temperature range: -40 TO 85°C Build in 18X18mm GPS antenna Rechargeable battery for Backup</td>
<td>14g</td>
<td>Every satellite will have a GPS but they will be operated so that they don’t interfere during the mission.</td>
</tr>
<tr>
<td><strong>SD Card Breakout</strong></td>
<td>2 Gb micro SD card will be provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pressure Sensor: Bosch BMP180 digital barometer</strong></td>
<td>300 to 1100 hectopascals (hPa) The Sensor also reports the current temperature</td>
<td>2g</td>
<td>The code on the Arduino will provide barometric pressure and temperature</td>
</tr>
<tr>
<td><strong>Arduino Pro Mini 328 - 5V/16MHz</strong></td>
<td>The arduino is a microcontroller that is programmed to undertake a number of processes.</td>
<td>2g</td>
<td>It programmed to take the measured barometric pressure, temperature and calculate the altitude. The data from the sensor and the GPS is saved on the SD card (2GB of data available). The data saved is the pressure, altitude, temperature and the GPS coordinates. A FTDI with USB port will be provided to allow the connection of the PCB to the computer.</td>
</tr>
<tr>
<td><strong>Battery pack</strong></td>
<td>9V</td>
<td>37g</td>
<td>Energizer Lithium were selected for the good performance at extreme weather conditions. The battery is connected to the PCB via a snap and it is allocated next to the PCB in the plastic box.</td>
</tr>
</tbody>
</table>
The electric circuit is printed on a PCB that it is screwed inside the plastic box. The electric schematic is provided below. The mass shown is the total mass of the electronics except the GPS and the battery.

<table>
<thead>
<tr>
<th>PCB</th>
<th>The plastic box protects the electronics from external weather condition (not the temperature change)</th>
<th>30g</th>
<th>The electric schematic is provided below. The mass shown is the total mass of the electronics except the GPS and the battery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wiring</td>
<td></td>
<td>26g</td>
<td></td>
</tr>
<tr>
<td>Plastic Box</td>
<td></td>
<td>57g</td>
<td></td>
</tr>
<tr>
<td>Parachute</td>
<td>Made of Low-porosity 1.1 Rip-stop Nylon. Reinforced with nylon webbing.</td>
<td>200g (7ft)</td>
<td>Tubular shroud lines sewn over top of the canopy. 4 shroud lines reduce chances of tangling A 3ft parachute is provided for testing A 7ft parachute will be used for the launch</td>
</tr>
<tr>
<td>Foam Box</td>
<td>A foam box will protect all the satellites from the impact on the ground</td>
<td>80g</td>
<td>impact velocity 5m/s</td>
</tr>
</tbody>
</table>

This photo shows the relative sizes of the components.

Mounted SD card, pressure sensor and GPS

Questions:

1. The atmospheric pressure on the weather reports is usually in kilopascals (kPa). What is the relationship between kPa and hPa.
2. Knowing the air pressure we can determine the altitude. Research to find out the formula that relates air pressure and altitude.
3. What is the importance of the Arduino in this project?
4. What data will the Arduino report?
### BALLOON CONFIGURATIONS

<table>
<thead>
<tr>
<th>Item</th>
<th>Qty</th>
<th>Mass each (g)</th>
<th>Total (g)</th>
<th>Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Balloon 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of standard frame</td>
<td>5</td>
<td>160</td>
<td>800</td>
<td>ASMS standard Kit</td>
</tr>
<tr>
<td>Camera Setup</td>
<td>5</td>
<td>110</td>
<td>550</td>
<td>Mitcham primary</td>
</tr>
<tr>
<td>Electronics and box</td>
<td>4</td>
<td>170</td>
<td>680</td>
<td>Mitcham secondary</td>
</tr>
<tr>
<td>Little weather Station</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(primary school experiment)</td>
<td>1</td>
<td>150</td>
<td>150</td>
<td>Hamilton College</td>
</tr>
<tr>
<td>Horus electronics (cut down system &amp; telemetry)</td>
<td>1</td>
<td>245</td>
<td>245</td>
<td>Reynella</td>
</tr>
<tr>
<td>Parachute (7ft)</td>
<td>1</td>
<td>200</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Foam Box</td>
<td>1</td>
<td>80</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td><strong>Total mass</strong></td>
<td></td>
<td></td>
<td>2705</td>
<td></td>
</tr>
<tr>
<td><strong>Balloon 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of standard frame</td>
<td>4</td>
<td>160</td>
<td>640</td>
<td>CBC</td>
</tr>
<tr>
<td>Camera Setup</td>
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<td>Fremont-Elizabeth</td>
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<tr>
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<td>680</td>
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<td>Hallett Cove</td>
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<tr>
<td>Horus electronics (cut down system &amp; telemetry)</td>
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<td>245</td>
<td>245</td>
<td></td>
</tr>
<tr>
<td>Parachute (7ft)</td>
<td>1</td>
<td>200</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>Foam Box</td>
<td>1</td>
<td>80</td>
<td>80</td>
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</tr>
<tr>
<td><strong>Total mass</strong></td>
<td></td>
<td></td>
<td>2485</td>
<td></td>
</tr>
</tbody>
</table>