EML4451C

Deliverable 1:

Need Assessment

Team 18

CANSAT

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Need assessment:

A small satellite is needed to deliver a sensor payload to a foreign planet with an atmosphere similar to that of Earth. The satellite and sensor payload need to be able to gather select data about the planet and send it back to a control station.

Project Scope:

To understand the atmospheric conditions of other planets, a satellite capable of gathering atmospheric and terrestrial data, then sending that information back to the control station is necessary. The satellite is to enter the planet's atmosphere, gather data, such as latitude, longitude and altitude via sensors and transmit that data via within certain telemetric constraints. The satellite is to safely land on the planet after in transit deployment of a sensor payload (egg) without the use of a parachute, para-foil, streamer or any similar device. The ultimate objective is to gather data on other planets in order to learn about the planetary and lunar formations across the solar system, and potentially, the outer solar system. The objective of this project is to design and construct a satellite with a mass of about 700 grams that fits into a cylindrical space that is 130 mm in diameter and 250 mm in length. The satellite shall be able to collect and transmit data including: latitude, longitude and number of satellites tracked (via GPS); mean sea level (via non-GPS altimetry); air temperature, state of flight software, and mission time.

Methodology:

While the satellite is above 400 meters the required velocity of 20 meters per second will be obtained with use of a passive decent control such as a parachute or other similar device. Once the satellite reaches an altitude of 400 meters the passive decent control will be released with the use of a mechanical release and an aero-braking structure will be used to control decent speed from this point onward

The methodology of the telemetry requirements shall include the use of XBEE transceivers (IEEE std. 802.15.4) and maintain a communications link from the ground station to the satellite. The use of digital communications shall be employed per the telemetry requirements of the competition rule. Real time communications shall be maintained and displayed from the ground station and transmitted also to the judges table.

The telemetry requirements will be designed and tested in a prototyping environment. This shall be a bench top configuration including a proprietary (Digi™ XBEE) or open source (IEEE 802.15.4) development kit and the corresponding configuration software. The final version of the software will be completed in this environment and a printed circuit board shall be designed and produced vis-à-vis the in house PCB milling machine or outsourced to a PCB fulfillment company.

The electrical power requirements of the CANSAT project shall be delivered via batteries. A power analysis shall be required to determine the limits of the physical constraints, namely the energy density to weight ratio. The minimum power delivery shall be capable of a 3 hour duration per the audible location device requirement.

All circuitry and electrical energy storage devices shall undergo a testing process that shall include in-lab bench tests with feedback and analysis. The analysis may include projections and estimations based on data gathered within time constraints, for example the power consumption and life of the batteries.

Expected Results:

- The sensor payload is delivered “in-tact” with no damage incurred.
- The telemetry requirements are transmitted in the radio frequency required and all telemetry is accomplished via the XBEE radios and IEEE 802.15.4 standards.
- The audible location device is activated and emits a tone of at least 80 decibels and maintains power until found.
- The power delivery system is sufficient to provide electrical power to all relevant components.
- The ground station antenna is at least at a height of 3.5 meters and powered by ground station circuitry.

Constraints:

- The cansat’s total mass must be 700 grams ± 10 grams before the egg is placed inside.
- The cansat must fit inside a cylinder that is 130mm in diameter and 250mm in length.
- When initially released the satellite may use any passive decent control device to reduce its speed to 20 m/s ±1m/s.
- When the container is below 400 m it cannot free fall or use a parachute or similar device.
- The container cannot have any sharp edges or protrusions that go beyond the envelope.
- The container must be a florescent color.
- No flammable substances may be used.
- The cansat must be able to produce a noise of at least 80dB.
- All decent control devices, attachments and mechanisms must be able to survive a 30 gee shock.
- The Canister must have an external power control.
- The cansat cannot use lithium polymer batteries.
- No electronics can be exposed except sensors.
- The cansat flight hardware must cost less than 1000 U.S. dollars excluding ground support and analysis tools.
- Mechanisms that produce heat must be ventilated.

- The container must protect the sensor load (egg).
- A decision must be made to either measure the force of impact the satellite has with the ground or to film the decent of the satellite with a mounted camera.
- The cansat Preliminary Design Review must be completed and submitted by Feb 1, 2013.
- The Critical Design Review must be completed and submitted by Mar 29, 2013.
- The Post Flight Review must be completed and submitted by Jun 9, 2013.