Project Plan and Product Specifications

EML 4551C – Senior Design – Deliverable #3

Team 18: CANSAT

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Product Specification

Desired Outcome

The desired outcome of the project is to simulate a satellite entering the atmosphere of a planet to gather atmospheric data and deliver a sensor payload (large hen egg) to the planet. Once released from the rocket, the satellite will passively control its decent velocity until it reaches an altitude of 400m. Upon reaching an altitude of 400m, a mechanical air braking system will reduce the decent velocity to a range where the satellite and the sensor payload can safely land intact. While descending, telemetry will be gathered and sent directly to the control center. Once the satellite has landed, it will be retrieved and any stored information will be obtained from it. Then the condition of the sensor payload will be checked. A post flight review will be conducted.

Customer Needs

- The cansat 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 and operate for atleast 3 hours.
- 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 must use the XBEE radio series 1 or 2.
- The cansat must transmit telemetry once every 2 seconds.
- Telemetry must include GPS data, altitude above mean sea level, Temperature, battery voltage, flight software state, and Flight software maintained mission time.
- 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.

Team Deliverables

Preliminary Design Review

The PDR is a "multi- disciplined technical review to ensure that the system under review can proceed into detailed design, and can meet the stated performance requirements within cost (program budget), schedule (program schedule), risk, and other system constraints". The cansat PDR shall demonstrate:

- An understanding of the cansat mission requirements
- Allocation and derivation of system and subsystem requirements
- Definition of the cansat concept of operations
- Overview of preliminary design that meets specified requirements
- Results of, or identification of, necessary trades to support preliminary design. While it is ideal to have completed trades prior to the preliminary design, it is not necessary.
- Results of, or identification of, necessary prototyping or testing efforts necessary to support or finalize the preliminary design.
- Preliminary budget
- Detailed development schedule

Preliminary design reviews shall be conducted via teleconference coordinated by the team lead(s) and mentors. The PDR presentations shall be less than 30 minutes in duration including time for questions.

Critical Design Review

The CDR is "a multi-disciplined technical review to ensure that the system under review can proceed into system fabrication, demonstration, and test; and can meet the stated performance requirements within cost (program budget), schedule (program schedule), risk, and other system constraints". The CDR shall demonstrate:

- All PDR level requirement TBDs and TBRs shall be resolved
- Refinement of the cansat CONOP
- Results of detailed design and analysis for each subsystem
- Verification that detailed design meets system and subsystem level requirements
- Identification of subsystem and system level tests necessary for requirements verification
- Results of requirements verification tests completed to date
- Overview of mission operations
- Preliminary launch day sequence of events
- Revised budget
- Updated development schedule

Critical design reviews shall be conducted via teleconference coordinated by the team lead(s) and mentors. The CDR presentations shall be less than 60 minutes in duration including time for questions.

Post Flight Review

The PFR provides an assessment of flight operations and results of the demonstration flight. The PFR provides an assessment of successful and unsuccessful flight operations. The PFR shall provide:

- Overview of mission objectives and cansat design
- Comparison of planned and actual CONOPS and SOE
- Raw and processed data from flight operations
- Failure analysis and assessment (for unsuccessful mission objectives)

Post flight reviews shall be conducted the day following the demonstration flight activities, unless flight operations are canceled due to weather. Presentations shall be limited to 10-15 minutes, including questions, based on the number of teams participating.

Project Timeline

The attached Gantt chart shows the expected timeline of the project. Both the Mechanical and Electrical aspects of the project are designed and manufactured simultaneously with communication between the leaders of each phase to ensure that all subsystems come together properly. Each class and competition deliverable is show as a milestone at the bottom of the chart so that it is clearly defined when the deliverables are due.

Task Table

ID	Task Name	Start	Finish
1	**Preliminary Tasks**	**Tue 9/11/12**	**Thu 10/11/12**
2	Code of Conduct	Tue 9/11/12	Sun 9/16/12
3	Needs Assessment and Scope	Thu 9/20/12	Tue 10/2/12
4	Product Specs and Project Plan	Thu 10/4/12	Thu 10/11/12
5	**Concept Generation**	**Fri 10/12/12**	**Mon 10/22/12**
6	Brainstorming	Fri 10/12/12	Tue 10/16/12
7	Concept Selection	Wed 10/17/12	Mon 10/22/12
8	**Container/ Breaking Mechanisim**	**Tue 10/23/12**	**Fri 4/19/13**
9	Research	Tue 10/23/12	Tue 10/30/12
10	Modeling and Simulation	Thu 11/1/12	Thu 11/8/12
11	Purchasing	Thu 11/1/12	Fri 2/1/13
12	Manufacture and assembly	Mon 1/14/13	Fri 4/19/13
13	**Telemetry and Communication**	**Mon 10/1/12**	**Thu 4/18/13**
14	Product Research	Mon 10/1/12	Thu 11/15/12
15	Purchasing	Fri 11/16/12	Thu 1/24/13
16	Programming	Thu 11/1/12	Mon 4/15/13
17	Circuit Design	Fri 2/1/13	Sun 3/31/13
18	Circuit Fabrication	Mon 4/1/13	Thu 4/18/13
19	**Class Deliverables**	**Tue 10/23/12**	**Tue 12/4/12**
20	Conceptual Design Review	Tue 10/23/12	Tue 10/23/12
21	Interim Design Review	Tue 11/13/12	Tue 11/13/12
22	Final Design Report	Tue 12/4/12	Tue 12/4/12
23	**Competition Deliverables**	**Fri 2/1/13**	**Sun 6/9/13**
24	Preliminary Design Review	Fri 2/1/13	Fri 2/1/13
25	Critical Design Review	Fri 3/29/13	Fri 3/29/13
26	Post Flight Review	Sun 6/9/13	Sun 6/9/13

References

"Mission: Planetary Atmospheric Entry Vehicle." *Mission: Planetary Atmospheric Entry Vehicle*. N.p., n.d. Web. 5 Oct. 2012. <http://www.cansatcompetition.com/Mission.html>