School of Aerospace Mechanical and Mechatronic Engineering

AERO3760: Space Engineering 2

SnapSat Preliminary Design Report

21 August 2015

Name and Email	Role and Responsibility
James Allworth | 312073038 jall8741@uni.sydney.edu.au	*Attitude Determination and Control System*
Thomas Forbutt | 312101058 tfor8012@uni.sydney.edu.au	
Oscar McNulty | 312106130 omcn3220@uni.sydney.edu.au	
Penelope Player | 312106718 ppla7388@uni.sydney.edu.au	
Nikita Sardesai | 312088205 nsar2497@uni.sydney.edu.au	

Contents

List of Figures

List of Tables

1 Spacecraft Deign Overview

Summarised in table 5.1 below is the outline of all components in the SnapSat proposed design.

Table 1.1: SnapSat Design Overview

Subsystem	Description
Structural	
ADCS	
EPS	
OBC / OBDH	
TT&C	
Thermal	

1.1 Subsystem Design Schematic

The layout of Snapsat, with the interconnects of power and data lines between the subsystems is shown in the figure below. (NOTE: this is only an example for now)

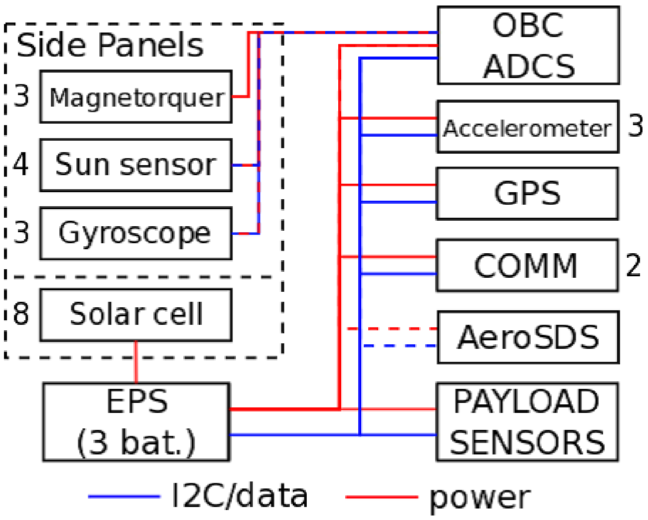


Figure 1.1: Design Schematic

2 Payload Design Overview

One page limit describing the payload and design operations.

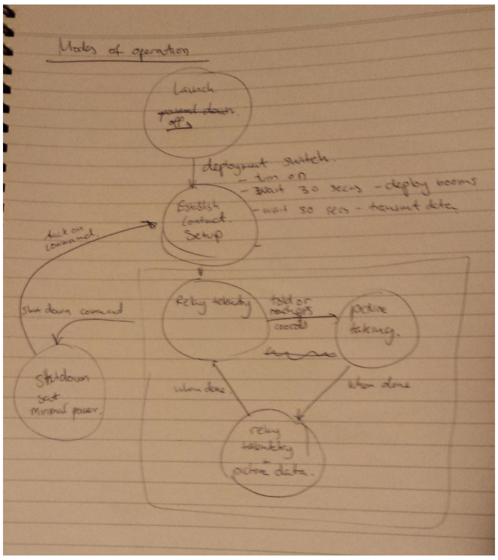
3 Spacecraft Modes of Operation

The spacecraft will experience the following modes during its lifetime. A different configuration of system operations and instructions will be executed by *SnapSat* in each case. These are summarised in table 3.1 below.

Table 3.1: SnapSat Modes of Operation

Spacecraft Mode	**Description**
Launch Mode	This turns the satellite off for launch to comply with CubeSat Design Specification 2.3.1. During launch the deployment switch is tripped which will turn the satellite on and transfer it into Establish Contact Mode.
Safe mode	(NOTE: this is example text) This mode is intended to keep the satellite alive. Only the essential components are ON all the time - such as the OBC, power board and VHF receiver. Transmitter is turned ON occasionally. Has uncontrolled attitude.
Recovery/De-tumble mode	(NOTE: this is example text) This mode is used to de-tumble the spacecraft after ejection from the deployment dispenser as well as to recover it from any spin-ups. In addition to the essential components that are ON all the time, the ADCS is also operational during this mode. Any other device could be turned ON by ground command.
Establish Contact Mode	In this mode the satellite waits 30 seconds (specifications) before deploying the antenna and attempting to communicate with the ground station
Payload Operation Mode	This mode is used only when taking a picture. The camera module is booted up, the camera takes a picture, stores it is RAM/ROM and then the camera is powered town again to conserve power. This mode can be triggered by reaching a preset GPS location or manually via communications. This mode can be entered either by reaching a GPS coordinate or through ground control command. It exists this mode straight into Relay Picture Mode.
Relay Picture Mode	This mode is entered after Payload Operation Mode and causes the CubeSat to start sending pictures to the ground station.
Relay Picture Mode	In this mode the camera is almost constantly transmitting images taken through the camera. It exists into Telemetry Mode when the picture has been sent.
Telemetry Mode	In this mode the CubeSat is idle, just displaying basic telemetry. Attitude controlled.
etc. (Other Modes)	

Figure 3.1: SnapSat State Diagram



This diagram illustrates the transitions between states.

4 System Budgets

This section detail the power and mass budgets of SnapSat. (overview/description)

4.1 Mass Budget

Table 4.1: SnapSat Mass Budget

Subsystem	Mass (g)	Contingency (g)	Mass + Contingency (g)	Fraction of Total Mass (%)
Structural				
ADCS				
EPS				
OBS / OBDH				
TT&C				
Thermal				
Payload				
Integration				
Total				
Target Mass	–	–		–
Mass Margin	–	–		

4.2 Power Budget

Table 4.2: SnapSat Power Budget

			Average Duty Cycle by Mode (%)				
Load	**Power Consumption (W)**	**Number of Units On**	*Safe Mode*	*Recovery Mode*	*Payload Mode*	*Other Mode*	
OBC							
VHF Rx							
S-band Tx							
Reaction Wheels							
Power Board							
Camera							
etc.							
Sum Loads (W)							
Efficiency							
Power Consumed (W)							
Power Generated (W)							
Power Margin							

4.3 Pointing Budget

Pointing budget CALCULATIONS

4.4 Link Budgets

Calculations for both link budgets (list assumptions here).

4.4.1 Uplink Budget

The uplink budget allows for XXX. The specifications are

- Antenna type at satellite: (omni, directional+gain)
- Frequency Band: (VHF (145.800MHz) , UHF (435.xxx MHz), SHF etc.)

- Objective C/N:
- Bit rate and modulation type:
- Expected occupied bandwidth:

4.4.2 Downlink Budget

The downlink budget allows for XXX. The specifications are

- Antenna type at satellite: (omni, directional+gain)
- Frequency Band: (VHF (145.800MHz) , UHF (435.xxx MHz), SHF etc.)
- Objective C/N:
- Bit rate and modulation type:
- Expected occupied bandwidth:

4.5 Data Budget

Data budget CALCULATIONS.

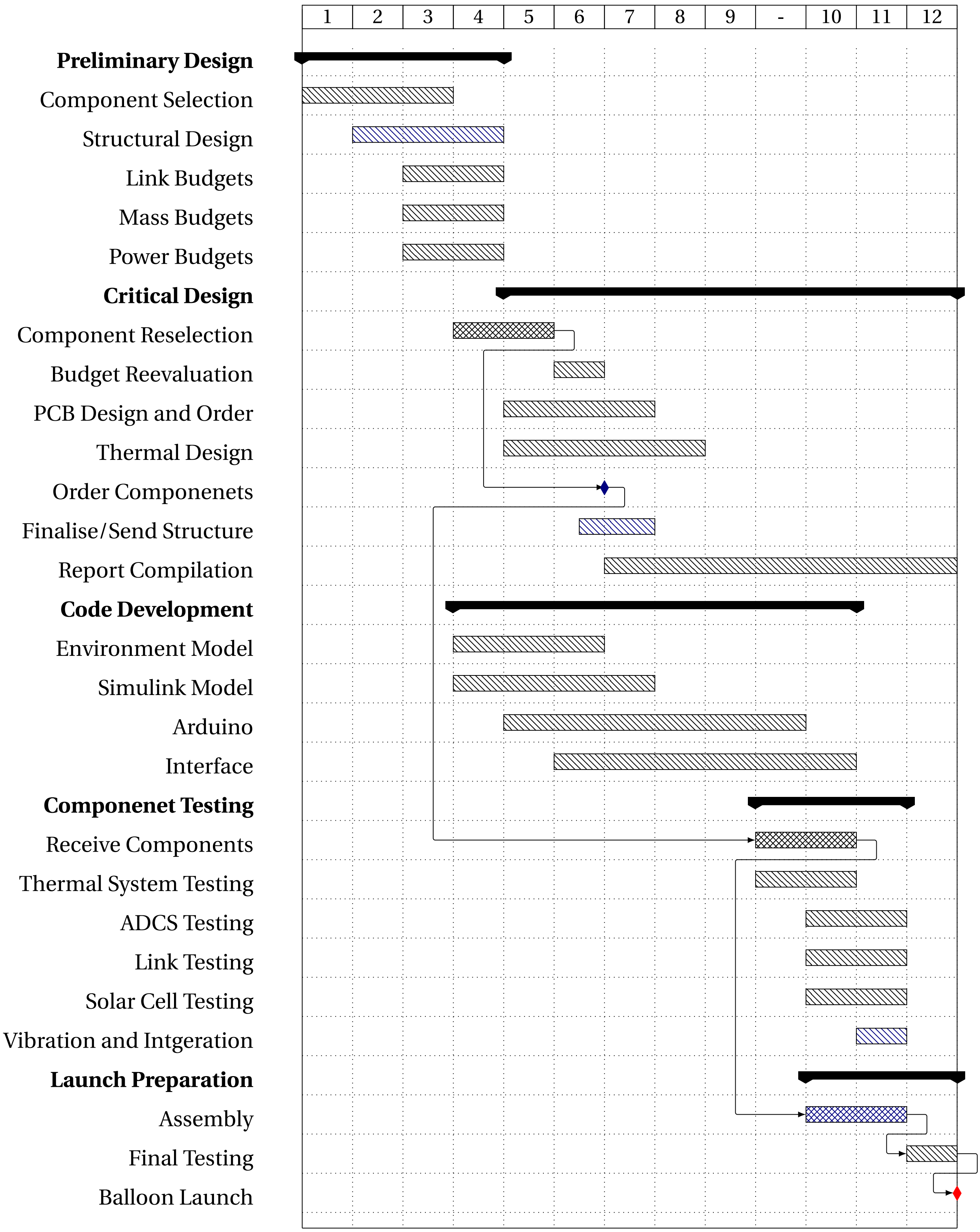
5 Project Plans and Schedule

A general schedule for the SnapSat project is outlined below. A Gantt chart is provided on the following page.

Table 5.1: SnapSat Project Schedule

Major Task	**Responsibility**	**Start Date**	**End Date**

5.1 Gantt Chart



6 Comments by Independent Reviewer

One page maximum. (Not quite sure what this is)

References

[1] W. J. Larson and J. R. Wertz, "Space mission analysis and design," tech. rep., Microcosm, Inc., Torrance, CA (US), 1992.

A Appendix: Supplementary Plots and Data

B Appendix: MATLAB Codes