|  |
| --- |
| BLUEsat UNSW Student Satellite Project  Document BLUE.2011.3.0 |
| Batteries & Solar Panels |
| Progress Report |
| **Authors and Contributors:**  Thomas Fisk  **Date:** |
| August 13th, 2012 |

# Introduction

trololo

# Table of Contents

[1 Introduction 1](#_Toc332451640)

[2 Table of Contents 1](#_Toc332451641)

[3 New Specifications 2](#_Toc332451642)

[4 Current Development Board 3](#_Toc332451643)

[5 Future Work 4](#_Toc332451644)

[6 Conclusion 5](#_Toc332451645)

# Specifications

## Power requirements of BLUEsat mission

The BLUEsat balloon launch mission is expected to last several days. In Alice Springs around March, the day/night cycle will be approximately 12 hours of daylight and night-time[[1]](#footnote-1).

The satellite

# Batteries

## Chemistry

BLUEsat will have a single string of 14 C-sized Nickel Metal Hydride (NiMh) battery cells, totalling a nominal supply voltage of 16.8V. This is a convenient voltage for the switch-mode regulators to step down to the required voltages for operation of the satellite.

## Battery Packs

## Mounting

# Solar Array

## Solar Cells

The previous design of the solar arrays (seen in Figure 5.3.1) used 14 Spectrolab gallium arsenide solar cells on each panel. Due to the prohibitively high cost of purchasing new Gallium Arsenide cells, the decision has been made to primarily use monocrystalline silicon solar cells for the balloon launch.

While BLUEsat does still have about 150 Spectrolab GaAs cells in stock that were purchased in 2004, it is believed that they have undergone some degradation due to moisture and other factors. Most of them are however still perfectly functional, and may be used on the balloon launch in conjunction with silicon cells (e.g. have one panel with GaAs cells, Si cells on all other cells).

There have been two complications with using mono-crystalline silicon solar cells on BLUEsat. These are:

1. A single mono-crystalline solar cell is typical 125 mm by 125 mm in size (or larger). This is too large for more than one to be placed on a single BLUEsat solar panel, each which has dimensions 240 mm by 240 mm.
2. The minimum voltage required for the battery charge regulator (BCR) to draw power from each solar panel is 2.7V. This requires a multiple cells (nominally ~0.6 V per cell) to be placed in series.

The solution to both of these problems has been to use 125 mm cells that have been cut into 5 pieces (125 mm by 25 mm, shown in Figure 5.2.1). 12 of these smaller cells are arranged in series to produce a nominal voltage of about 7V.

More detail…

## Solar Panels

The BLUEsat solar array consists of either 5 or 6 solar panels, each mounted onto a side of the satellite structure as pictured in Figure 5.3.1. Originally, it was intended for the solar array to be mounted on all 6 sides of the Satellite, including the –Z (bottom/baseplate) side. Because the satellite will be oriented with the –Z side facing Earth during the balloon launch, it has been decided that a solar panel on the –Z side will be unnecessary.

Each solar panel consists of the solar cells mounted onto a printed circuit board (PCB), along with bypass diodes and a temperature sensor. Cells glued with a thermally conductive epoxy to the PCB and tabbing wire is soldered onto contacts on the PCB.

Previous designs have involved the use of Fibreglass (FR4) PCB glued onto an aluminium panel (as can be seen in Figure 5.3.1). Because of difficulties in mounting the FR4 PCB to the Aluminium panel (further discussed in the next section), the decision has been to replace the aluminium panels and FR4 PCB with an aluminium backed PCB. This will both simplify the assembly of the solar array and allow the solar cells to be properly thermally coupled to the structure.

Currently, a prototype of a silicon solar panel has been constructed, pictured in Figure 5.2.1. This prototype has been constructed primarily for testing of the Battery Charge Regulator (BCR) subsystem. To reduce the cost of the prototype, a fibreglass (FR4) PCB has been used instead of a aluminium backed PCB, and the low cost ‘Mars Rock’ solar cells have been used.

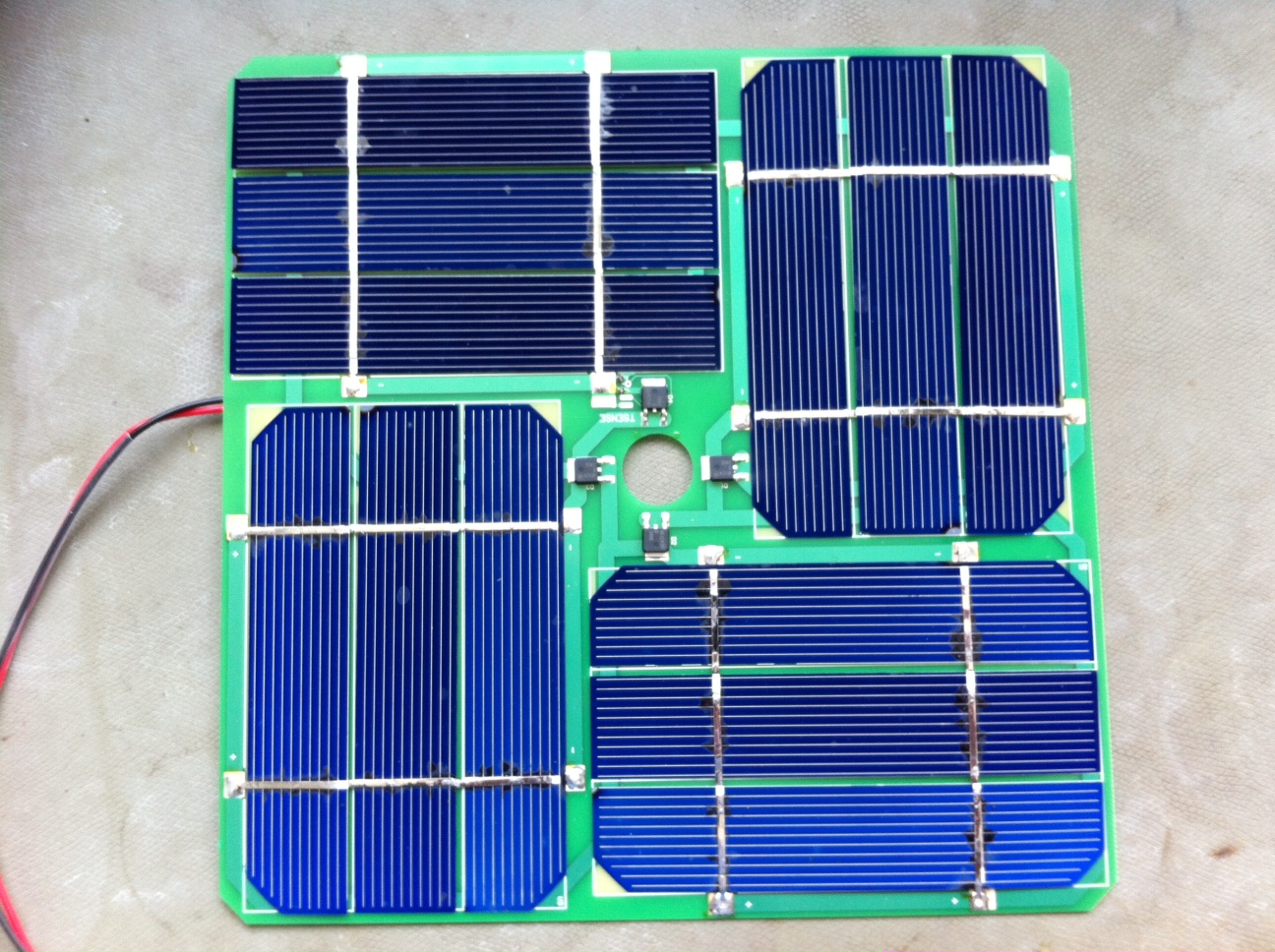


Figure 5.2.1 – Prototype of silicon solar panel

## Assembly and Mounting

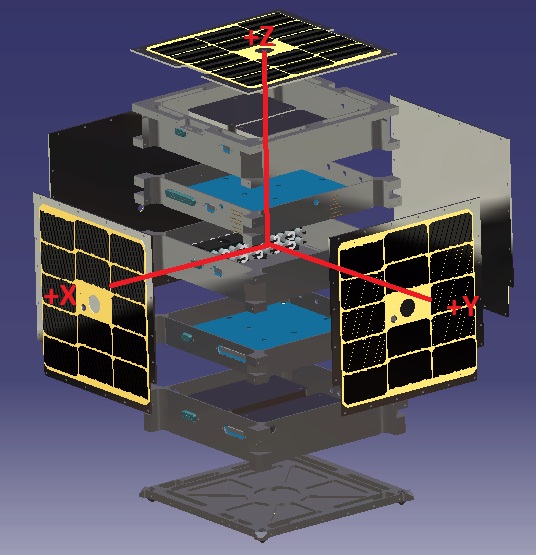


Figure 5.3.1 – Exploded view of satellite structure including solar array

# Future Work

# Conclusion

1. Source: www.timeanddate.com/worldclock/astronomy.html?n=929&month=3&year=2012&obj=sun&afl=-11&day=1 [↑](#footnote-ref-1)