Student Payload First Flight (SPIFF) Payload Team Monthly Status Report

Boston University / Georgia Institute of Technology/ New Mexico Institute of Mining and Technology

March 30, 2012

Boston University

The Boston University team has various PCBs currently in different stages of design. Testing has been performed on all major components at the current development stage.

The magnetometer is currently progressing to brassboard level - the design has been tested and found to function at the breadboard level, but minor flaws were recently found and remedied in the initial design and these are currently progressing into the brassboard layout via CAD modeling in Altium.

The C&DH subsystem has successfully demonstrated I2C communication between a proxy software system running on a laptop and a SPA-1 capable instrument (a camera currently in development for the BUSAT auroral imaging system). SPA-1 capability is expected to be demonstrated by April 3rd. Hardware components for this system were populated as of March 29, and current testing is focused on the microcontroller that oversees the health of the NanoCDH board and provides auxiliary protocol translation. Next steps for this subsystem are transferring software functions from the proxy platform to the NanoCDH SBC.

The power interface board is currently populated and undergoing testing for basic functionality. Currently a multiplexer circuit is presenting some problems, likely due to a broken component. Voltage regulation is in breadboard stages, and is undergoing testing. The ClydeSpace EPS and batteries have not yet arrived from the manufacturer.

Georgia Institute of Technology

1) **Electrical Field Mill: Analog Board**

Over the last month, the Georgia Tech team has focused on the design of the analog electronics for the Electrical Field Mill. Starting from the work Trostel *et al* [2010], the design incorporates two sensing plates to reduce the impact of noise. Each sensing plate is then fed to the input an instrumentation amplifier whose outputs are passed to a differential amplifier. A bilateral 4000 series switch is then used as a decommutator. This implementation is shown in Figure (1).

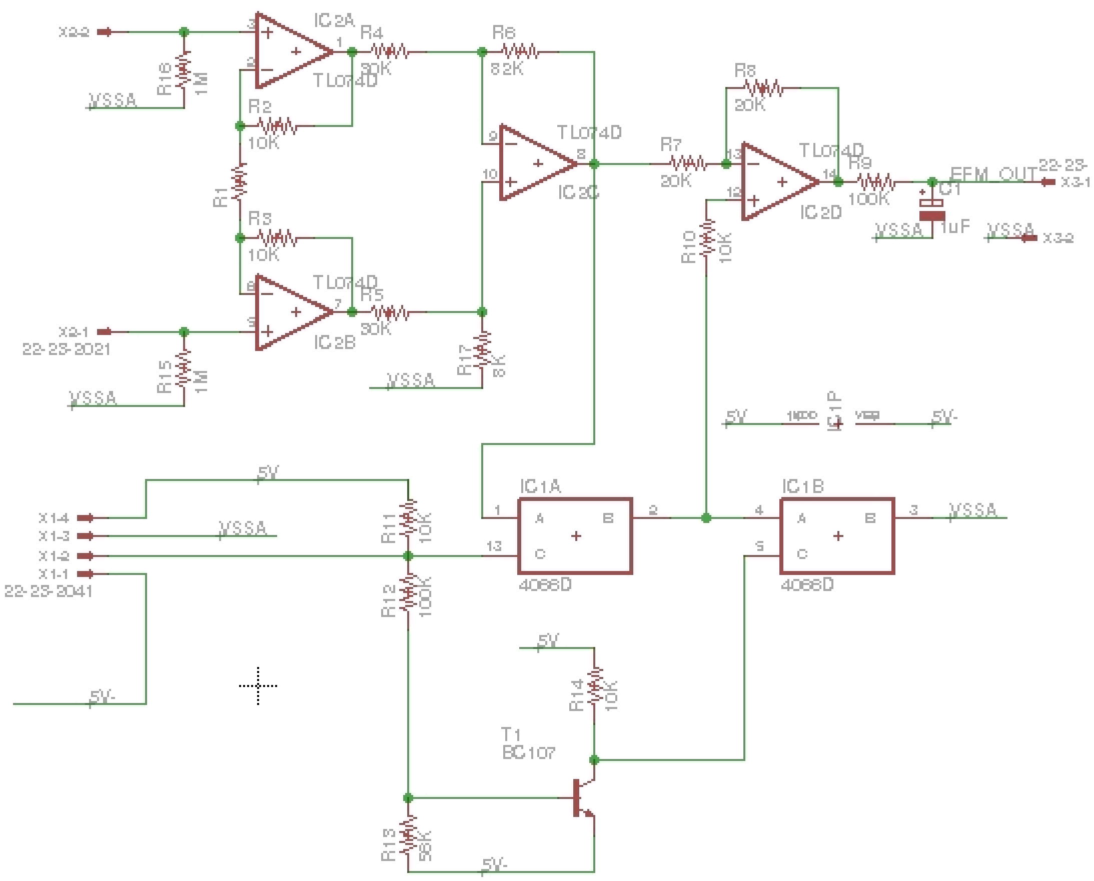

FIGURE (1): Analog front end of Electrical field mill

After the signal is filtered, the EFM output is sent to one of the inputs of a dual analog-to-digital converter (AD7992). The second input of the ADC will be used to digitize the output of a low power humidity sensor. Additionally, as pointed out in Rakov *et al* [2007], there may be a relationship between the magnitude of charge and temperature in thunderclouds and volcanic plumes. As such, the analog board also includes a TMP102 temperature sensor. We expect to have a prototype ready for manufacture by mid-April.

2) Electrical Field Mill: Digital Board

Significant changes have been made regarding the choice of microcontroller for the EFM since the last report. Namely this group has decided to move from the MSP430 to an ATmega chip. This decision was fueled greatly by the fact that Arduino, an easy-to-use microcontroller language, can be used on a number of Atmel devices. With a strong desire to have a broader impact, Arduino will allow high school students in the Atlanta area with no previous programming experience to rapidly start developing applications for the VolcanoNet sensor network. Additionally, Atmel chips support TinyOS, a lightweight operating system designed specifically for wireless sensor networks.

The current digital board design is based around the Arduino Pro Mini board sold by Sparkfun electronics. Significant changes to this design include the addition of a stepper motor controller, a wireless transceiver, (this will later be used for prototype network around the Tungurhua volcano in Ecuador) and pads for an optional GPS receiver.