HADES 2013 Status Report
Month: February

1. Activities of the Team Members:
A. Mechanical:
After careful consideration, we have determined the size and requirements of the DC motors that are good candidates to drive the rotation of the sampling chambers and UV sensors. The design is a direct drive motor in the center of axial rotation. (Other designs that were considered included non-direct drives involving chains, pulleys, belts, bevel gears, and ring gears.) In the design we will need data communication from the bottom "fixed" box to the top "rotating" box. Two methods suggested for this are blue tooth (low power radio communication) or a slip ring (hard wired communication). We have looked into different types of slip rings to be used in the application. Because of the low RPMs a stepper, or gear, motor would be best for creating the rotation. To hold the weight of the top box on a "swivel" we have looked into Lazy Susans. We have received two of them to cold and load test (put weight on it and flip it around upside down). We will will finalize and order the motor and a slip ring to test.

B. Electrical:
1. Determine the inconsistencies with the prototype arms.
2. Determine the reason for not receiving voltage to part of the board.
3. Measuring UV vs. angle on the roof to create a profile and correct the flight data.

C. Software:
1. Determine the issues with the prototype software.

D. Biology:
Identify microorganisms recovered from lower altitude flights in preparation for culturing microbes from HASP.

2. Issues Encountered:
A. Mechanical: Determining an appropriate and effective design.

B. Electrical:
1. There are four pins on the "H-Bridge Interface Board" that interfaces the H-Bridge board with the Arduino micro-controller that are not receiving 5V. This problem is in the design of the PCB as the leads to the 5V source are not routed to these pins. Luckily these pins are for the actuators for the West Chamber on LAMB and are not needed. This problem was discovered while investigating an issue discussed below in (2).
2. The linear actuators used to operate the chamber doors are not sending back a consistent ADC value (numerical sequence that represents the actuator arm position) to the micro-controller. Although they are operational, the software depends on an ADC value that does not fluctuate in order to determine if the

chamber door is fully closed. It is not believed to be a software problem, and all pieces of the hardware are being tested to find the issue/solution. We may have to order new actuators in the case that they all were damaged during LAMB's landing.

3. Getting the UV equipment on the roof. Waiting for a sunny day at exactly noon. Complications with the stand not being able to efficiently turn 180 degrees.

C. Software:

1. During LAMB's flight, the software rebooted multiple times. It is believed to be an issue with the buffer size, but this has yet to be confirmed (by reducing the buffer size, system does not reboot during tests). We will run more tests to attempt recreate the reboot and see if anything other than the buffer size is causing this problem.

D. Biology:

Reagents that are subjected to multiple freeze thaw cycles yield inconsistent results during the sequencing process. Several steps were taken to determine precise faulty reagent. Starting the reaction with fresh stocks has successfully solved this problem.

3. Milestones Achieved:

A. Mechanical:

Settled on an appropriate overall design concept; received lazy Susan (turntables) to test for the payload; picked out slip ring and motor options to discuss with Michael to determine the most suitable hardware for the main mechanical system.

B. Electrical:

1. We now have a RS232 to TTL converter so that we can send serial data to the micro-controller for flight simulations.
2. Received temperature sensors on 02/15. Made a breadboard circuit for a few of them and they work well with the micro-controller. Will begin developing interface system to connect to the Arduino.
3. Achieved basic profile for UV broadband, A, and B.

C. Software:

1. We now have a fully functioning flight simulation system. We can produce full flight profiles for testing payload operations. Ran an accelerated flight profile on 02/15 and all actuators functioned at their determined altitudes.
2. With the flight simulation, I can run a full flight without a reboot by reducing the buffer size. As stated before, it is not certain why or if the buffer size is causing a system reboot; but I can at least show that there is a system reboot for LAMB's flight buffer size and a no-reboot for lower buffer sizes. Still need

to investigate this and also attempt to find the maximum buffer size before reboot occurs.

3. Developed software for temperature sensors. Ready to integrate with flight software.

D. Biology:

With the problem reagent identified, we are consistently producing high quality 16S sequencing data. This information allows us to identify the next nearest species member to the organisms cultured in lab.

4. Current Team Members and Advisors:

Name	Year	Demo	Role
Noelle Bryan	Graduate Student	Caucasian	Team Lead, Biology
Scott Burke		Caucasian	Mechanical
Meggie Alleman	Senior	Caucasian	Electrical
David Branch	Junior	Caucasian	Software
Brent Christner	n/a	Caucasian	PI