## University of Colorado at Boulder HELIOS IV May Status Report

In the month of May HELIOS solved last month's issue with the power board, designed, populated, and tested a new power board, integrated the image analysis software with the flight code, and fabricated a test stand. While an unusually rainy month prevented any full systems tests outdoors, the team ran multiple long-duration system tests indoors.

<u>Team Demographics:</u>

Student	Ethnicity	Gender	Year	Major	Start Time	End Time	Grad/ Undergrad
Paige Arthur	Caucasian	Female	Sophomore	Aerospace Engineering	November 2013	Current	Undergrad
Cooper Benson	Caucasian	Male	Sophomore	Aerospace Engineering	November 2013	Current	Undergrad
Kristen Hanslik	Caucasian	Female	Junior	Computer Science	December 2013	Current	Undergrad
Dylan Richards	Caucasian	Male	Sophomore	Aerospace Engineering	November 2013	Current	Undergrad
Ryan Cutter	Caucasian	Male	Sophomore	Aerospace Engineering	January 2014	Current	Undergrad
Brandon Boiko	Asian and Caucasian	Male	Junior	Mechanical Engineering	June 2014	Current	Undergrad
Kevin Paynter	Caucasian	Male	Junior	Mechanical Engineering	October 2014	December 2014	Undergrad
William Vennard	Caucasian	Male	Junior	Mechanical Engineering	January 2015	May 2014	Undergrad
Anthony Torres	Caucasian	Male	Sophomore	Aerospace Engineering	October 2014	May 2014	Undergrad
Flor Gordivas	Hispanic	Female	Junior	Electrical Engineering	October 2014	Current	Undergrad
Rebecca Lidvall	Caucasian	Female	Junior	Aerospace Engineering	October 2014	May 2014	Undergrad
Alex St. Claire	Caucasian	Male	Freshman	Aerospace Engineering	November 2014	Current	Undergrad

Team Organizational Chart:
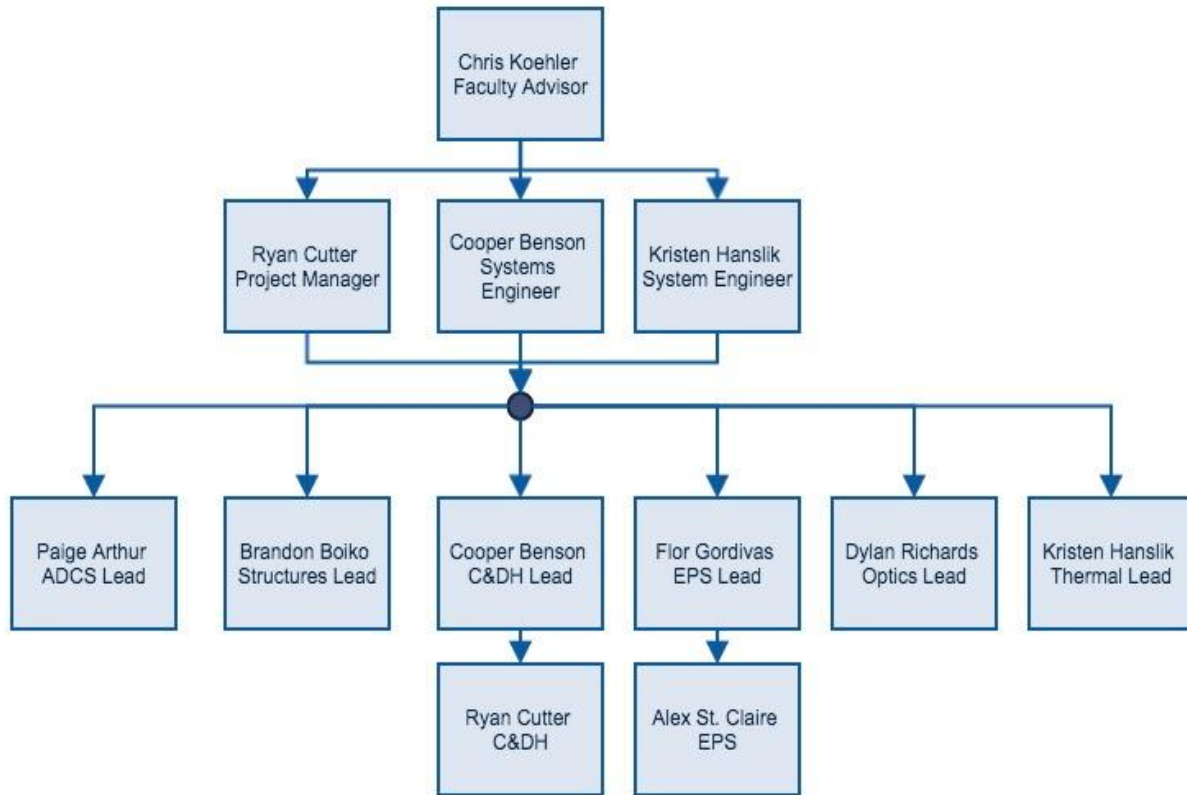
Accomplishments of May:

ADCS: The Attitude Determination and Control System integrated the image analysis software with the flight and determined that the code could compile and run. However, due to the weather they were unable to test the software's accuracy. They fixed several issues in the flight code that were preventing the payload from turning the correct number of steps when given a nudge command. They tested the nudge commands through uplink and determined that they worked successfully. The only issue they are still working on is the fact that the system does not correctly reset when the nudges push it past its maximum angle of 360 degrees. They also built a test stand that allows them to easily rotate the payload a known number of degrees, thus mimicking the movement of the platform, and allows them to determine the number of degrees that the camera housing moves in response. They successfully tested the motor inhibit, which they can implement during TVAC to ensure that the payload does not hit the top or sides of the TVAC chamber. They attached the gnomon in a more permanent fashion using Velcro instead of the tape they had been using since last year's flight and completed some testing with it outdoors; however, the weather was too cloudy for any concrete results to be reached during this month.

C&DH: Command and Data Handling set up a new SD card so that multiple sub-teams can work with the microprocessors at a time. They tested serial uplink and downlink and determined that both were functioning normally. The team member who created the image analysis software left for the summer, so he instructed the rest of the team on how to use the code. They have been

working on solving the problem that causes the camera to fail to start after force quitting the flight code, and while they have alleviated some of the issue, they have not solved it completely. Fortunately, while this issue is inconvenient while testing, it will not hinder flight performance since the main flight loop will never be force quit without also rebooting the microcontroller. CDH has also been working with Optics to test the timing of the two cameras. They have been testing the time intervals between images and ensuring that they match the time stamp on the image by pointing the cameras at a clock for long durations of time. CDH has also verified that, with the expected image file sizes, each camera's SD card will be able to hold several times more pictures than are expected to be taken during flight.

EPS: The Electrical and Power System designed, ordered, received, populated, and tested the new power board (3rd revision) all within the first two weeks of May. The issue encountered with the 2nd revision occurred because the zener diodes they added to protect the microcontroller were not allowing the signal to pass between the photodiodes on the board. The 3rd revision fixed this issue as well as made the board more secure by incorporating the changes that had been white wired on the second revision. They had a problem in which running all of the components simultaneously resulted in the accelerometer failing, but they solved it by using different capacitors on the board. They worked with CDH to test serial uplink and downlink as previously discussed. They also ran systems tests in which they tested and confirmed that the power board can operate nominally at the expected flight minimum and maximum voltages of 29V and 33V.

Optics: Optics has added a new filter to the GoPro that allows images to be taken without any extraneous light such that the sun can be seen as a perfect circle. They have been working with CDH to test the timing of the images taken, as previously discussed. They have been having several issues with focusing the ADCS camera: the camera seems to be only able to focus on objects very close up, even on its maximum focal setting. They have been getting in contact with the camera and lens manufacturers to try to solve this issue.

Structures: Structures has finalized the balancing of structure such that the ADCS has no trouble turning on both axes and the structure is statically within height and width limitations. By the end of this week they will have counter bored the screws connecting the structure to the base plate. Because of other commitments, structures can now only work every other Friday and weekends; however, the structure is practically complete and only needs to be painted and insulated.

Management: Because of other commitments, the project manager has stepped down but is still an active member of the team. The ADCS team lead Ryan Cutter has stepped up as new project manager. Management has completed the documentation requested after the demo except for proof of a systems test, since due to poor weather conditions they have been unable to perform a full systems test outdoors. Once this is complete, management will be able to finish the documentation requested. However, they have been able to complete many long duration systems test indoors during which the entire system ran for multiple hours, often locking onto the window or ceiling light and taking images. Management has organized the team meetings and has continued to mentor the SIMBA team. They have coordinated with the director of COSGC.

Plan for June

HELIOS IV will solve the problem of focusing the ADCS camera. They will paint the structure and will complete the image timing tests. They will fix the issue encountered with the nudges causing incorrect resets when the system is pushed over 360 degrees. As soon as the weather permits, they will begin extensive systems testing outdoors. During these tests they will quantify the photodiodes' field of view and, after everything else is working reliably, they will characterize the image analysis software.