

## University of Colorado at Boulder HELIOS V Team March Status Report

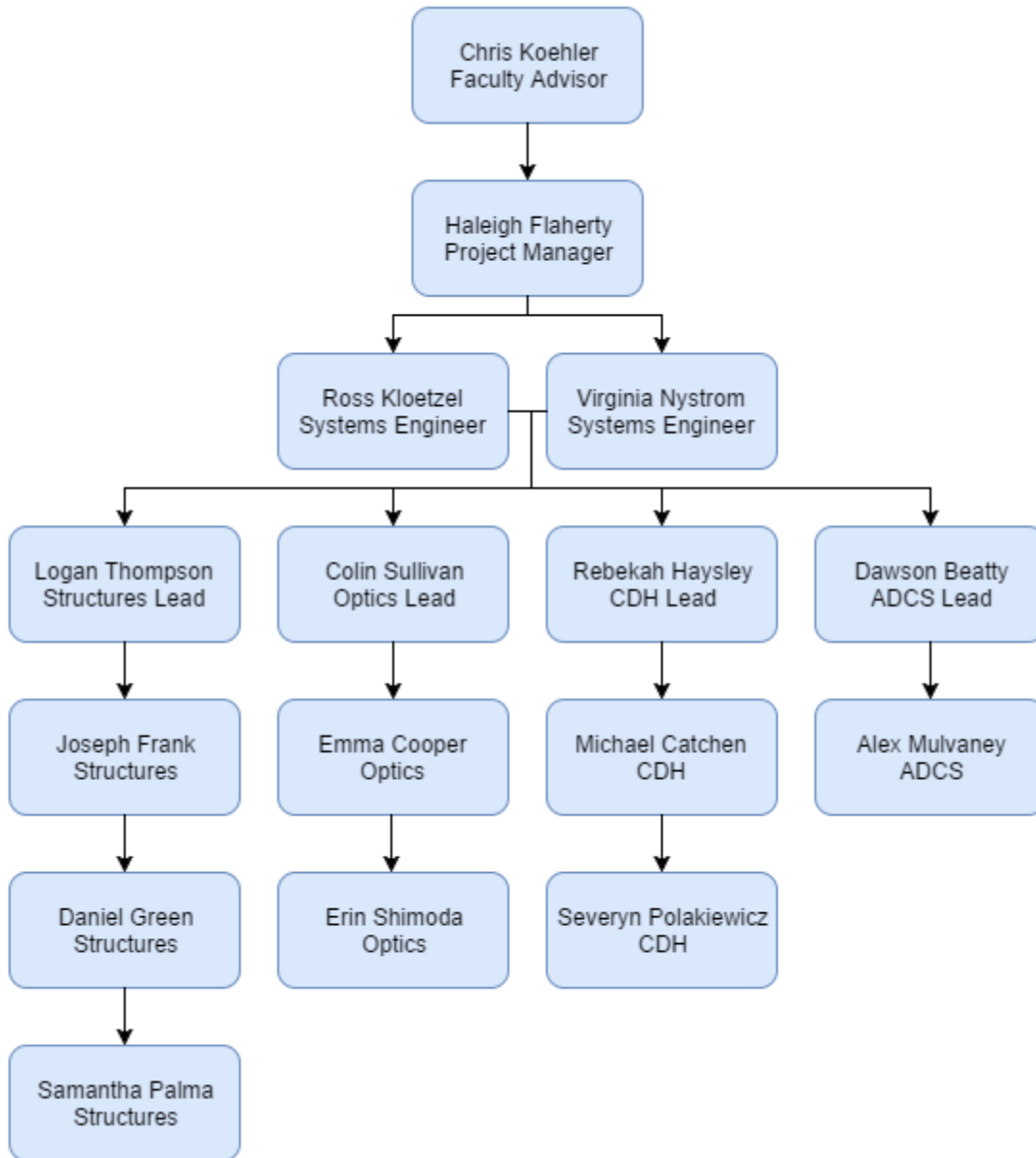
This month the HELIOS V team completed two design review presentations. Through these two design reviews, the team has been able to make several improvements to the payload. After the first review, the Conceptual Design Review (CoDR), the team found that they were trying to change too much. After reviewing the feedback from the CoDR, the team focused on reducing the changes and making sure that any changes had solid reasoning as something that would improve the design from HELIOS IV. They presented the new design in the Preliminary Design Review (PDR) and are now working on reviewing the feedback they received from this presentation.

### Team Demographics

Student	Ethnicity	Gender	Year	Major	Start Time	End Time	Grad/ Undergrad
Haleigh Flaherty	Caucasian	Female	Sophomore	Aerospace Engineering	January 2015	Current	Undergrad
Paige Arthur	Caucasian	Female	Junior	Aerospace Engineering	January 2015	Current	Undergrad
Ryan Cutter	Caucasian	Male	Junior	Aerospace Engineering	January 2015	Current	Undergrad
Erin Shimoda	Caucasian/ Asian	Female	Freshman	Aerospace Engineering	February 2015	Current	Undergrad
Virginia Nystrom	Caucasian	Female	Freshman	Aerospace/ Applied Math	February 2015	Current	Undergrad
Joseph Frank	Caucasian	Male	Freshman	Engineering Physics	February 2015	Current	Undergrad
Severyn Polakiewicz	Caucasian	Male	Sophomore	Aerospace Engineering	February 2015	Current	Undergrad
Rebekah Haysley	Caucasian	Female	Freshman	Mechanical Engineering	February 2015	Current	Undergrad
Colin Sullivan	Caucasian	Male	Freshman	Aerospace Engineering	February 2015	Current	Undergrad
Samantha Palma	Caucasian/ Asian	Female	Freshman	Mechanical Engineering	February 2015	Current	Undergrad

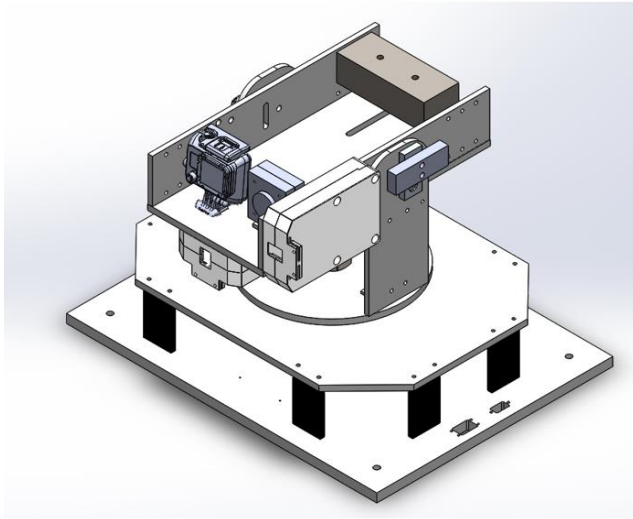
Ross Kloetzel	Caucasian	Male	Freshman	Aerospace Engineering	February 2015	Current	Undergrad
Michael Catchen	Caucasian	Male	Freshman	Aerospace Engineering	February 2015	Current	Undergrad
Alex Mulvaney	Caucasian	Male	Freshman	Aerospace Engineering	February 2015	Current	Undergrad
Logan Thompson	Caucasian	Male	Freshman	Aerospace Engineering	February 2015	Current	Undergrad
Dawson Beatty	Caucasian	Male	Freshman	Aerospace Engineering	February 2015	Current	Undergrad
Gage Froelich	Caucasian	Male	Sophomore	Mechanical Engineering	February 2015	March 2015	Undergrad
Daniel Green	Caucasian	Male	Sophomore	Mechanical Engineering	February 2015	Current	Undergrad
Emma Cooper	Caucasian	Female	Freshman	Aerospace Engineering	March 2015	Current	Undergrad

## Team Organization

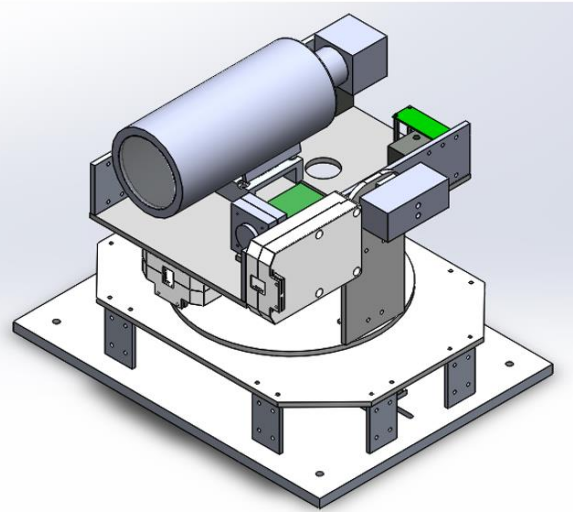


## Accomplishments of March

**Structures:** The structures team started working head on at improving the HELIOS payload. The main elements that their work included was to widen the upper housing to accommodate the new optics system and mount that optics system. Below is the current comparison between the HELIOS IV and V payload designs.



HELIOS IV



HELIOS V

*Figure 1: HELIOS Payload Comparison*

As seen above, they have widened the upper housing and adjusted the base to accommodate the new housing size. The plan for mounting the telescope is to use the telescope's existing mounting piece (shown to the right) to attach it to the payload.

During the March teleconference, the HASP team expressed concern about the size of the new payload and how far out of the HASP design envelope it goes. Below are images showing the HELIOS V payload as it moves around. The grey area is the HASP design envelope. In the highest position the top of the telescope is about 17 cm above the envelope, which is 4 cm higher than the HELIOS IV payload reached. Due to this week being spring break for the team, the images do not have dimensions on them. Properly dimensioned images will be sent to HASP next week.



*Figure 2: Telescope mount*

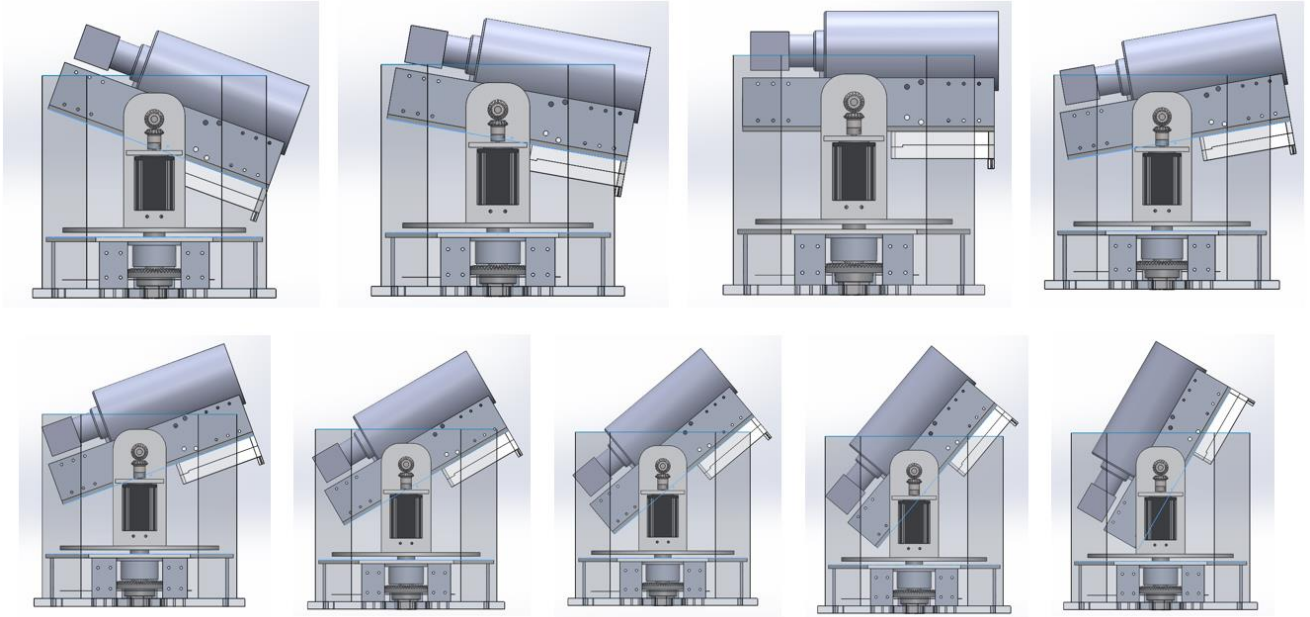


Figure 3: Range of angles, side view

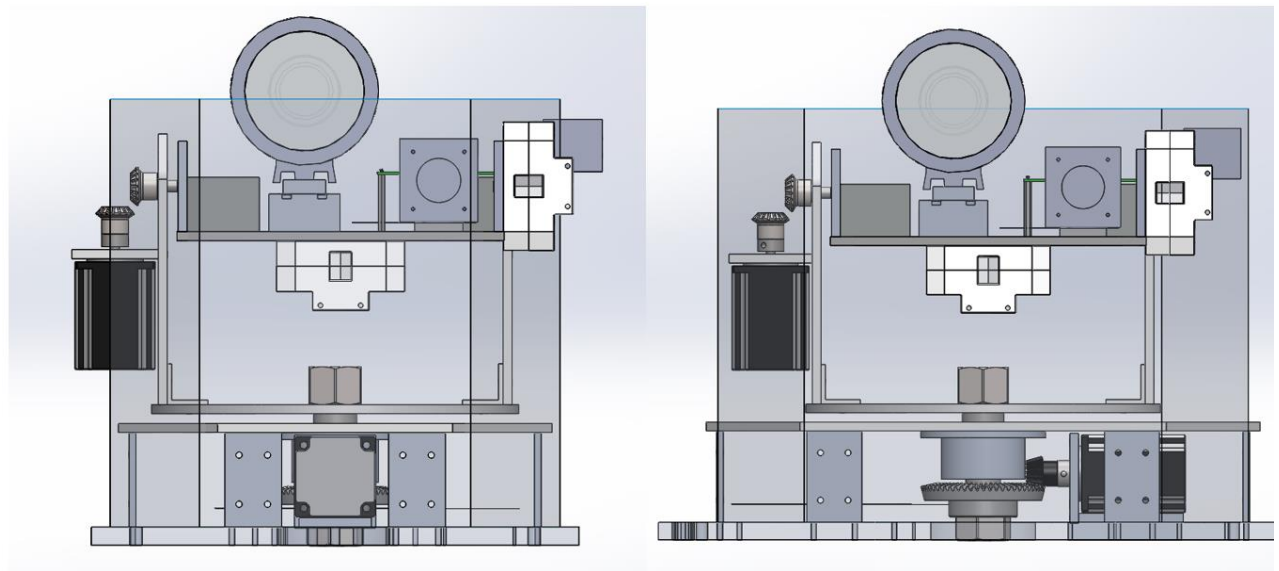


Figure 4: Rotational range of motion, viewed from the side (left) and front (right)

**Optics:** The optics team have been working with their hardware to improve the optics system design. This included testing the telescope and camera as well as learning about the filters the system will need to take images in Hydrogen-Alpha. Below is a comparison between the optics systems designed by Dylan Richards for HELIOS III and the new design for HELIOS V. The main differences are the new .44x focal reducer, and that the heat shielding filters will go over the telescope itself.

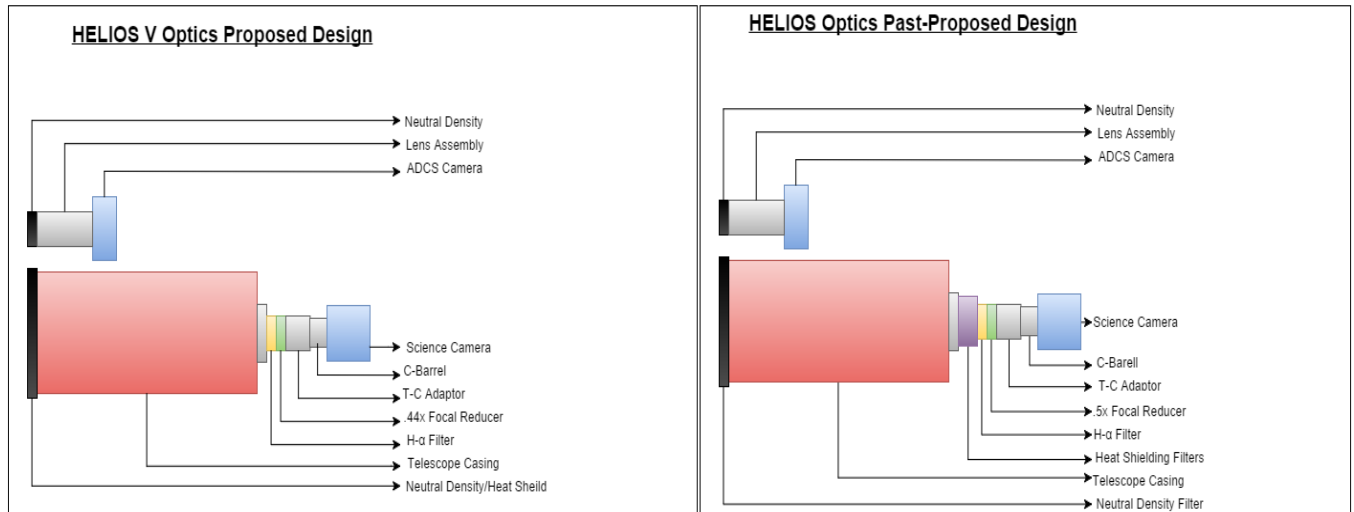


Figure 5: Optics Design Comparison

The optics team has also discussed the issue of when the science camera will capture images with the rest of the team. The current plan is to have the science camera take an image when the ADCS camera has detected the sun in a certain tolerance zone, which is show below. This will require good communication and work between the optics, ADCS, and CDH teams.

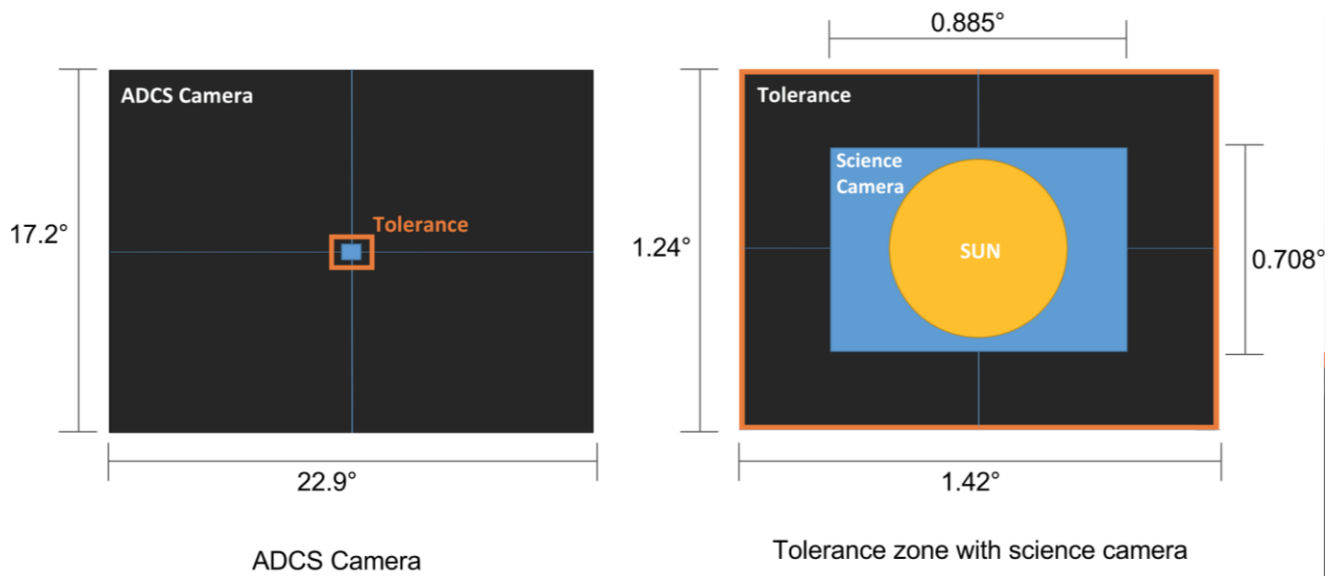


Figure 6: Camera tolerance zone

There has also been a change in the plan for the star trackers. The HELIOS V payload will

no longer have two star trackers, but instead will only have one in the back of the payload. The purpose of the star tracker is now to show that the HELIOS V payload can serve as a bus for other science payloads. The reason for this change is so that the optics team can focus on the telescope optics system since PolarCube will handle all of the details of the star tracker and will only require 5 V of power and a USB connection from the HELIOS team.

**CDH:** The CDH team has been working on the changes needed to accommodate the new optics system and implementing parts that the HELIOS IV team said they wished they could have done for their payload. This includes adding a second microprocessor, a second Pi 2, which will be used to control and save images off the science camera and star tracker. The team will also be implementing health checks into the code so that the payload can better monitor its performance.

**ADCS:** The ADCS team have also been working on improvements to their system. A major focus has been addressing HELIOS IV's main failure, which was when the counterweight fell and caused the system to start skipping steps. To address the problem of the skipping steps, the ADCS team is adding a physical reset so that if there is a failure, the system can reset itself on step counts.

**Systems:** The systems team is focusing on the electronics that will be required for the new optics system and the two microprocessors. This includes working on the new PCB board that will be used for the HELIOS V payload.

### **Plans for April**

The HELIOS V team has a final design presentation coming up in the second week of April. This will be the team's last step before beginning the major construction on the payload. For the structures team, they will be finalizing the design in April which will include determining the size of the counterweights of the payload. The optics team will begin testing their current optics design so they can find the best set up for the system. CDH will be focusing on implementing the health checks and working on the code needed for taking the science camera images. The ADCS team will be working on the physical reset design and the systems team will begin working on Altium to make the PCB design. All of this work will be presented for feedback in the final design review in April.