High Altitude Student Platform 2019

Stratospheric On-Board Laminar-flow Acidic Reduction Inspection System (SOLARIS)

Science Report

College of The Canyons
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Table of Acronyms

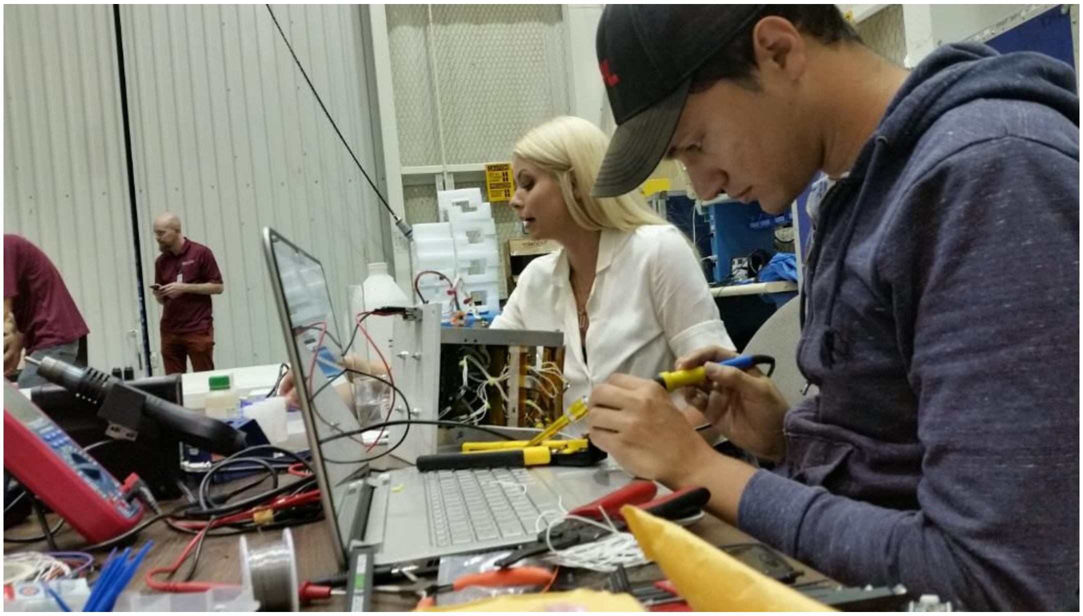
FCB	Flight Control Board
WRP	Weight Reduction Pockets
COC	College of the Canyons
TVT	Thermal Vacuum Testing
HASP	High Altitude Student Platform
LSU	Louisiana State University
FLOP	Flight Operations Plan
PSIP	Preliminary Specification and Integration Plan
SOLARIS	Stratospheric On-board Laminar-flow Acidic Reduction Inspection System
STEM	Science Technology Engineering Mathematics

I. Abstract

The Earth's atmosphere is constantly changing and evolving, especially with increased emissions from human activity. This human activity has resulted in increased acid levels in the atmosphere. At the level of the stratosphere, gaseous acids are involved in redox reactions that break down ozone, resulting in a thinner ozone layer. The byproducts of the redox reactions remain in the atmosphere, and act as an insulating layer that slows heat loss to space. Geo-engineering techniques may help to mitigate release and/or abundance of pollutants in the atmosphere. Pulling inspiration from SCoPEx - a scientific balloon experiment designed to understand the behavior of aerosols and particles in stratospherec air - SOLARIS was initiated to explore the behavior of a basic solution when exposed to stratospheric air. A common substance was used as a base to attempt neutralization of acids by introducing atmospheric samples to an aqueous solution via an isolated experiment chamber. The SOLARIS project goals were to contribute to data and information related to solar geoengineering by actively experimenting in stratospheric conditions, in ways never before tested. The NASA HASP 2019 program has provided an opportunity to test whether neutralization was possible and measurable, while collecting valuable flight data of the conditions in the stratosphere. Success of the concept may be a viable solution for mitigating the effects of climate change.

II. Introduction

Concept



The SOLARIS that flew in 2018 had a single chamber and different delivery system than the SOLARIS that flew in 2019 aboard NASA HASP. The SOLARIS project evolved, moving from a single chamber to two chambers, so that we would have a control on board. Additionally, the delivery mechanism was changed, implementing observations and analysis of data from the previous year's flight. Instead of delivering a solution to the atmosphere like SCoPEx, we attempted to bring the atmosphere to our solution. Our team found ways to simplify the 2018 SOLARIS payload design, while increasing the potential measurable outcomes with a control chamber added to the 2019 SOLARIS payload. As a primary objective, SOLARIS 2019 would validate the collection of stratospheric acids in an experiment chamber by comparing pH changes in the experiment chamber to the control chamber.

Principle of Operation

Solar geoengineering is emerging and safe methods for mitigating harmful acids are being explored. The SOLARIS team members envisioned methods of operation that would safely and effectively bring acidic aerosol samples in contact with our aqueous agent. The payload contains, protects, and isolates several onboard sensors and specific hardware; it was designed to isolate the experiment and continuously collect both environmental and pH data during flight. Two independent chambers inside the payload housed pH sensors immersed in an aqueous base solution.

The SOLARIS platform is unique in its compact delivery system and simplistic operation. During the balloon's accent the payload remains relatively inert, handling housekeeping and environmental data. At float altitude, all of the payload's systems go live; this is the result of a preprogrammed timed event.

Upon interacting with the solution, redox reactions occur through titration, and the resulting pH fluctuations are measured by an analog sensor using its own control board. The payload runs an open cycle for approximately eight hours. Different than 2018s design, it did not have an open/close valve. It simply started the experiment by turning on the pH sensors to conduct the experiment.

III. Design and Fabrication

Design Principle

The 2019 SOLARIS payload utilized previously tested materials and processes that were developed and analyzed during the 2017/2018 and 2018/2019 academic years as our team participated in the HASP program. In 2019, we explored the potential for new solution mixtures and redesigned a portion of the interior of the payload and the atmosphere delivery mechanism. We re-used much of the 2018 payload, including the flight computer and much of the hardware, reducing costs and production time of the 2019 SOLARIS payload, proving that a payload could be re-used with a few modifications.

Mechanical

SOLARIS embodied the concepts of its predecessors, using quarter inch aircraft grade aluminum as a base plate and sixteenth inch side panels. Its construction layered threaded holes that tap-head screws joined multiple sections of the payload together in one operation. This configuration produced the structural support necessary to withstand the landing forces as outlined in HASP's compliance manual, and also provided a lightweight but sturdy frame in which the experiment chamber and intake manifold were securely supported.

This year we removed one of the three tiers that were used in the previous years payload to reduce weight. The base plate is where SOLARIS' flight computer and **FCB** were mounted. The second tier was composed entirely of the experiment chamber; made from aluminum 6061. It served as a vessel that would safely contain our aqueous solution and isolate our experiment from the rest of the payload's systems. A host of manufacturing technologies were used in the production of our payload; an end mill, drill press, circular saw, sheet metal press, and bandsaw were used to perform the sizing of the two tiers, the drilling of holes, and adding weight reduction pockets to the aluminum.

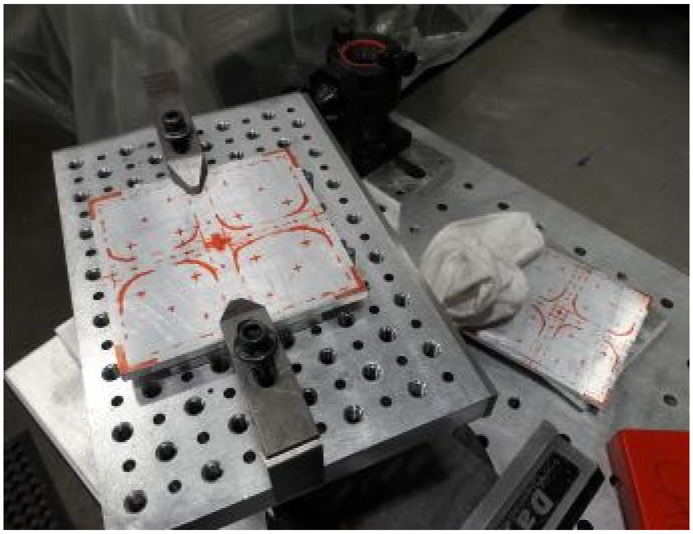


Figure 1a. Rough stock for the base plate

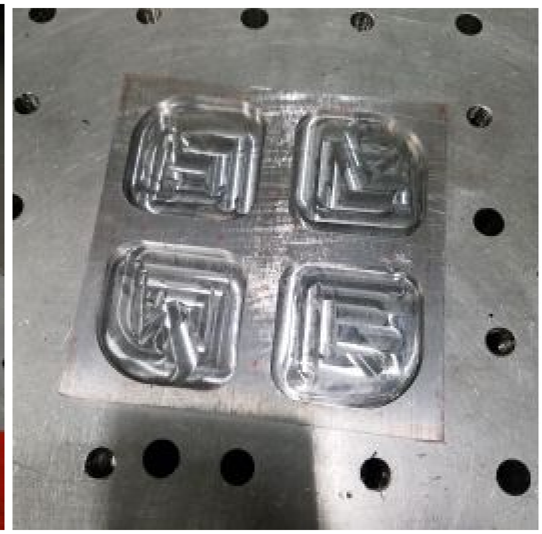


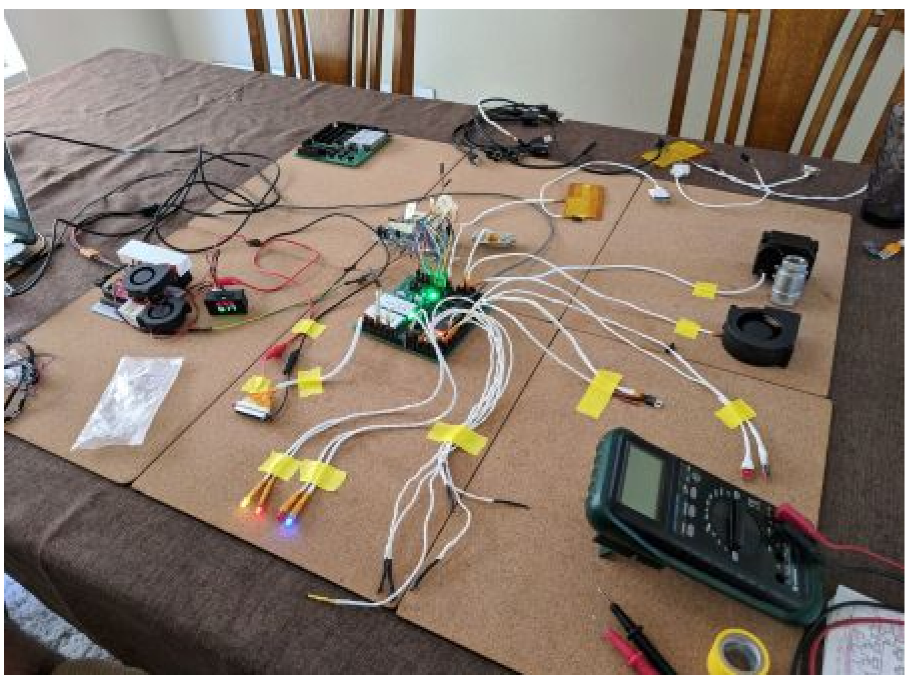
Figure 1b. Weight reduction pockets to the base plate

The above pictures show that we used the same exact plate from the 2018 payload for our 2019 payload. College of the Canyons is unique in that its students have access to both a traditional and CNC machine shop. The team enlisted the use of one of these CNC machines to add the deeper WRP to the quarter inch aluminum plates. One of our main concerns in utilizing a different delivery and detection method were the complications and time constraints in reengineering the payload to accommodate the new system. Despite changes being made to the internal operation of the payload, we were satisfied that SOLARIS took the form of preliminary CAD models and did not deviate much from the original mechanical concept. Overall, the design worked well for our applications, if only a bit cramped internally once the wiring harness took shape.

Solution Chambers

The section of the 2018 SOLARIS payload that was designed to bring atmosphere into the payload was redesigned to have two reusable chambers, one for the experiment chamber and one for the control chamber. The goals of the design modification was to include a control chamber and to be able to use this exact same dual chamber for upcoming years. The team used aluminum 6061 for the solution chambers to ensure there were no leaks through the bottom of the chambers and no corrosion from the solution. Using CAD models, we were able to create designs that fit within the exact dimension requirements given by the HASP program.

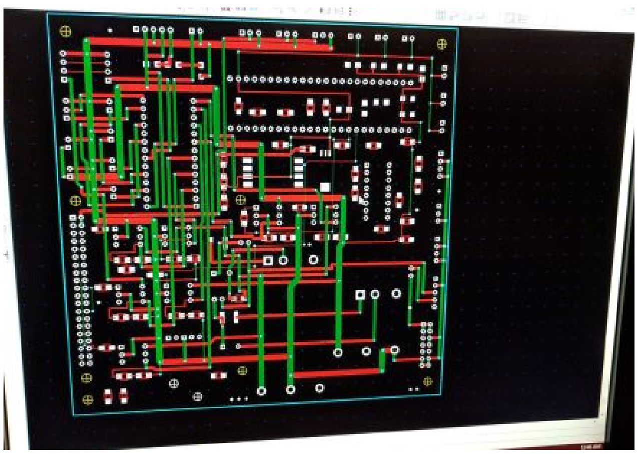
Electrical

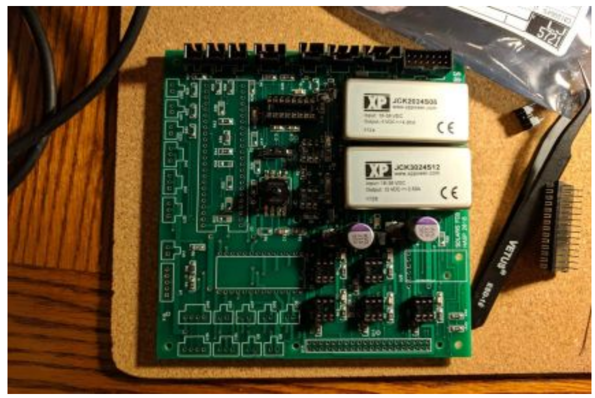


For the 2019 payload, we re-used the same electronics from the previous years payload as it was proven true and simple. The electrical systems utilized for our payload consisted of an integrated design built directly into our PCB board. Regulators received and conditioned power from HASP's side before relaying the specified voltages to the appropriate devices. This was intended to reduce the extra mass involved with a dedicated electrical system and to simplify the work required. Power was relayed from the regulators into our Arduino and Teensy computers which were used as relays to control power to the sensors and the intake fan. Two dedicated power lines were utilized for the pump assembly and intake valve due the power demands which would have risked overloading the flight computers.

Electrical systems performed nominally during testing and flight. Unlike the previous year, we did not experience any difficulties with electrical arcing or shorting in the pre integration vacuum tests at the College.

Flight Control Board





Again, like other hardware on the 2019 payload, the Flight Control Board was re-used from the 2018 payload. SOLARIS utilized a flight control board to efficiently route electrical components together with a custom printed design by our systems team leader. Unlike the prior years however, the board was printed as such to accomodate all hardware needed and removed the tiered design previously used, saving on mass and space. Additionally, the board's dimensions allowed for a greater number of I/O, analog, and power pin connections in order to bypass the need for dedicated arduino shields and breakout boards. The board performed well during testing and flight, however a bad trace on the RS232 chip configuration did prevent uplink commands from being utilized.

Sensors

Ph

Our analog pH sensor was the simplest, most cost effective solution to replacing the spectrometers to measure potential redox reactions. It was secured in place by a mounting port at the top of the solution bottle, allowing it to be fully submerged in the agent while taking readings directly above the mixing source. The probe functioned using a seperate control board and read via the onboard teensy . The probe read the changing the pH of the solution; 700 was considered a baseline reading while either higher or lower numbers correlated to an inversely proportional relationship with the acidity of the solution.

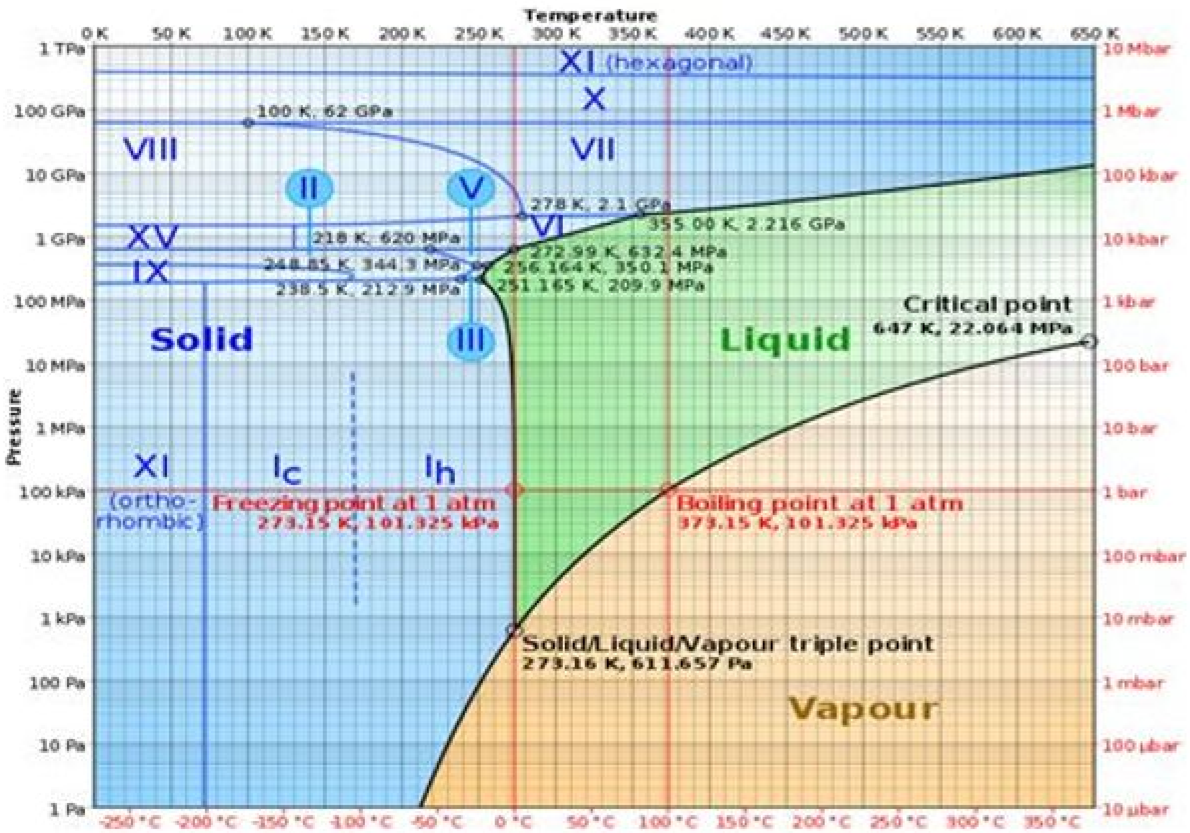
Current/Voltage

Current was monitored both through a returned value with an onboard current sensor, as well as the data returned through the HASP housekeeping data. Voltage however was only monitored through returned HASP data due to an inactive program in the payload's coding. Originally it was intended for our onboard sensors to track both, but complexities in the wiring and coding made this difficult. Regardless, power draw remained nominal and within expected values through flight with the trend being towards higher draw during heating and measurement cycles.

Software

Software for this year's payload was written with Arduino architecture to simplify programming and reduce the chances for errors that a more complex code could have produced. This additionally allowed us to tailor our flight computer selection to Arduino based components. To prevent the issues encountered during the previous year's integration, coding and testing began extremely early on in the program, allowing us to arrive at CSBF with a functional code. There was some difficulty interfacing with the HASP gondola systems, mainly due to an improperly wired RS232 converter and a switching of the serial data input. In order to integrate on time, the program was changed to run on an automatic timer sequence which negated the need for non functioning uplink commands.

Chemical



To keep it simple, the chemical team re-use the same chemical formula that was used in the 2018 payload. The chemical team was directly responsible for calculating the theoretical potential of the payload’s neutralization agent, analyzing all scientific data both digitally logged during flight and acquired during post-flight experimentation, producing an aqueous solution that would remain stable at a wide range of pressures and temperatures, and derive the chemical equations of different redox reactions occurring between stratospheric acids and the agent.

The use of base substances, like calcium carbonate and sodium bicarbonate, can reduce the buildup of acids such as hydrochloric and sulfuric acid. These chemical substances are not hazardous or toxic and are a naturally occurring byproduct of limestone production. Specifically, the mission targets the reactions with Hydrochloric, Sulfuric, and Nitric acids:

Calcium carbonate + hydrochloric acid produce carbon dioxide gas + water + dissolved calcium.
$CaCO_3 + 2HCl \rightarrow CO_2 + H20 + Ca+ + 2Cl_6$

Calcium carbonate + sulfuric acid produce calcium sulfate + carbon dioxide gas + water
$CaCO_3 + 2H_2SO_4 \rightarrow Ca(SO4)_2 + CO_2 + H2O$

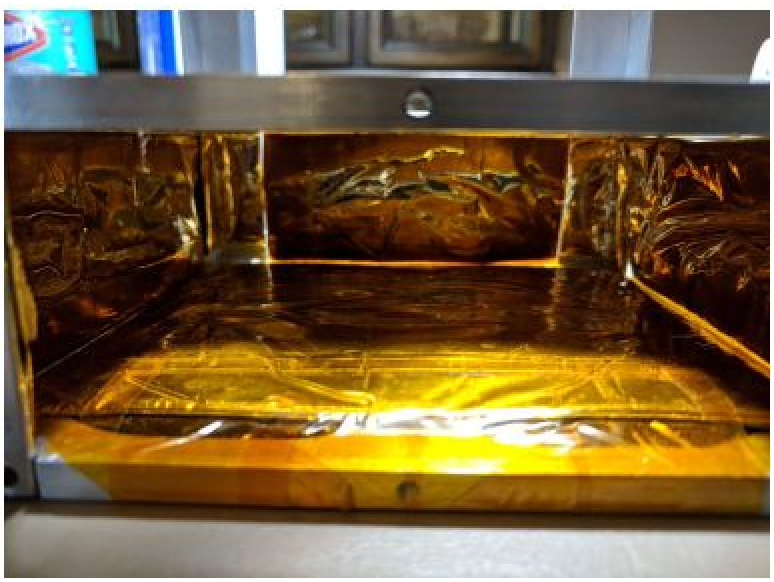
Calcium carbonate + Nitric Acid produce calcium nitrate + carbon dioxide + water

$CaCO_3$ (s) + $2HNO_3$ (g) → Ca(NO3)$_2$ (s) + CO_2 (g) + H2O(g)

The carbon dioxide from these reactions takes a gaseous form while allowing these acids to be converted into calcium sulfate, calcium nitrate, chlorine, and water. Just about any acid can produce these results, but dilute hydrochloric acid or vinegar are the two recommended acids for testing the effectiveness of calcium carbonate solutions. The result of these reactions will be the neutralization of acids present in the stratospheric layer of our atmosphere with the byproducts produced being more benign substances.

As atmospheric pressure lowers the boiling points of liquids and the conditions of the flight promote subzero temperatures, the solution agent used was a 50/25/25 mix. 50% of the solution contained a mixture comprised of filtered water taken from a 100 mL tank with 35.9 grams NaCl (salt) dissolved into it. This ensures a maximum soluble mixture of around 39.5% salt to water percentage. Salt water has a higher boiling point than regular untreated water and resists freezing more efficiently. 25% of the solution contained propylene glycol concentrate, which is often used as a food preservative agent. Propylene glycol is classified as nontoxic to humans as well as being relatively stable at a range of temperatures which will assist in keeping the solution stable. Lastly, 25% of the solution contained calcium carbonate concentrate to act as a neutralizing agent for acidic particles in air samples.

<u>Thermal Protection</u>



Along with using the proper materials to withstand environmental temperatures, our team also used a variety of simple passive and active methods to regulate the payload's internal temperature. On the passive side the payload used layers of mylar wrapped in reflective tape; specially designed channels cut into various pyload structural components allowed for additional mylar to be packed there to further insulate the interior. The exterior was given seven layers of white paint in order to reflect the rays of the sun. On the active side, flexible heaters were wrapped around critical flight hardware such as the valve and pump assembly. These heaters were programed into the code to keep the ambient temperature of these components around 65 degrees fahrenheit. Together, these measures prevented the freezing or overheating of our payload; from the onboard data, we can see that the internal temperature remained fairly constant throughout the flight duration.

IV. Integration

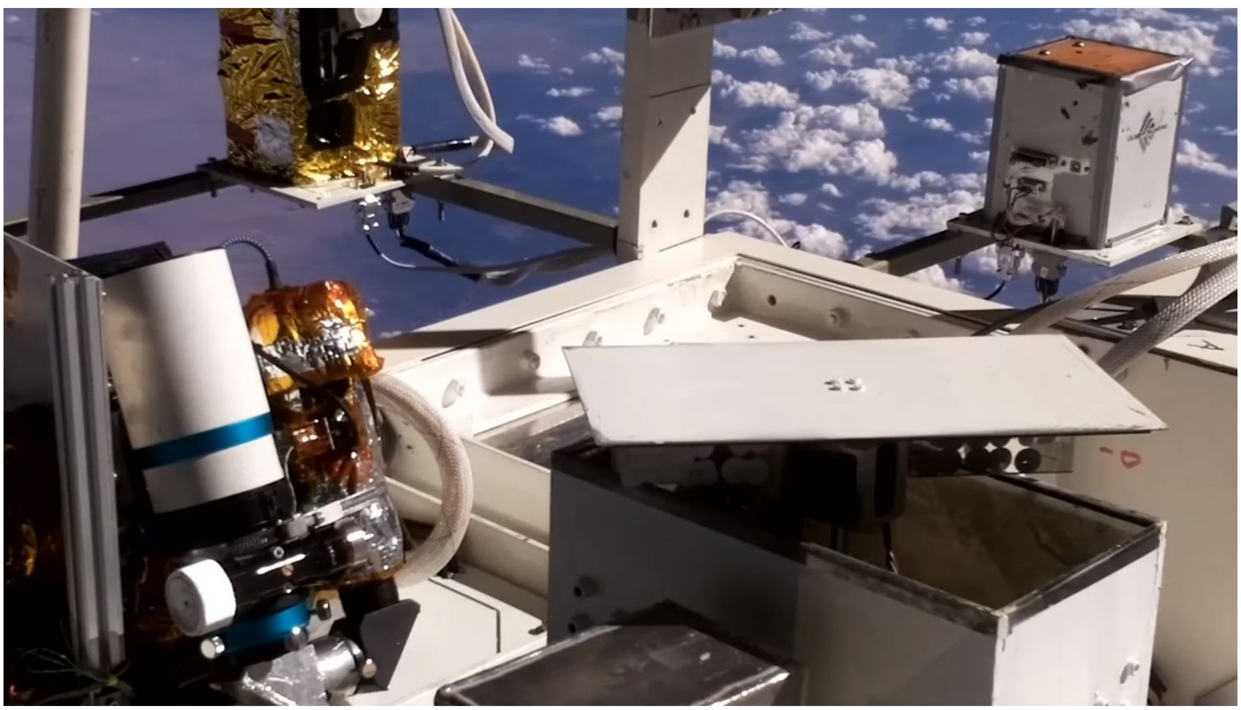
Two members of the team arrived at CSBF in Palestine, Texas, with the 2019 SOLARIS payload assembled and everything functioning optimally. We passed pre-integration on the first try; marking the second time in a row to pass on the first try for College of the Canyons. Our first **Thermal Vacuum Test** highlighted potential issues with our experiment; our solution started to leak as it went through different cycles of the test. This was a major issue because we could not have our solution leaking onto the gondola or contacting other team payloads.

The team spent the following days and weeks reinforcing the interior chambers to better contain the solution. We also re-tested our reaction solution to assure the proper mix ratios were confirmed to be stable at the anticipated temperature ranges and in vacuum conditions. Proof of successful solution containment was needed to be able to fly the payload. Testing results completed at College of the Canyons, that we were able to prevent the solution from leaking, were submitted via email to Dr.Guzik. Upon review, our 2019 SOLARIS payload was cleared to fly.

V. Ft. Sumner Reintegration and Pre-Launch Support

This was the college's second year of attending the launch in Ft. Sumner, New Mexico. The 2019 SOLARIS payload required a mission critical pre-launch operation, adding the solution to the payload, so attendance was necessary. After a flight from California, we promptly unpacked our payload and filled the solution bottle with a fresh mix of our neutralization solution before sealing the payload shut and reintegrating it onto the balloon gondola. The following morning a pre-flight check was done and the payload's solution was found to leak under specific conditions. We determined that there must be too much solution in the chambers and that we would need to decrease the amount of solution as well as possibly reinforce the interior and exterior walls to prevent any solution from leaking. We were granted fifteen minutes the following day, just prior to the hang test, to fix the problem. We bought absorbent material to lay inside of the payload, to stop any internally leaked solution from making it to the outside of the payload. After the payload was manipulated, testing was done, and the use of absorbent material proved successful in stopping the payload from leaking so SOLARIS was declared fully operational and cleared for flight. We enjoyed being on site for launch; this provided four of our team members an added dimension to our HASP experience as we witnessed pre-fight operations for a NASA science balloon. Unfortunately due to weather conditions, our launch window was later than the duration of planned attendance. We returned home to await the launch date.

VI. Flight



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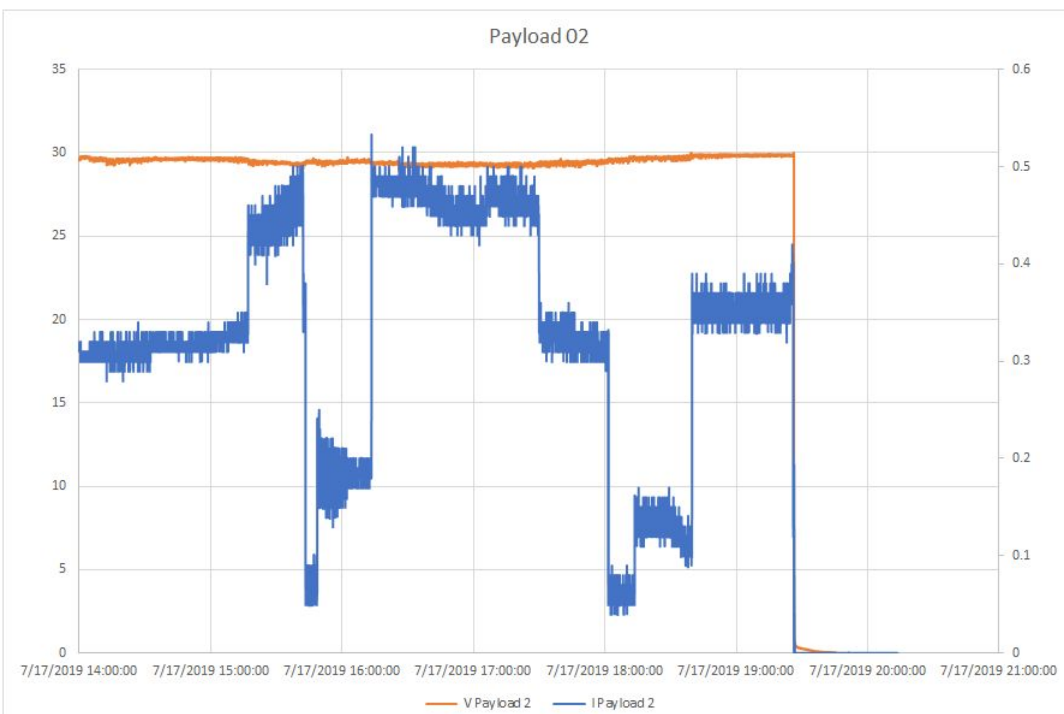
```

Downlink Showing our autonomous payload program

SOLARIS performed most of its objectives with success. The payload’s timed events executed as expected once the balloon had reached float altitude. Current draw only approached limit levels at one point during the flight according to the data returned, which could potentially have been an anomaly. We came across the problem that the ph probes were not collecting any data. This could be occurring because the solution simply spilled over internally and no solution was left inside the chamber to conduct the experiment and Ph probe malfunction.



Current and Voltage over the duration of the flight.

VII. Post-Flight Analysis

The instruments objective was to neutralize stratospheric acids using a basic solution consisting of a sodium bicarbonate and propylene glycol solution. Due to the pH sensor not providing data during flight and having no physical testing that could be done post flight as there was no solution remaining in the chambers after flight, we were only able to track and collect environmental data. Possible experimental error accounting for pH probe failure might be subzero temperatures, insufficient current draw or physical damage to probe prior/during flight.

A pH drop should be expected if the agent successfully neutralizes acid. Reaction: (excluding spectator ions, where A = Cl, HSO_4, NO_3 $NaHCO_3(aq) + HA\ (g) \rightarrow NaA(s) + H_2O(l) + CO_2(g)$.

VIII. Results

In Flight Data

Data returned from the PH probe in flight, did come back problematic, but we did yield positive results with the temperature readings. We see different temperature fluctuation throughout the flight that will be extremely useful in the upcoming years. The second and third lines show us the different temperatures throughout the flight.

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Temperature reading from the start of the flight

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```

Temperature reading from the end of the flight

IX. Conclusion

College of the Canyons has now flown with HASP for the fourth time, designing and modifying two unique experiments, and each time the students who participate on the team learn valuable skills related to the STEM fields and we learn soft skills as we work together solving problems and trying solutions. The team worked many hours designing and building a new SOLARIS payload for 2019 HASP. The experience was both difficult and invaluable; traditional classes do not provide the opportunity of learning all aspects of space missions, so student platforms like HASP are necessary to prepare students for their careers. The following comments include a discussion of payload failures, an analysis of how the failures may have occurred, the plans for our next HASP experiment, and what the HASP experience has done for the College of the Canyons students who participated.

Failures and Analysis

The payload arrived in Texas for integration with the expectation that we would pass all the vacuum/thermal and integration tests. The payload was successful when tested for integration, but did not pass TVT. The team was not expecting any leakage from the payload as it was tested before prior to the testing at CSBF, and the SOLARIS payload had exhibited no problems prior to the CSBF testing. Once the team returned home, we began looking into every possible solution to fix the problem. The final solution was to add a layer of cork and permatex to enforce the edges of the solution chamber. After many successful tests, the results were sent to Dr.Guzik to confirm that we fixed the problem and that our payload would not be a danger to any other schools payloads or the gondola.

When the team arrived in Ft. Sumner, New Mexico, we expected a successful pre-launch test until it was demonstrated that there was still potential for solution to leak from our payload. Last minute testing in the hanger by Dr.Guzik showed us that we still had some problems to fix as the payload would still leak a little from the bottom under certain manipulations of orientation. We were given fifteen minutes to fix the problem, so we reinforced the payload by adding absorbent material in case any internal leakage did occur, so the solution would be absorbed rather than leaking out of the payload. Our analysis indicates that the absorbent material soaked up all the liquid from the chamber, leaving the pH sensors dry and non-functional which is why we did not have any readings from the pH sensors during flight.

Future Experiments and Implications

Future experiments will not contain any liquids due to the complications that occurred with the 2019 payload. Even though we did not collect the pH sensor data that we had been anticipating, we did collect valuable data with our temperature probes. This data will help contribute to our idea for a 2020 scientific payload experiment which will consist of thermal containment and distribution using VantaBlack.

Whether our payload functions or simply provides us with an opportunity to problem solve real issues that occur in the process of space flight, our payloads serve as an example of what is possible. We routinely participate in science outreach events, describing the NASA HASP program and our experiments to our community. People are always excited to know that students are sending experiments to space, that NASA supports student projects. College of the Canyons students plan to continue to participate on NASA HASP in future years, and we have already designed the next payload.

X. Team and Student Impact

Roster

Name	Major	Major	Previous HASP Participant?	Female/Male	Ethnicity/Race
Gregory Poteat	Manufacturing Advisor	CNC Manufacturing Professor	Yes	Male	Caucasian
Teresa Ciardi	Logistics Advisor	Physical Science Professor	Yes	Female	Caucasian
Arthur Berberyan	Chemical Team	Physics	Yes	Male	Arminian
Coulson Aguirre	Mechanical Team	Mechanical Engineering	No	Male	Hispanic
Kyle Strickland	Electrical Lead	Electrical Engineering	Yes	Male	Arminian
Shelby Moore	Chemical Lead	Physics	No	Female	Caucasian
Jisun Kim	Software Team	Computer Science	No	Female	Asain
Oshoo Issar	Mechanical Team	Mechanical Engineering	No	Male	Indian
Paul Gotcher	Software Team	Computer Science	No	Male	Caucasian
Nathan Furtado	Electrical Team	Electrical Engineering	No	Male	Caucasian
Ruben Curiel	Electrical Team	Electrical Engineering	No	Male	Hispanic
Matthew Martinez	Electrical Lead	Electrical Engineering	No	Male	Caucasian
Gupreet Singh	Electrical Lead	Electrical Engineering	No	Male	Indian
Tyler Bond	Electrical Lead	Electrical Engineering	No	Male	Caucasian
Miles Salek	Mechanical Team	Mechanical Engineering	Yes	Male	Caucasian
Elizabeth	Mechanical	Aerospace	Yes	Female	Caucasian

Provencio	Team	Engineer			
Stephanie Villablobos	Electrical Team	Electrical Engineering	No	Female	Caucasian
Natalie Aliaga	Mechanical Team	Architectural Engineering	No	Female	Caucasian
Carlos Vasquez	Mechanical Team	Mechanical Engineering	No	Male	Hispanic
Luis Ivey	Software Team	Electrical Engineering	No	Male	Hispanic
Clifford Alvarez	Mechanical Lead	Mechanical Engineering	No	Male	Hispanic
Savannah Niedrick	Chemical Lead	Chemical Engineering	Yes	Female	Caucasian
Patricia Foley	Chemical Advisor	Chemistry Professor	Yes	Female	Caucasian
Gillean Graves	Chemical Team	Chemical Engineering	Yes	Female	Caucasian
Daniel Tikhomirov	Systems Lead	Electrical Engineering	Yes	Male	Russian
Raul Venegas	Electrical Team	Electrical Engineering	Yes	Male	Arabic
Matthew Merritt	Software Team	Highschool Student	Yes	Male	Caucasian
Phillip Bonell	Chemical Team	Chemistry	Yes	Male	Caucasian
Minerva Cardova	Mechanical Team	Mechanical Engineering	Yes	Male	Hispanic
Richard Lopez	Electrical Team	Electrical Engineering	Yes	Male	Hispanic
Peregrine Mcgehee	Software/Electrical Advisor	Astronomy Professor	Yes	Male	Caucasian
Krys Ciardi	Mechanical Team	Mathematics	Yes	Female	Caucasian

The 2019 NASA HASP project benefited both college and high school level students, providing opportunity for students to teach students and showing the real impact possible through STEM applications. A team of roughly 30 students comprised the largest HASP team COC has ever had. The team prides itself on being a safe, inclusive learning environment for anyone who has a desire to be part of the team, to participate in the NASA HASP project. For many on the team, this was their first experience designing and fabricating an experiment that would need to withstand the harsh environment of space. Several community outreach events and some media exposure kept HASP and SOLARIS in the public eye, spreading the impact of the project into the community.

Students are acquiring marketable skills and being selected for internships and scholarships (presented in table below) as a result of those skills. Having flown with NASA HASP four years in a row, we now have 54 students who have secured internships (paid and unpaid) and scholarships, and we have our first two students with permanent jobs attributed to their work on HASP. Gillean Graves (HASP 2017) has been hired by the EPA, and Richard Lopez (HASP 2017) works at Northrop Grumman. Daniel Tikhomirov (HASP 2016) has is currently the propulsion lead for the Society of Aerospace & Rocketry at University of California Irvine, and made it a final interview with SpaceX, all because of the skills he gained initiating our college's adventures with HASP. For most, HASP was the first real opportunity students had to do something practical with their academic experience, making a career in STEM seem real and possible.

Internships

	Aerospace & Sciences Team Internships & Scholarships					
	Skills from NASA Payload Design, Manufacutring, Constructions, Testing, & Launch 2016 - 2019					
	Student Name	***Academic Major***	***Internship Term***	***Years/Months***	***Industry Sponsor***	***Paid/Unpaid***
1	Tikhomirov, Daniel	Electrical Engineering	FA 2017 - SP 2018	1 Year	JPL	Unpaid
2	Tikhomirov, Daniel	Electrical Engineering	Summer 2018	3 Months	JPL	Paid 30 hours/week
3	Tikhomirov, Daniel	Electrical Engineering	Summer 2018	3 Months	CalTech	Paid 30 hours/week
4	Gagnon, Patrick	Aerospace Engineering	Summer 2018	3 Months	NASA NCAS	Unpaid
5	Strickland, Kyle	Electrical Engineering	FA 2018 - FA 2019	1.5 Years	JPL SIRI Program	Unpaid
6	Napier, Hunter	Mechanical Engineering	Fall 2018	3 Months	NASA Lucy	Unpaid
7	Berberyan, Arthur	Astrophysics	Fall 2018	3 Months	NASA Lucy	Unpaid
8	Aquirre, Coulson	Mechanical Engineering	Fall 2018	3 Months	NASA NCAS	Unpaid
9	Alvarez, Clifford	Mechanical Engineering	Fall 2018	3 Months	NASA NCAS	Unpaid
10	Berberyan, Arthur	Astrophysics	Fall 2018	3 Months	NASA NCAS	Unpaid
11	Saylors, Mindy	Electrical Engineering	FA 2018 - SP 2019	1	Schweitzer Engineering Labs	Paid 15-40 hours/Week
12	Gagnon, Patrick	Aerospace Engineering	Spring 2019	3 Months	NASA Armstrong	Paid 40 hours/week
13	Graves, Gillean	Chemical Engineering	FA 2018 - SP 2019	1 Year	Space Sciences Lab, UC Berkeley	Unpaid
14	Graves, Gillean	Chemical Engineering	Summer 2019	3 months	Space Sciences Lab, UC Berkeley	paid 20 hours/week
15	Aguilar, Adam		Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
16	Berberyan, Arthur	Astrophysics	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
17	Mendez, Azurim		Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
18	Aranda, Basil		Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
19	Alvarez, Clifford	Mechanical Engineering	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
20	Aguirre, Coulson	Mechanical Engineering	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
21	Cortes, Erika		Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
22	Lopez, Ivonne	Computer Science	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
23	Johnson, Kennedy		Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
24	Delgado, Kimberly		Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
25	Strem, Kyle		Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
26	Ivey, Luis	Computer Science	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
27	Bennett, Matthew	Aerospace Engineering	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
28	Sanchez, Michael	Computer Science	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
29	Zivsa, Michael	Mechanical Engineering	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
30	Gagnon, Patrick	Aerospace Engineering	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
31	Gotcher, Paul	Computer Science	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
32	Moore, Shelby	Nursing & Physics	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
33	Salah-Eddine, Steven	Mechanical & Aerospace	Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
34	Gilmartin, Sydney		Spring 2019	3 Months	Makerspace Internship	Paid 20 hours
35	Berberyan, Arthur	Astrophysics	SP 2019 - SU 2019	6 Months	CA Space Grant Consortium	$600 Scholarship Stipend
36	Niedrick, Savannah	Chemistry	SP 2019 - SU 2019	6 Months	CA Space Grant Consortium	$600 Scholarship Stipend
37	Salek, Miles	Mechanical Engineering	SP 2019 - SU 2019	6 Months	CA Space Grant Consortium	$600 Scholarship Stipend
38	Provencio, Elizabeth	Aerospace & Mechancial	SP 2019 - SU 2019	6 Months	CA Space Grant Consortium	$600 Scholarship Stipend
39	Aliaga, Natalie	Mechanical Engineering	SP 2019 - SU 2019	6 Months	CA Space Grant Consortium	$600 Scholarship Stipend
40	Strickland, Kyle	Electrical Engineering	SP 2019 - SU 2019	6 Months	CA Space Grant Consortium	$600 Scholarship Stipend
41	Aguirre, Coulson	Mechanical Engineering	SP 2019 - SU 2019	6 Months	CA Space Grant Consortium	$600 Scholarship Stipend
42	Alvarez, Clifford	Mechanical Engineering	SP 2019 - SU 2019	6 Months	CA Space Grant Consortium	$600 Scholarship Stipend
43	Moore, Shelby	Nursing & Physics	SP 2019 - SU 2019	6 Months	CA Space Grant Consortium	$600 Scholarship Stipend
44	Aranda, Basil		SP 2019 - SU 2019	6 Months	CA Space Grant Consortium	$600 Scholarship Stipend
45	Aguirre, Coulson	Mechanical Engineering	Summer 2019	3 Months	NASA Lucy	Unpaid
46	Tikhomirov, Daniel	Electrical Engineering	Summer 2019	3 Months	Aerojet Rocketdyne	Paid 45 hours/week
47	Aranda, Basil	Aerospace Engineering	Summer 2019	3 Months	NASA NCAS	Unpaid
48	Martinez, Leonardo	Engineering & Physics	Summer 2019	3 Months	NASA NCAS	Unpaid
49	Berberyan, Arthur	Astrophysics	SP 2019 - SU 2019	6 Months	IPAC at CalTech	Paid 20 hours/week
50	Graves, Gillean	Chemical Engineering	FA2019 - SP 2020	1 Year	EPA	Paid
51	Saylors, Mindy	Electrical Engineering	Spring 2019	n/a	Boeing	$5,000 Scholarship
52	Aguirre, Coulson	Mechanical Engineering	Summer 2019	1 Month	LSPACE	Paid $3,600
53	Aguirre, Coulson	Mechanical Engineering	Fall 2019	3 months	NASA Lucy Level 2	Unpaid
54	Furtado, Nathan	Welding	Fall 2019	3 months	NASA NCAS	Unpaid

In the News

William S. Hart Union have their cellphones

See PHONES, A7

dents and families, accordin

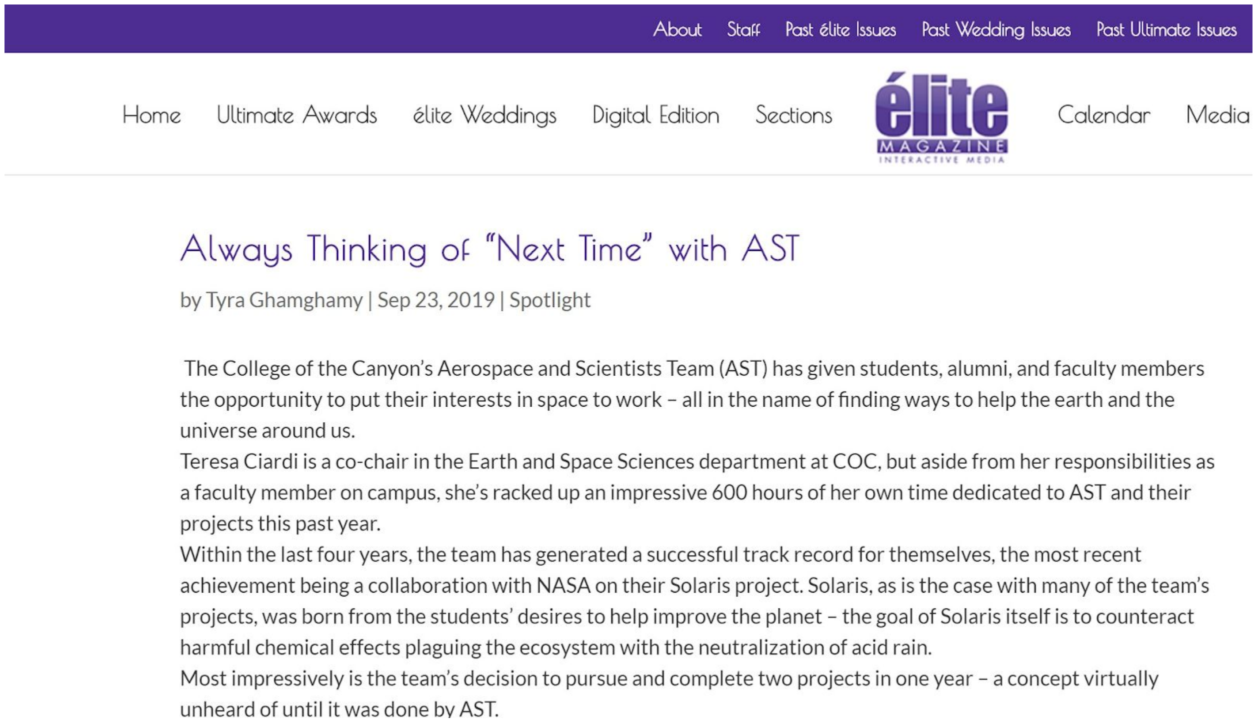
Star students celebrate stellar space launch

Photos courtesy of Louisiana Space Grant Consoritum, above, and Charla Provencio, right

(Above) For the fourth time since 2016, College of the Canyons students participated in NASA's High Altitude Student Platform research program, which was inflated at dawn Thursday, shortly before it was launched anywhere between 100,000 and 120,00 feet into the air for 24 hours. Following their recent return from Virginia, multiple members of COC's astronomy and physics club headed to New Mexico to view their second NASA launch of the semester. Students reflected on their experiences with the project in The Signal last week. Read the full story at: bit.ly/SPACE-COC.

(Right) Local residents Elizabeth Provencio, Clifford Alvarez, Greg Poteat and Shelby Moore tour the Columbia Scientific Balloon Facility base in Fort Sumner, New Mexico, prior to the launch of their payload.

Signal Local Santa Clarita Valley Newspaper



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Always Thinking of "Next Time" with AST

by Tyra Ghamghamy | Sep 23, 2019 | Spotlight

The College of the Canyon's Aerospace and Scientists Team (AST) has given students, alumni, and faculty members the opportunity to put their interests in space to work – all in the name of finding ways to help the earth and the universe around us.

Teresa Ciardi is a co-chair in the Earth and Space Sciences department at COC, but aside from her responsibilities as a faculty member on campus, she's racked up an impressive 600 hours of her own time dedicated to AST and their projects this past year.

Within the last four years, the team has generated a successful track record for themselves, the most recent achievement being a collaboration with NASA on their Solaris project. Solaris, as is the case with many of the team's projects, was born from the students' desires to help improve the planet – the goal of Solaris itself is to counteract harmful chemical effects plaguing the ecosystem with the neutralization of acid rain.

Most impressively is the team's decision to pursue and complete two projects in one year – a concept virtually unheard of until it was done by AST.

<u>Events</u>

In addition to the media response that the payload and project received, our team has given presentations at many events to promote our work and encourage the community to participate and support this work. Listed below are just a few of the outreach events we participated in over the last year.

- Green STEM summit
- College of the Canyons' Chancellor's Workshop
- College of the Canyons' Star Party
- College of the Canyons' Chancellor's Circle Dinner
- College of the Canyons' Manufacturing Day
- iLead Science and Innovation Expo
- Makerspace Events in the Community
- The Local Group Astronomy Day