Hawk HASP 2007
Final Report

Hawk Institute for Space Sciences
University of Maryland Eastern Shore

By: Pete Arslanian & Michael Dunn

12-28-07

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XII. Standard Atmosphere Graph Appendix 11

This graph compares the temperature referenced from the standard atmosphere to the values recorded by the external temperature probe.

XIII. Statement of Robert Davis

This is a statement from the mentor of the Hawk HASP students showing his opinions and perspectives.

Hawk HASP

Hawk Institute for Space Sciences &

University of Maryland Eastern Shore

UMES Students:

AVSC: 288 "Gateway to Space"

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Danielle Simmons	Martin Jackman	Maurice Deville	Ibrahim Bodra
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Surafel Cherinet	Galal Kamendego	Doug Young	

(Instructors: Marco Villa & Bob Davis)

NASA Step-up Interns @
Hawk Institute for Space Sciences

Pete Arslanian	Tycora Brown	Michael Dunn
Richard Choquette	Lisa Dean	

(Mentors: Bob Davis, Ron Bettini, Charlie Lipsett, & Marco Villa)

Student Interns of Hawk Institute for Space Sciences (post summer '07)

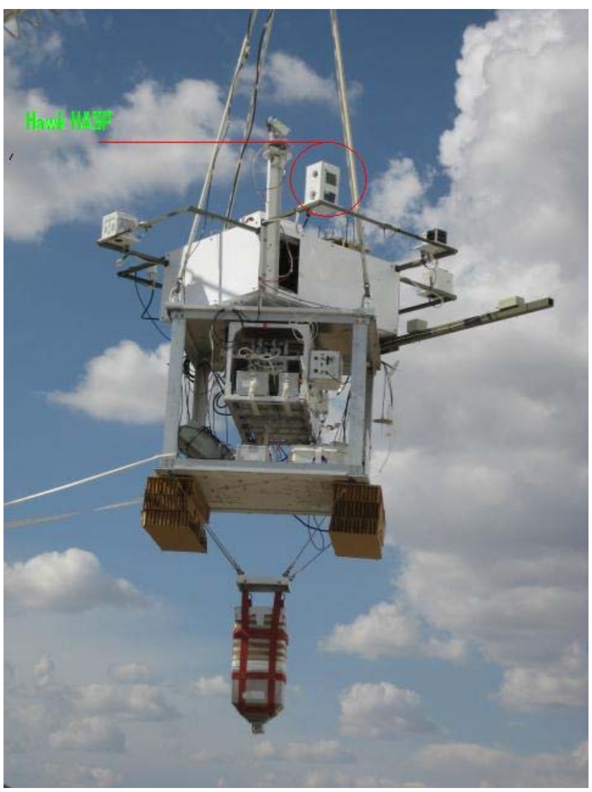
Pete Arslanian	Michael Dunn

(Advisors: Ron Bettini & Bob Davis)

Mission Statement

To successfully select and build a payload that complied with the standards set by LSU,for a small payload, launched on a high altitude balloon during the summer of 2007. This payload housed several experiments that measured atmospheric and environmental information. The data collected will be used for future research at the University of Maryland Eastern Shore, Wallops Island Flight Facility, the Hawk Institute and LSU.

Hawk HASP

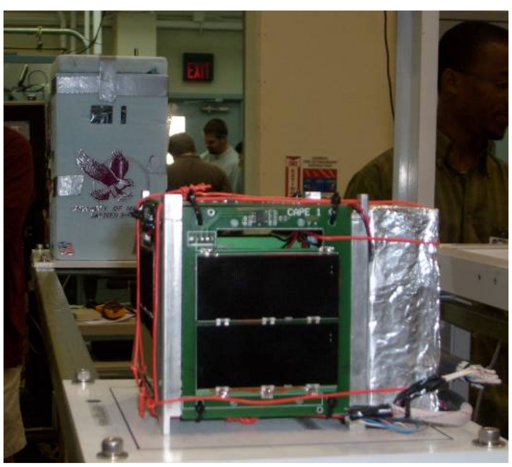


The students of the University of Maryland Eastern Shore, the Interns of the NASA Step-Up program and the student employees of the Hawk Institute for Space Sciences were encouraged to participate, along with other Universities and groups, in a joint program with LSU and NASA, to craft a small payload no more than 30 cm in vertical height, no more than 15 cm on each horizontal axis, and weighing no more than 1 kg and to launch a high altitude balloon for atmospheric and space research. Power was supplied by the LSU structure at 28 volts dc and 0.5 amps. The HASP balloon was launched September 2nd after a failed attempt on September 1st. A variety of devices were included on the UMES/Hawk payload to record data we feel will be beneficial to the University, NASA, LSU, and of course, our further education: a Pyranometer, 2- Solar Cells, 2- Temperature Probes, a Digital Camera and a Film Camera.

Groups Involved

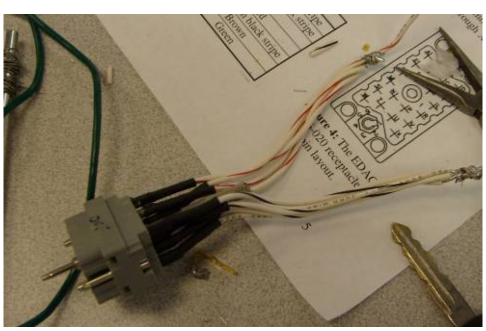
Thirteen University of Maryland Eastern Shore students, from the Gateway to Space class, were the first students to become involved with the Hawk HASP project. The class began in the spring semester of 2007 around mid January. When the class concluded in May, the project was not completed and was passed on to the student interns of NASA's Step-up Intern program who were working at the Hawk Institute for Space Sciences during the summer of 2007. These students were involved in the final the assembly, the integration and launch of the payload on September 2nd. At the end of the intern program several students stayed on to help analyze data collected by the payload and to finish the final report.

Integration



At the time of Integration the total payload weight was 1002 grams, 2 grams over the requirement but allowed to fly. The unofficial payload weight, according to the digital scale used in pre-shipment testing at the Hawk Institute, was 8 grams under maximum weight.

When power was tested the payload was found to draw .514 mA, around 110% of the .50 amps, which was the maximum allowed, the same was concluded at the Hawk Institute (Refer to Appendix 6). The power check on the payload was the only systems testing needed to be done to the UMES/Hawk payload. The visual and data logging systems were turned on and power regulators were checked and monitored. This was done repeatedly as the payload was hooked up to multiple power cables from other positions. The Power connector that was issued to UMES had the wrong configuration but was corrected at the integration site. Payload was supposed to be in position #1 power connection. The current sensing circuit was not installed in the #1 power connection and the payload was temporarily run off the #2 power connection for testing. UMES/Hawk Payload was used to check all other power connections after its individual power draw was checked. The # 1 current sensing circuit was replaced, and the payload was returned to its original position at payload #1. No film was inserted into the film camera and neither the digital camera nor the data loggers' storage was erased and reset. This action was done during Pre launch procedures. As it stood, no other equipment was to be added or abandoned. It was found that the solar panels needed to be better secured, and a thermal blanket and reflective covering needed to be added. The thermal blanket covered 60% on the Hawk payload and was constructed with one layer top and bottom of 1 mil reinforced Mylar. In between these two layers were 4 layers of B2A netting and 4 layers of ¼ mil perforated Mylar. The remaining 40% which consisted of the side with the cameras and the solar panels were covered with white duct tape to increase the reflective properties of those surfaces.



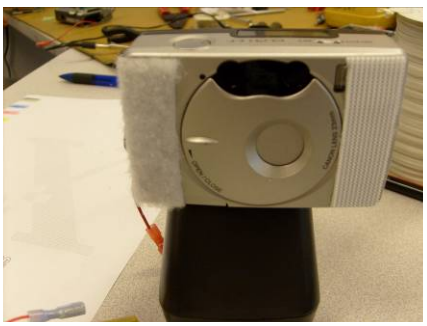
The area surrounding the light sensor on the film camera needed to be expanded for the camera to take proper pictures.

Launch and Flight

The first part of the UMES/Hawk flight team arrived in New Mexico on August 27th. Pre-launch system resets and film replacement started on August 30th. The Payload access panel was taped securing it with the exterior of the payload. The Solar Cells were given extra Velcro backing for security. The HOBO data collection device that recorded the Pyranometer, internal and external temperature was having problems with interference; extra spacing was given between connections to limit the interference during the flight (see spreadsheet Interference). Launch took place on September 2nd after a failed launch attempt on the 1st due to high winds. The launch procedures started at 0300 hours mountain time. UMES/Hawk HASP was powered on at 0605 and a final systems inspection was done at 0615. The balloon was launched at 0713. The flight lasted 19 hours 27 minutes and reached a peak altitude of 37,775 meters. The balloons flight path carried it over New Mexico and Arizona flying in an almost straight line in a westerly direction and landing in Poston, AZ. HASP was recovered on September 4th.

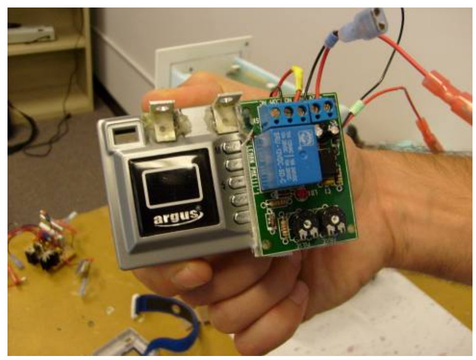
II. Systems

Film Camera



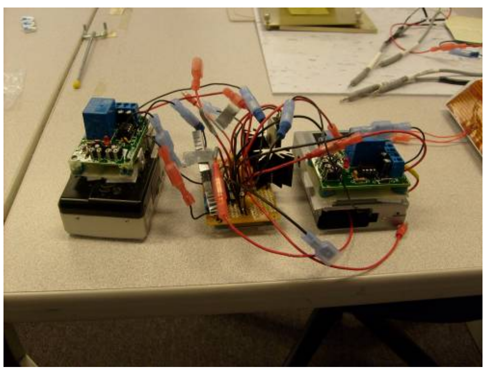
The power of the film camera was independent of the power supply provided by LSU, but the power given to its timing circuit was dependent on LSU's power and regulated by Hawk power regulation circuitry; this specific power draw was monitored throughout flight by the ground station and recorded (Refer to Hawk Pwr spreadsheet). The film was taken to Advantage Color Labs, Inc. in Salisbury, MD for development. The technician confirmed the following results: A total of six pictures were shown to have been taken with the remaining film exposures void of images. When the film was developed it appeared that the chemicals on the film that allow it to capture an image had evaporated or reacted with the high altitude, the difference in pressure, or other atmospheric conditions. The six negatives that were collected were so faint that a print could not be produced from them. Upon inspection the film camera showed no reaction to application of power (i.e. battery power). Several separate tests were done using new batteries and a DC power supply with the same results, zero operation. There is a rewind button on the camera but with no power the film would remain where it was. The camera should have rewound the film automatically with the last exposure; the latch to access the film was locked indicating that the film was not rewound completely. A good power source would have allowed the camera's display to indicate the number of images captured. To retrieve the color film the camera was dismantled very carefully in complete darkness. The left film compartment was accessed first, it was noted that only a small amount of film was present here. The rest of the film was still in the film cartridge. The film was then pulled from the film cartridge and placed in a protective film canister and delivered to the photo lab mentioned earlier. This extraction did not expose the film to light as a cloudy film would be present on the negative. From the amount of film that was present in the right side of the camera at extraction it appeared that the camera failed to operated after the 6 exposures or continued to operate normally with evaporating film chemicals and stopped rewinding as the HASP vehicle endured the descent through the Troposphere and the Tropopause, these conditions are the operational range for the camera, or upon impact with the earth. With the film camera timing circuit operating at 30 +/- 5 minutes, 38 exposures would have been captured during the 19 hours and 48 minutes the power was supplied. With no indication of exposures after the initial six on the film this conclusion has some fault to it. The film was analyzed to see if any time stamp indications could be extracted from the developed film codes. The same technician that developed the film at Advantage Color Labs firmly stated that the film would not process in the automatic developing machine. The absence of any useful image would cause the film to be rejected by the automated machine; therefore the machine cannot be forced to print the blank film with the time stamp information.

Digital Camera



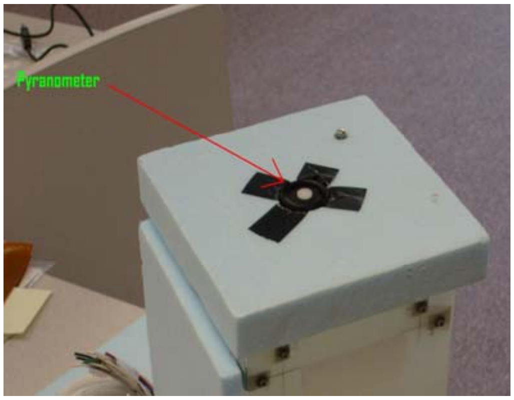
The digital camera operating power and the timing circuit that initiates image capture are dependent on LSU power and the Hawk power regulating circuitry. The digital timing circuit operated on a 45 +/- 1 second interval with reliable accuracy up until image 135; 13:50 UTC (Refer to Hawk Pwr spreadsheet). Starting with image 137 a one second (Refer to Hawk Pwr spreadsheet) increase in the time interval is highlighted at UTC 13:51. The time interval will increase by 20 seconds over the next 8 minutes. When image 148 was to have been captured a 21 second increase in the delay activated the power saving default built into the camera and turned itself off. This event occurred at UTC 14:01. The timing circuit for the film camera experienced some abnormalities during this same time period, therefore these failures warrant a separate paragraph for explanation.

Timing Circuit



Both timing circuits were built around the LM555 *Ic* oscillator (see appendix 5). The film camera timer was modified to increase the pause delay from a maximum of 1 minute to a maximum of 30 +/- 5 minutes with the addition of 15 Meg ohms of resistance and 100 Micro farads of capacitance (see Modified Timing Circuit diagram). An incremental increase of current is seen leading up to the digital timing circuit failure. This current increase (see Hawk Pwr. spreadsheet) is very suspect in that the value returns to normal as the timing relay returns to normal operation. The pulse portion of the delay square wave is affected, with a longer duration in addition to the pause portion extending its value; this either pinpoints one component or does not. The resistance value RV2 + R1 and the capacitance value C*1* multiplied with a given value of .693 (representing the LM555 I*c*) will represent Pulse portion of the resulting square wave. The resistance value RV1 + R2 and the capacitance value C*1* multiplied with a given value of .693(representing the LM555 I*c*) will represent Pause portion of the resulting square wave. The specific configuration of the timing circuit used works a little differently, the pulse and pause values using the described method add up to 1.6 seconds max for pulse and 32 seconds max for pause. The configuration used as displayed in (see appendix 4) extends both segments to 5 seconds and 60 seconds respectively. The extended time delay for both timing circuits occurred during ascent when the atmosphere was at its coldest. The physical characteristics for the resistors, capacitors or the *Ic* LM555 involved in the equation may have changed in this time period only to return when the temperature increased. Data for the descent to compare the ascent with is not available; data was not provided in the power category after 0615 UTC two hours prior to descent. For a more reliable timing circuit of this design to be utilized again this subject will have to be thoroughly examined.

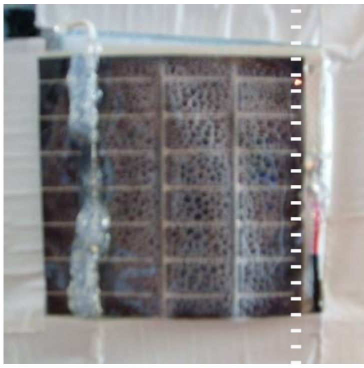
Pyranometer



The Pyranometer was used to measure the sun's radiate energy during flight for a consistent and accurate comparison with data collected by the solar panels. Using the data from the Pyranometer, solar orientation could be concluded as well as the increase in solar exposure with altitude due to the decreased filtering by the earth's atmosphere

The voltage values that were collected can be separated into two distinct times for comparison. The first would begin when Hawk HASP was powered up, and would include the rising, hovering, and falling of the HASP balloon. The data collected after the settling of the payload to the surface, represents the second comparison set, but is shortened by the retrieval of the HASP balloon.

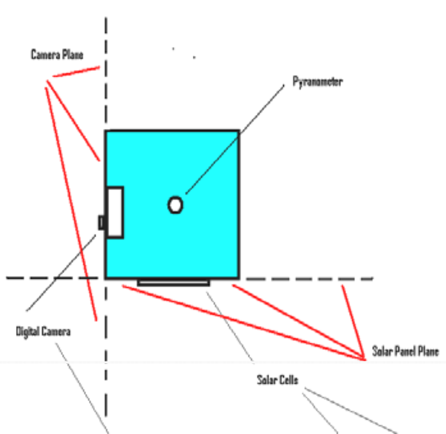
The time of comparison is from 0610 to 1609 New Mexico time, on both the 2nd and the 3rd of September when the Pyranometer could track the progress of the sun as it rose and fell. The data used in comparison was collected with the Pyranometer as it lay on the ground after flight. This is a general measurement because of uncertainty of Pyranometer facing angle which could have caused a delay or decrease in recorded values.



The voltages between the two readings paralleled each other until three hours after sunrise, although the value taken during the Flight is higher due to the increasing altitude and a decrease in atmospheric shielding. The data is most accurate between the time of 1600 and 1700, when the incidents of interference are at their lowest.

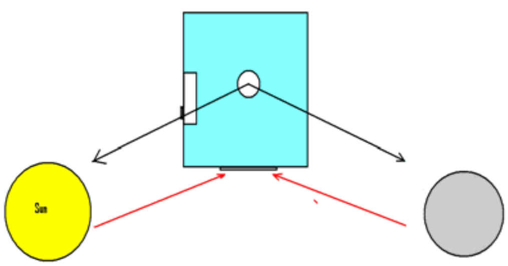
Solar Cells

The solar cell experiment consisted of two different cells each used for different applications. The first cell was a standard "off the shelf" silicon flexible cell, and the second a space grade single-junction Gallium Arsenide (GaAs) cell. The experiment originally planned by the students was to do a comparison of the two cells efficiency, showing how the much of an increase the space grade cell would show over the silicon flex cell. During the ascent the flex cell had a reaction with the environment which caused an expansion in the plastic protective coating on the exterior of the cell at 1446 (refer to S.C.V graph for drop in voltage). The drastic change in pressure as the balloon rose was thought to cause any of the air bubbles caught in the plastic during production to expand temporarily reducing the cell's solar collection abilities. The voltage was restricted to .002584 VDC from 1446 to 1730 UTC time.



In reference to the Solar Panel Voltage Amps spreadsheet many values exist. Both the Glass and the Flex Cell's voltage and mA were logged. Using these values we were able to determine the actual voltage developed by the cells before the voltage was reduced by the solar load circuit. Values were reduced to levels in the HOBO's data collection range (see Appendix 3). The cells were of various sizes so the first "power" column of the glass and flex cells (G and S respectively) were the total power generated by each cell. The cells' power was then determined per cm to give us an accurate comparison. The glass panel showed a power value of 0.000388991 *Watts* and the Flex cell generated 0.00015314 *Watts* at 1343 UTC approximately 30 min after launch, a 154% increase in efficiency between the two. Total power generated at this exact same time ,not per cm value, is for the glass cell .006379454 *Watts* and the flex cell is .006923746 *Watts* .Using random points, the average difference between the voltages (pre-flex cell damage) was .09525 (151.2 % increase.)

Using the variations in data from the voltage of the cells and the pictures taken by the digital camera, we were trying to make deductions on the orientation of the sun to the two sides of the payload. If the camera is shown to be directly in the sun we can determine the angle of exposure of the solar cells and compare it to the voltage produced. If the sun is not in the camera view but the voltage produced is the same then the sun would have the same angle with the cells but in the opposite position due to rotation. Once the sun was 90 degrees away from the solar cells but to the opposite side of the camera would be hard to determine. The number of



pictures taken was limited but this is the conclusion;

Based on just the voltage data (see Solar Panels V-Amps spreadsheet and S.P.V chart) you could possibly configure what position the sun was in, relative to the solar panels but only for two definite positions; in front of the panels where the output would be the highest, and behind; where the output would be the lowest. If the sun is to either side of the panel or angled to the panel, the voltage would be between the highest and lowest values, for that altitude under the same atmospheric conditions, but exact right or left orientation can not be verified. Without pictorial evidence, we can not be sure. The frequency of the pictures would need to be increased, considering the speed of ascent. Also it would help if the frequency of the voltage data were taken more often to show a more curved rotation of the HASP. Video would be and improvement, or a combination of solar panels, cameras and accelerometers for the most precise results.

Internal Temp

The internal temperature from start up rose to 200° F at 1205 UTC. As the balloon continued to rise, the temperature dropped relative with the external temperature until float at 37,750 m. During the float period the internal temperature maintained stable 100°F. With consideration, this value seems false knowing that the external temperature based on the standard atmosphere (for Standard Atmosphere use Temp. Std. Atmos. Chart) is around -20 ° Celsius. It is thought the unsecured probe settled near one of the two voltage regulator heat sinks, whose temperature would have risen to around 200 °F in the beginning and the internal heater would only maintain 120 °F. Data gathered from the internal probe can not be used because of its wide variations and lack of another testing value.

External Probe

External temperature probe produced expected results, once again based on the standard atmosphere, from start up to float. During float, the direct exposure of the metal casing, covering the sensor, to the sun's radiate energy caused an unusual increase in temperature, making the data from float to sunset unreliable. From sunset to termination the temperature again mimics the standard atmospheric table (Refer to Temp. Std. Atmos. Chart).

Success/ Failures

Each of the experiments attempted was a new experience for all of the students participating in the Hawk HASP project. All of the students came from different backgrounds and different majors, none quite yet being specialized in their field. All of the experiments provided a variety of data to be analyzed, all interconnected to the next experiment.

The camera experiments were thought to be one of the easier and more straight forward components in the payload but soon proved to be our most taxing, both before and after the launch. Not one of the cameras had total functionality through 100% of the flight both seeming to stop at around 16,000 to 17,000 meters. The cameras were exposed to too much of the outside air and should be shielded in the next attempt by either a small piece of clear glass or plastic. This will also keep the internal conditions of the payload more controllable. This experiment would like to be attempted on the next flight, where the cameras would be limited to one camera to allow more space for other components. Most likely the camera would be digital for ease of processing and less risk of film failure due to atmospheric conditions.

The Pyranometer was the least understood component in the group when first received because of its shear simplicity. In the end the component was successful in showing the position of the sun throughout the flight (refer to Pyranometer Ground to Flight Comparison chart) and after the flight had settled to the earth. The students should have placed the component on the same axis as its complimentary component (aka solar panels) for comparison of data and a more accurate reading. The experiment will not be continued in the next flight, although the data was useful, the students are looking to pursue a different component for the same data in the form of a photodiode.

The solar panels returned the highest quantity and most useful data of all components. The Panels allowed solar position and solar intensity, compared to altitude, to be calculated. The Flex Panel's plastic coating should have been removed before the flight to stop decompression of the trapped air bubbles, in retrospect a different cell should have been used altogether. This experiment will be continued with the next class but will be modified. The panels used will continue to be those with different applications but both will have a higher efficiency. The increased efficiency will allow a broader range of data for analysis.

Temperature Probes

The internal probe proved to be the most disappointing for the values throughout the whole flight were unreliable, and a more precise device should have been used. The experiment is a necessity for a successful launch because of the vulnerability of the experiments. The use of thermal couples should have been investigated as well as a more accurate probe. If allowed to fly again, thermal couples would be attached to each device, giving data on the temperature of all components, not just the temperature at one location.

The external probe had a variation of success early and late in the flight, but failure during float. If flown again the external probe will be shielded with a hood or covering allowing for accurate temperature readings but protection from the interference of high altitude radiate energy.

We the students have concluded that the flight of the 2007 Hawk HASP small payload was a success due to three main reasons:

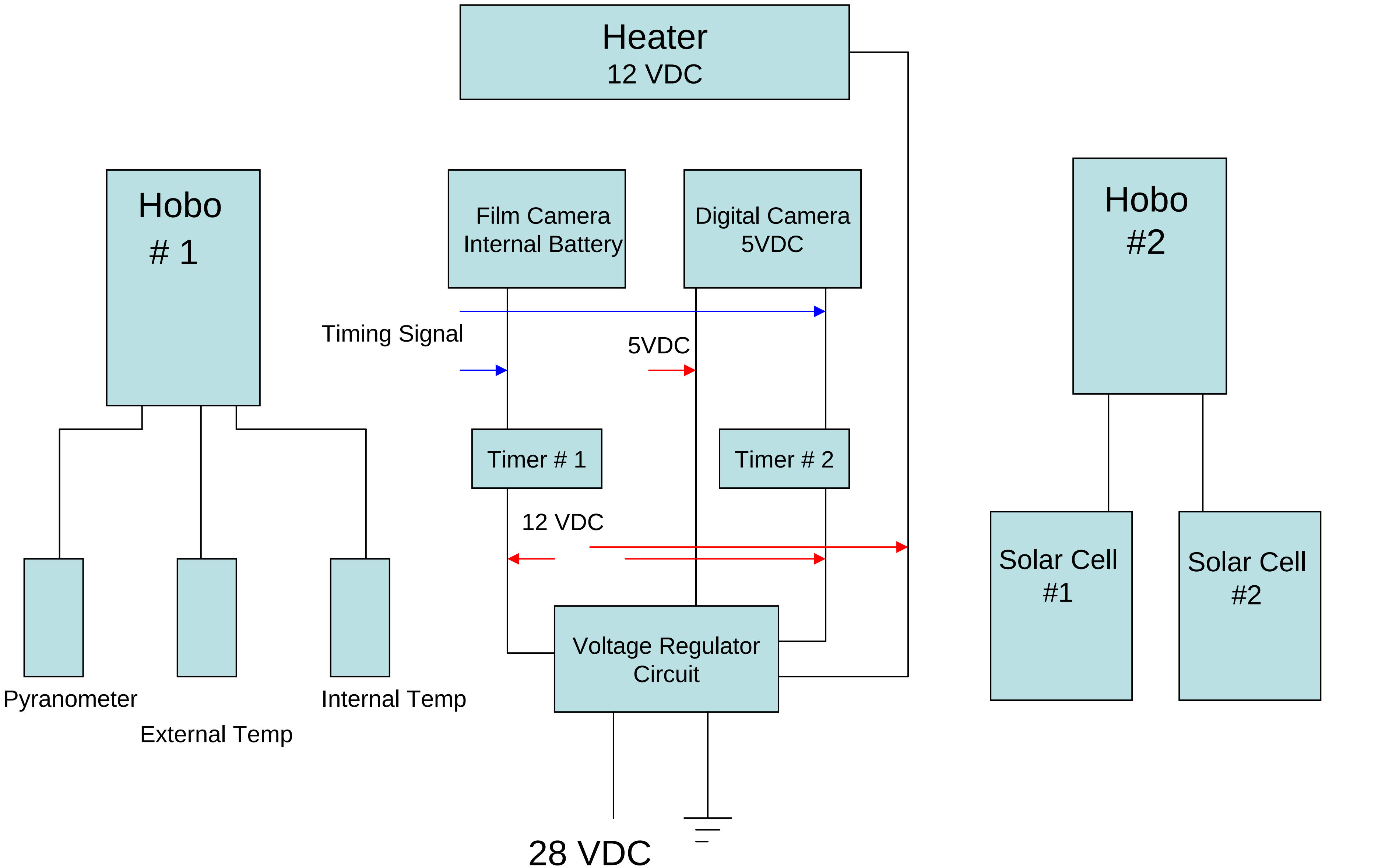
One the payload was delivered on time and was integrated with all of LSU's guidelines met.

Two, the wealth of data collected enabled the students to answer the questions that were originally proposed to the students of UMES class # AVSC 288.

Three, the achievement of the primary goal which was to give students experience with the complete process of a satellite program; the design, construction, integration, launch, data analysis and eventual conclusion were met. We the students conclude that we would like to continue the program for the educational benefits and shear experience of launching this type of payload.

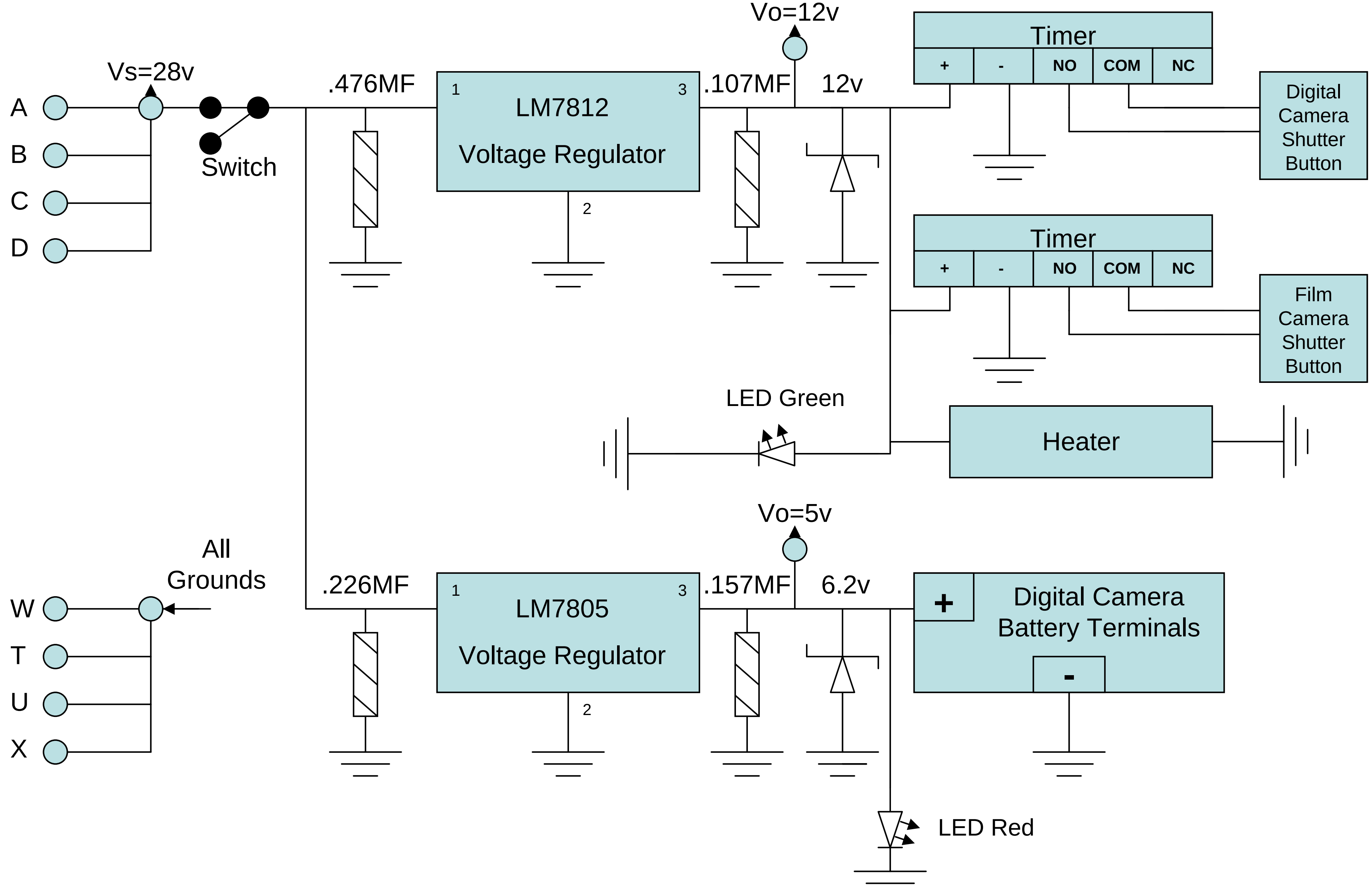
Appendix 1

Subsystem Diagram



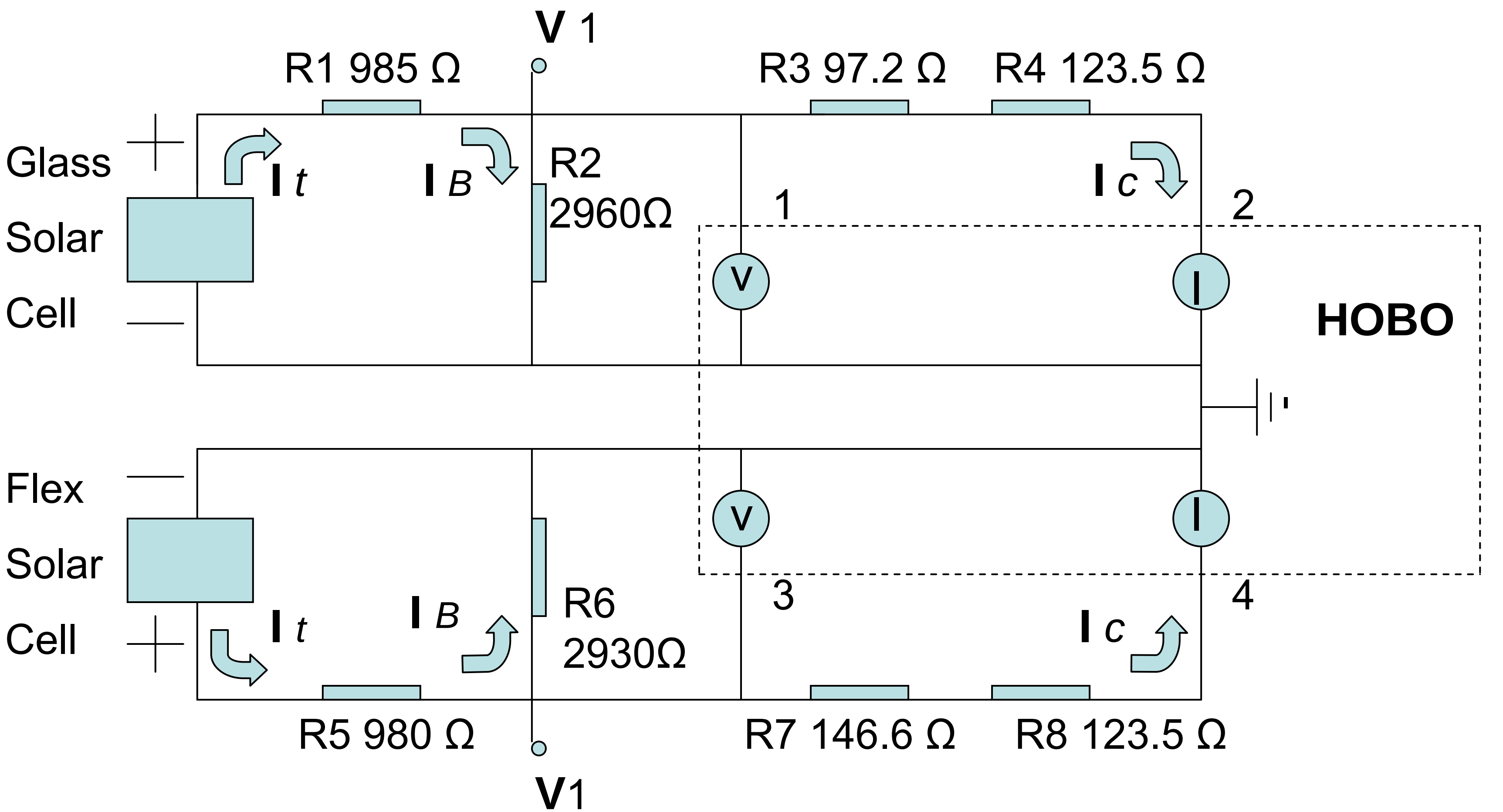
Appendix 2

UMES Hawk HASP Payload Wiring Diagram



Appendix 3

Solar Cell HOBO Load Circuit



$\mathbf{V}1 / \mathbf{R}2 = \mathbf{I}\,B$

$\mathbf{I}B + \mathbf{I}\,C = \mathbf{I}\,t$

$\mathbf{I}\,t * \mathbf{R}\,t = \mathbf{V}t$

Glass $\mathbf{R}\,t$ = 1190.4 Ω

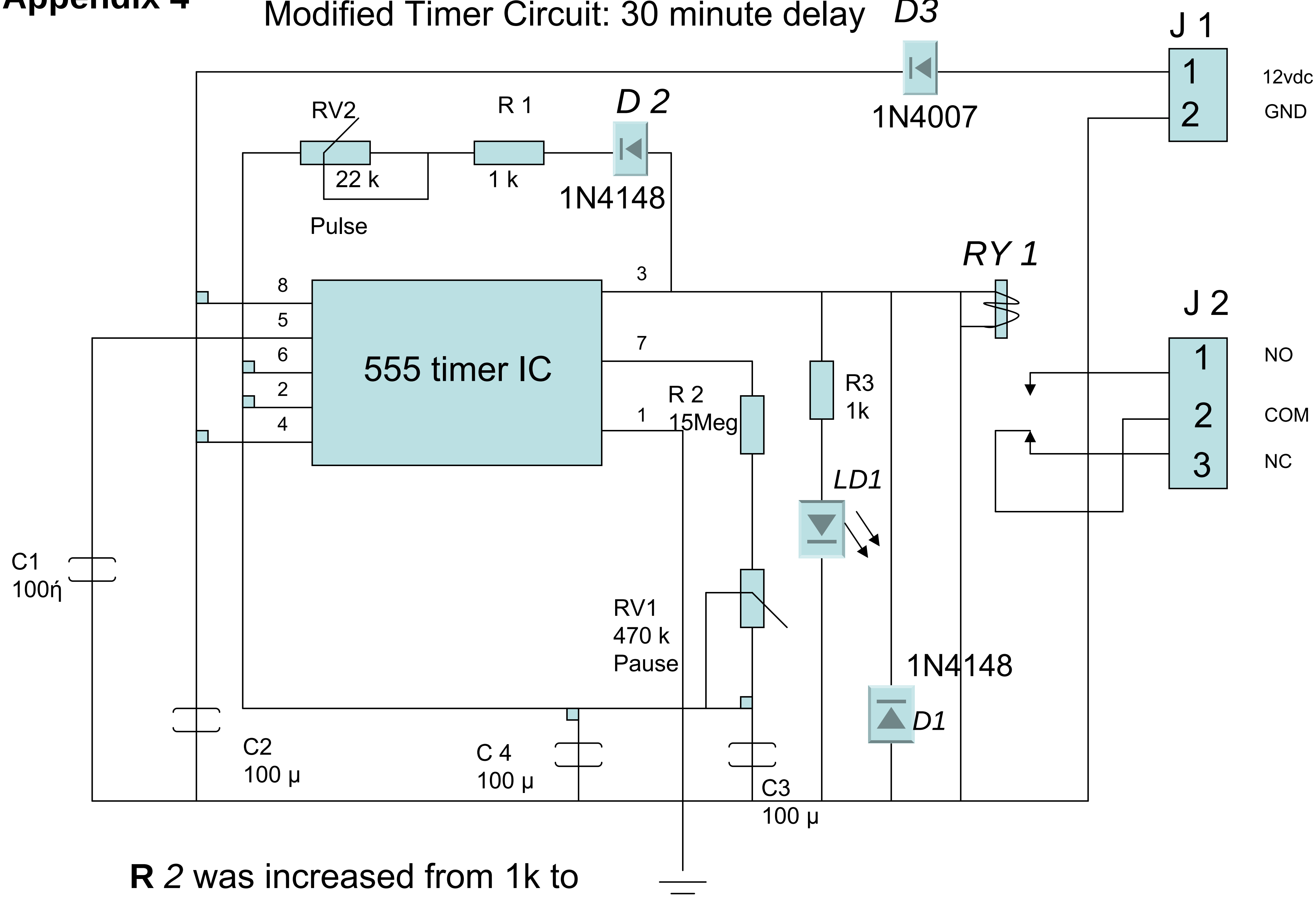
Flex $\mathbf{R}\,t$ = 1227.3 Ω

$\mathbf{P}t = \mathbf{V}t^2 / \mathbf{R}t$

R 4 & **R** 8 represent the resistance built into the HOBO current cables

Appendix 4

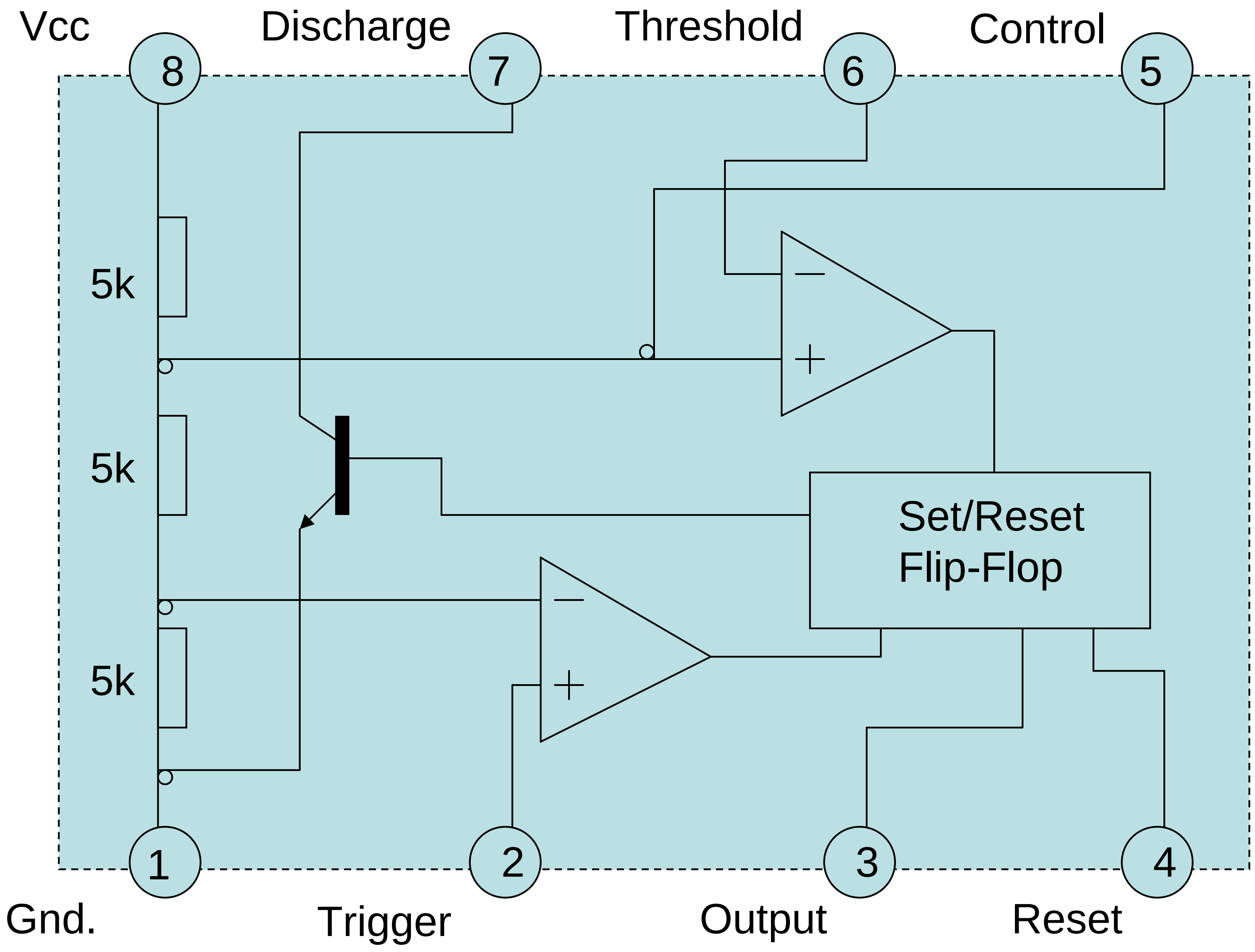
Modified Timer Circuit: 30 minute delay



R *2* was increased from 1k to 15Meg, and **C***4* was inserted.

Appendix 5

LM555 Timer Internal Circuit Diagram



Appendix 6

	Current A	VDC
Voltage Regulator	0.023	28
Green L.E.D	0.004	12
Red L.E.D	0.003	12
Film Camera Timer	0.01	12
Activated	0.036	12
Total	0.046	12
Digital Camera Timer	0.01	12
Activated	0.036	12
Total	0.046	12
Heater Minco	0.24	12
Digital Camera	0.086	5
Taking Picture Peak	0.152	5
Total Peak	0.514	

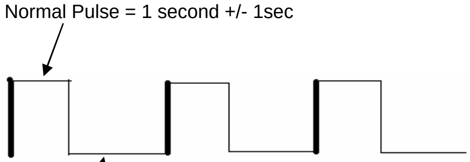
The total peak current represents the occurance that both timing circuits trigger at the same moment.
This did occur in flight and in theory the total current draw exceeeds the maximum.
The peak is attained when the digital camera is processing the image into the memory stick and a millisecond spike is produced.
Normal operating current is .376 with all systems on and no images, film or digital being taken
A digital picture will represent a current increase by the timer with a .036 increase to .412
and a camera increase by .066 to .478 . This spike descibed initially is a .02 increase
then it rolls up to .066 very rapidly and back down to no increase.
In the Hawk Pwr Excel sheet this value can be seen every 45 seconds until failure, as an increase from .37 to .43-.44;
the spike does not register on the LSU PWR record.
Total Peak over draw was explained to the LSU team and the device was allowed to pass by the fact that a .75 amp fuse
controlled the circuit that Hawk belonged to.

Hawk Hasp normal current draw	0.376
Hawk Hasp normal current draw while taking a digital picture	0.478
Hawk Hasp normal current draw while taking a digital picture and film picture	0.514
Hawk Hasp normal current draw while taking a digital picture and film picture recored in (Excel Hawk Pwr Utc 13:42)	0.48
Hawk Hasp current draw with digital camera off	0.29

Digital Camera	Argus DC-3185	www.arguscamera.com
1Gig SD card	SanDisk	www.sandisk.com
Film Camera	Canon ELPH LT IX 240 A.P.S	www.usa.canon.com
Film	Kodak A.P.S 200 / 40 exposure color	www.kodak.com
Timer	velleman-kit MK111	www.vellemanusa.com
Heater	MINCO 9242 HK6070-05B54.0 ohm	www.minco.com
Data Logger	HOBO U12 / 4-External Channel part# U12-006	www.onsetcomp.com
Temperature probes	part# TMC1-HD	www.onsetcomp.com
current cable	part# CABLE-4-20mA	www.onsetcomp.com
voltage cable	part# CABLE-2.5 STEREO	www.onsetcomp.com
Pyranometer	LI-COR part# LI-200SA	www.licor.com
Universal Transconductance Amplifier	EME Sytems / UTA	www.emesystems.com
5 volt regulator	LM7805	www.radioshack.com
12 volt regulator	LM7812	www.radioshack.com

Digital timing circuit

Normal Pulse = 1 second +/- 1sec

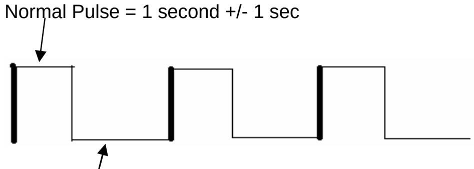


Normal Pause = 44 seconds +/- 1 sec

At digital camera failure the pulse increased to 11 seconds and the pause to 54 seconds for a total of 65 seconds from the last leading edge to trigger the camera.(Excel Hawk Pwr,UTC 14:01 second 3691)
At failure the time increase was 10 seconds for each part of the square wave.

Film timing circuit

Normal Pulse = 1 second +/- 1 sec



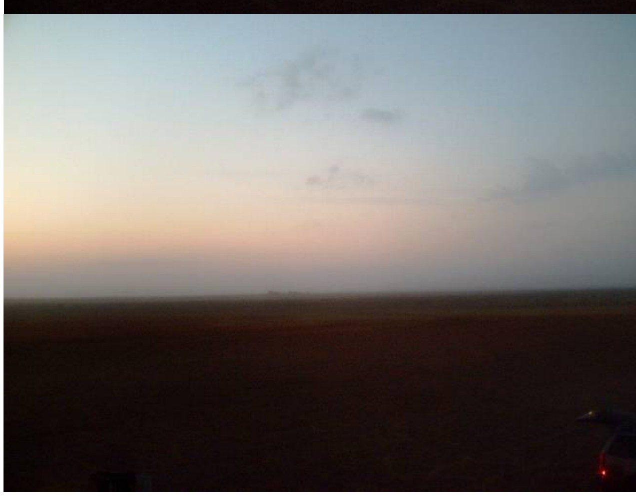
Normal Pause = 2075 seconds(34min,35 secs)

Eighteen minutes after the digital camera failure the film timing circuit activated with a pulse that lasted for 45 seconds.(Excel Hawk Pwr, UTC 14:19 second 4765)
The pause increase during this cycle was three minutes to 37:26

Appendix 7







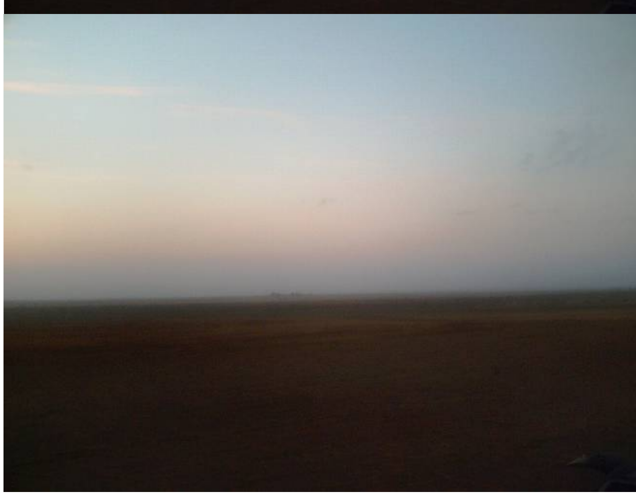








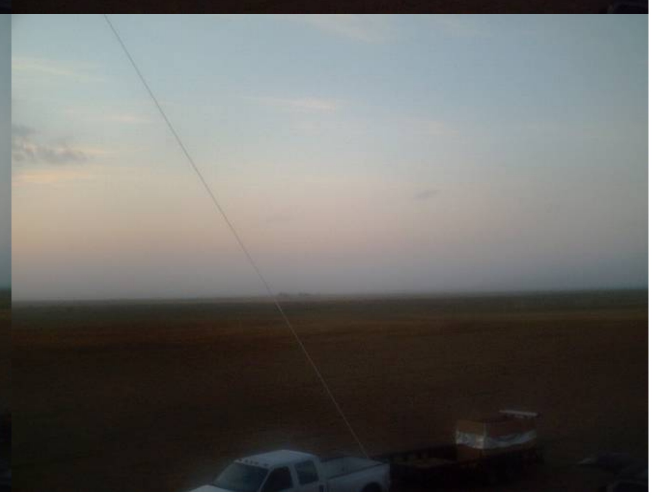






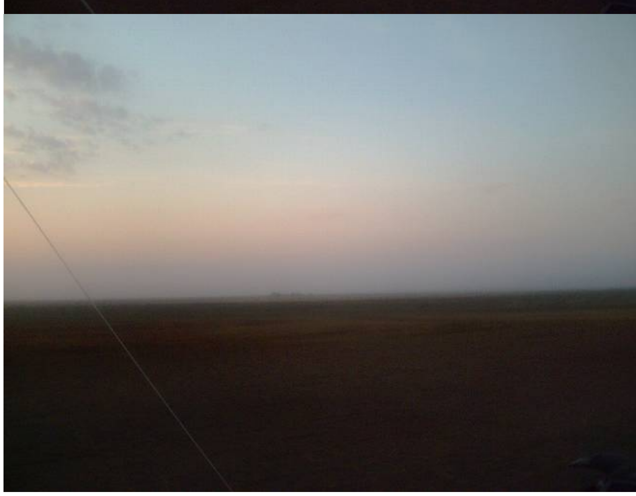
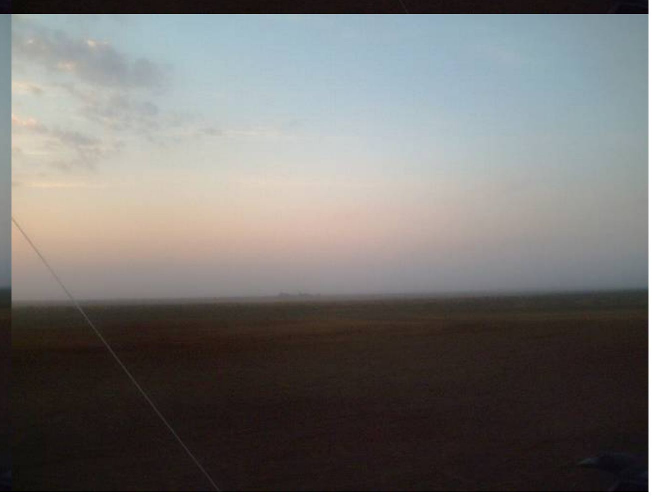






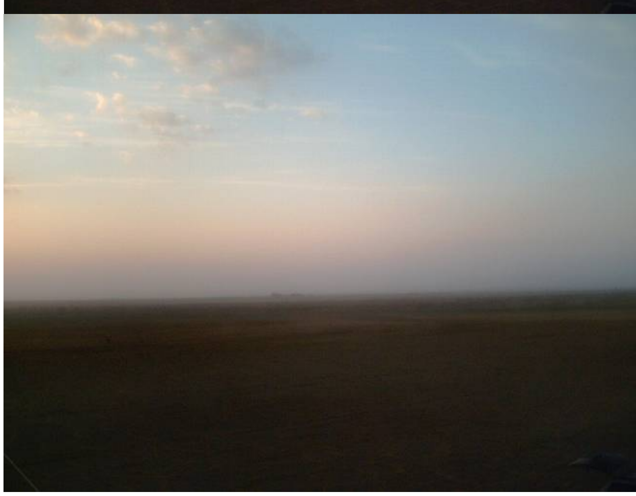






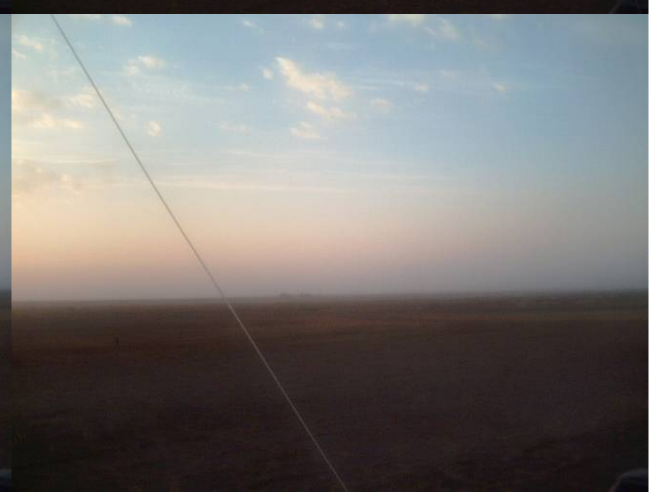










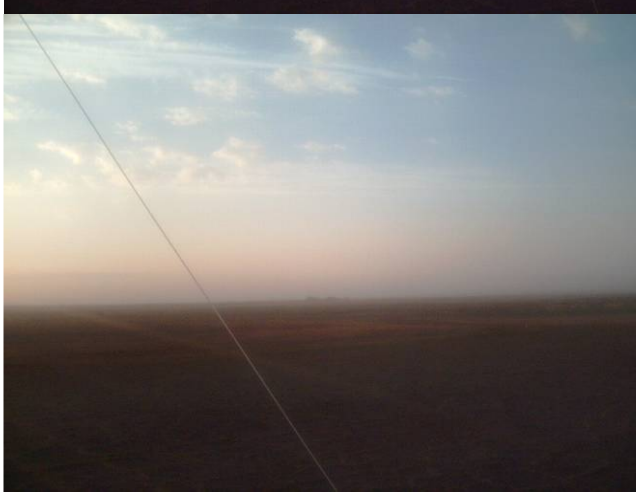
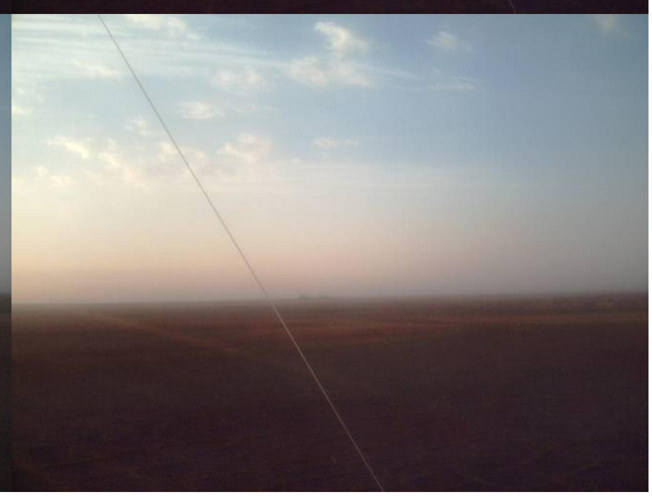










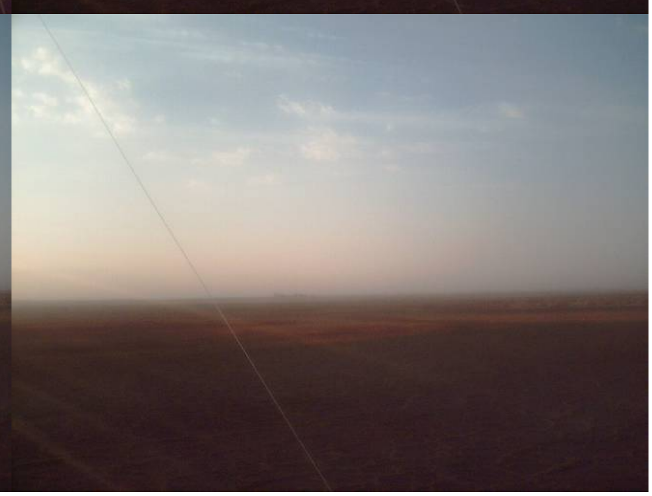
















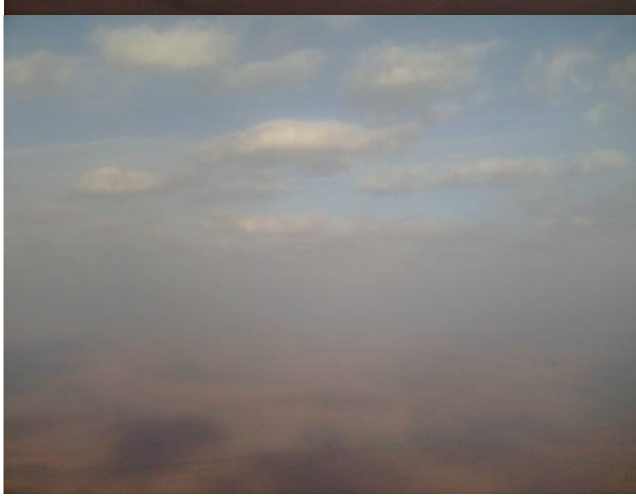
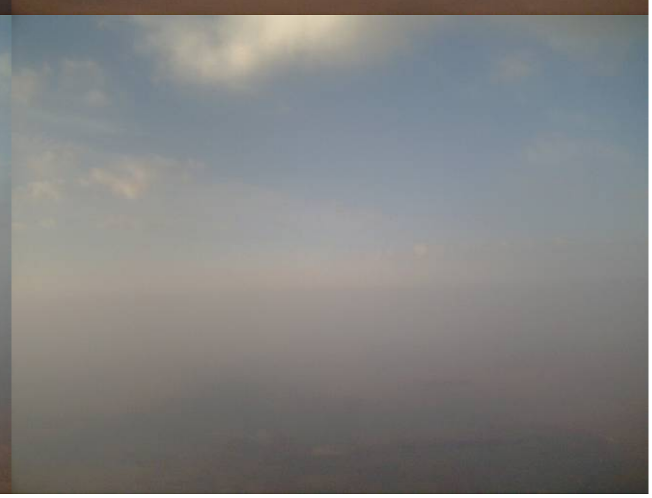


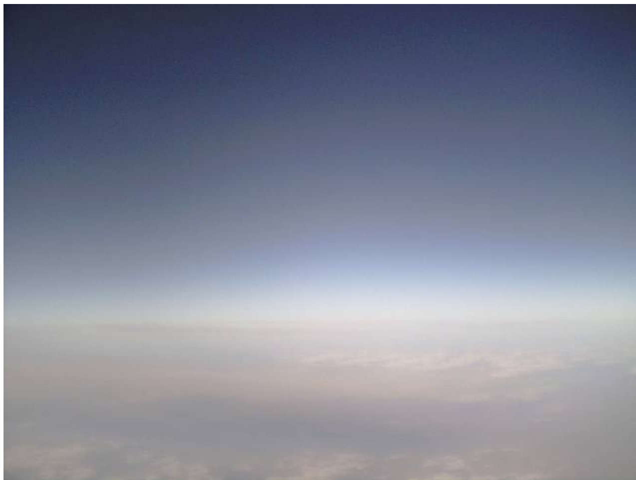
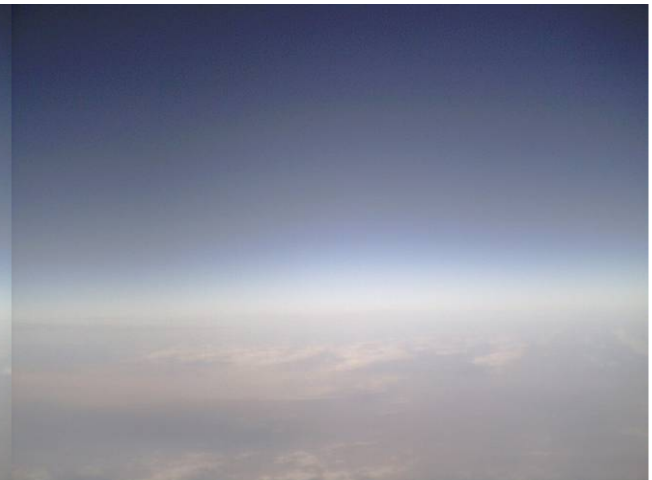


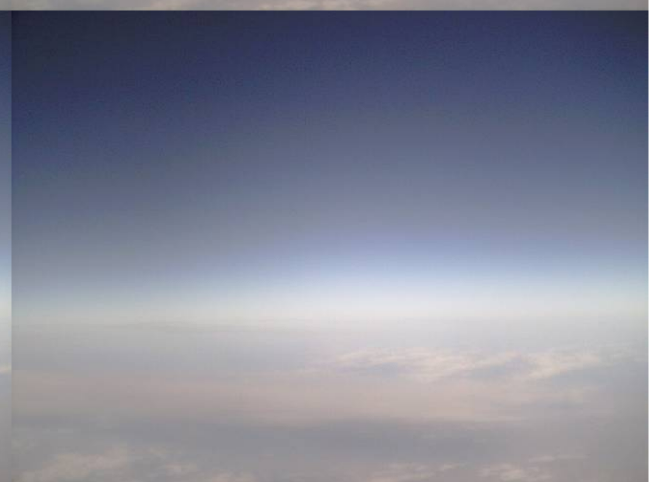
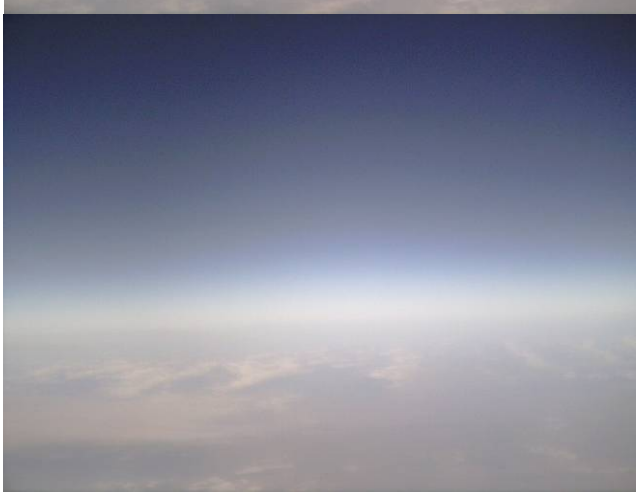
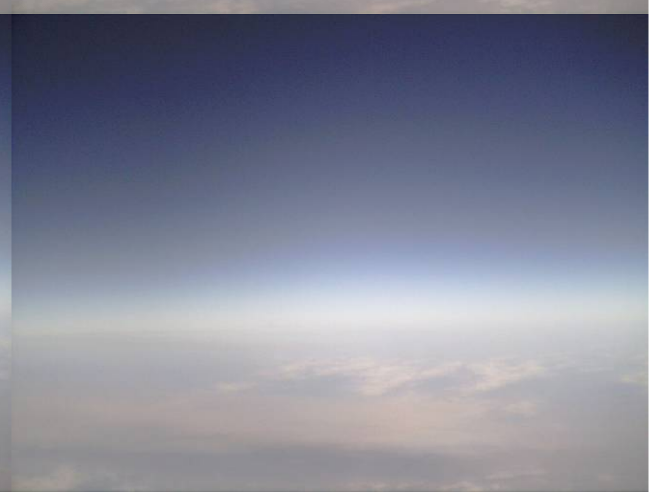


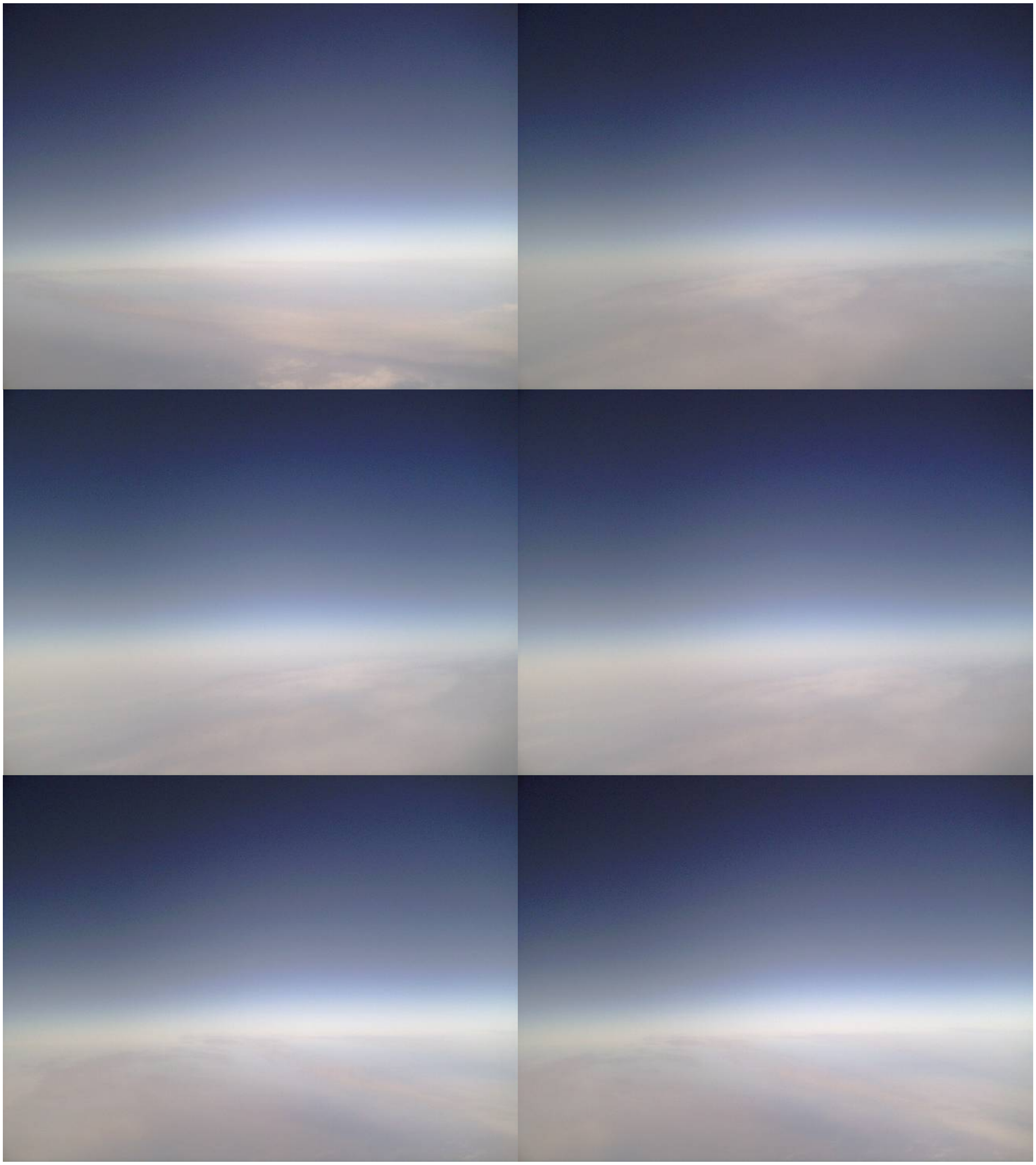


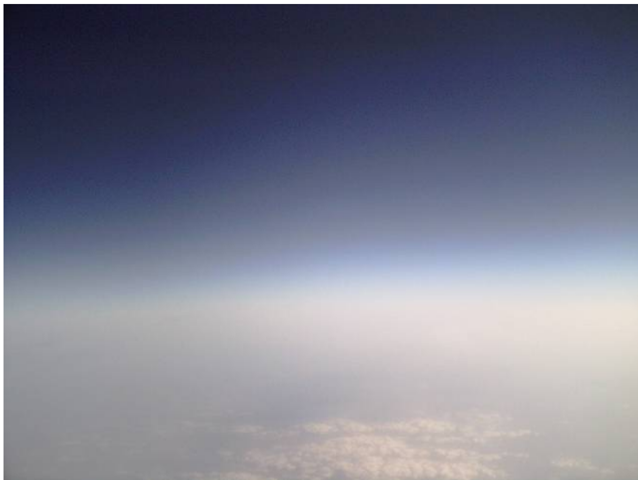


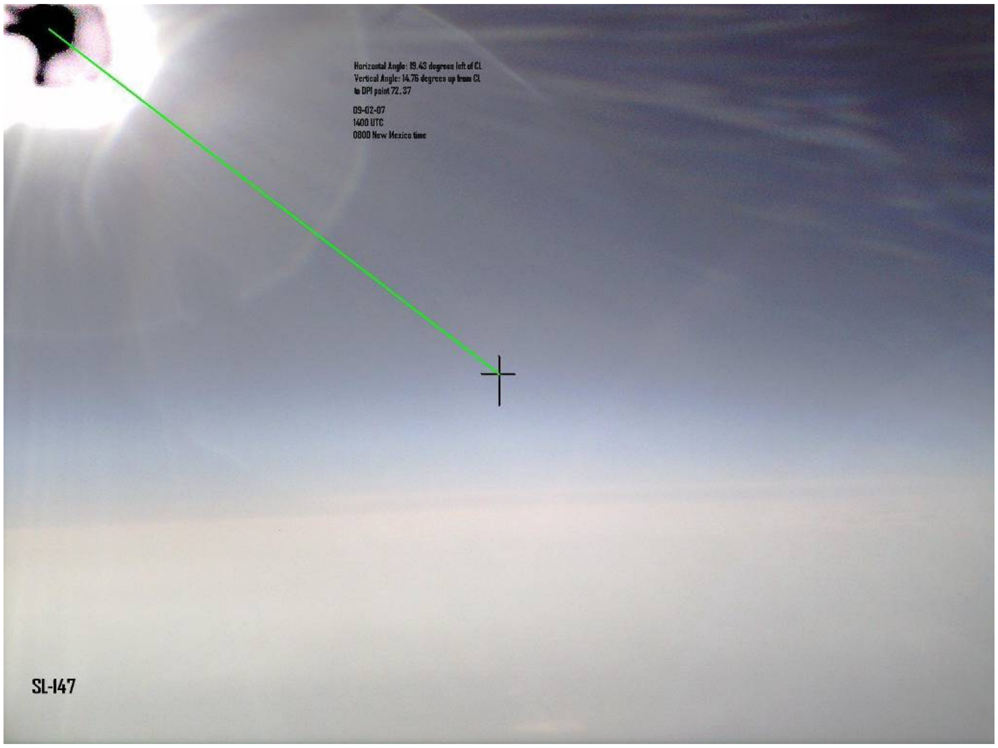







Appendix 8



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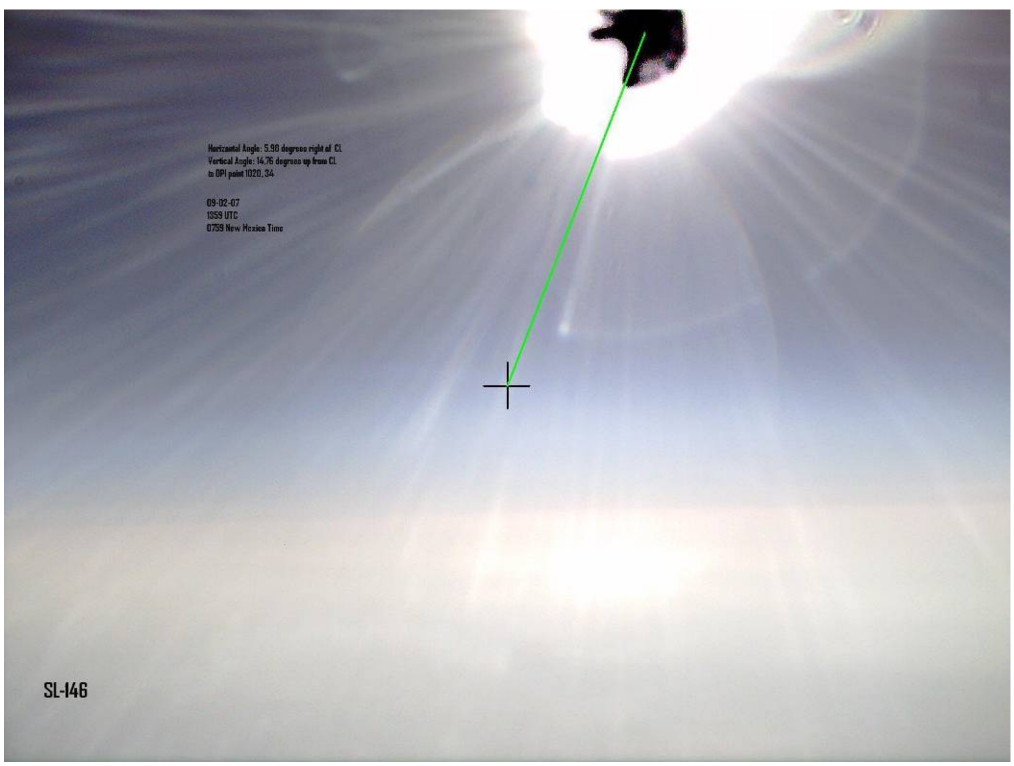
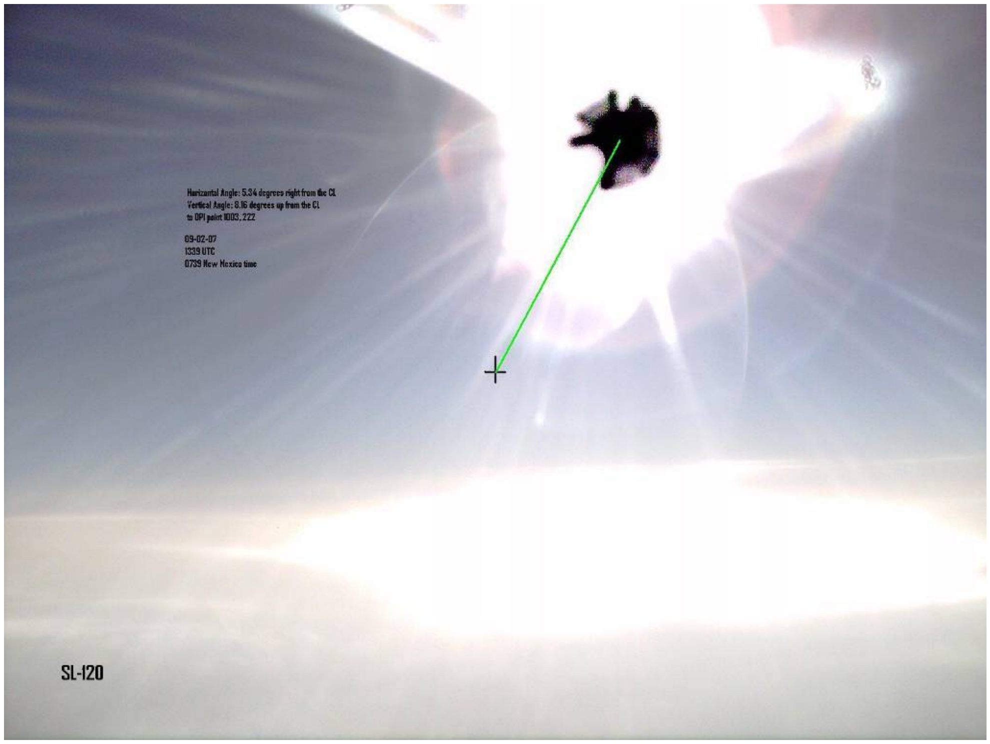
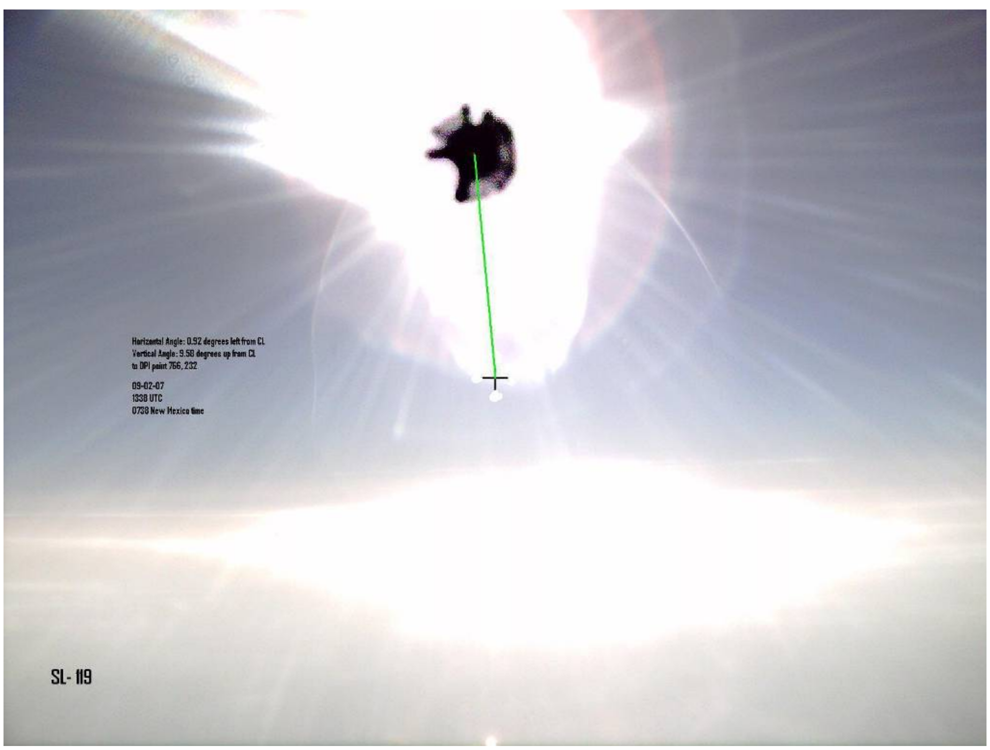
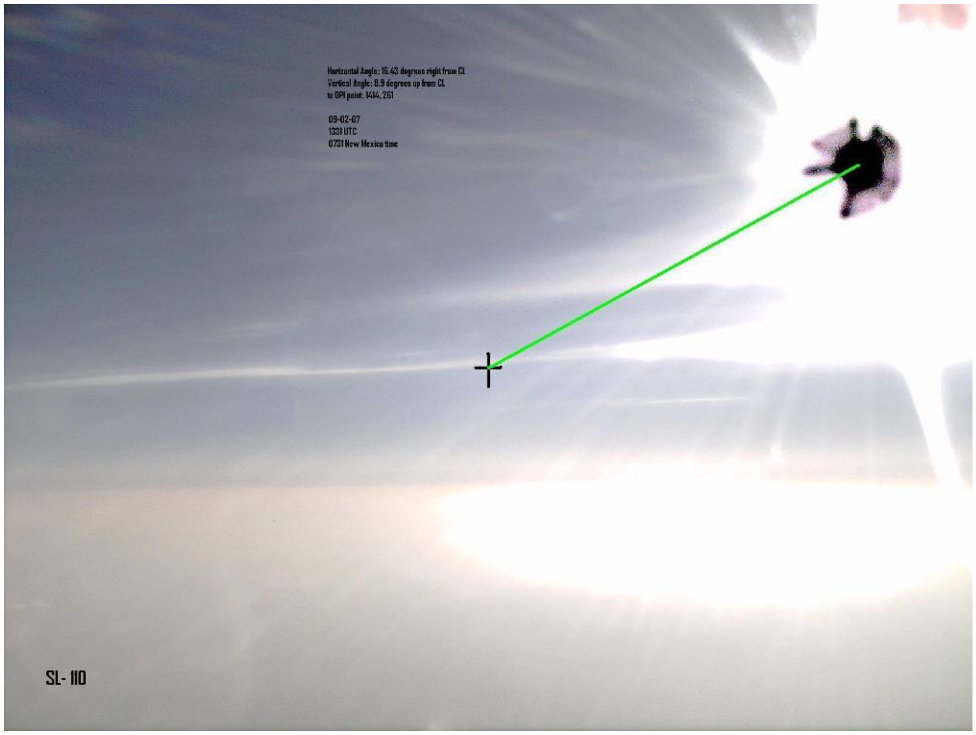
Vertical Angle: 14.76 degrees up from CL
to DPI point 72, 37
09-02-07
1400 UTC
0800 New Mexico time
SL-147

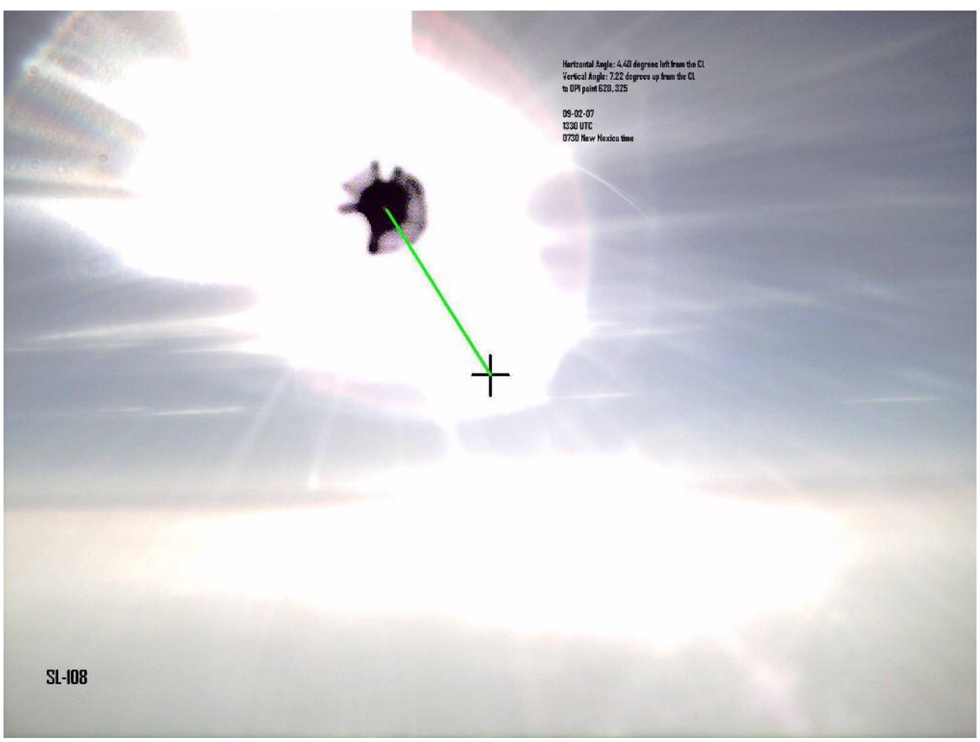


Horizontal Angle: 5.90 degrees right of CL
Vertical Angle: 14.76 degrees up from CL
to DPI point 1020, 34
09-02-07
1359 UTC
0759 New Mexico Time
SL-146


Horizontal Angle: 5.34 degrees right from the CL
Vertical Angle: 8.16 degrees up from the CL
to DPI point 1003, 222
09-02-07
1339 UTC
0739 New Mexico time
SL-120

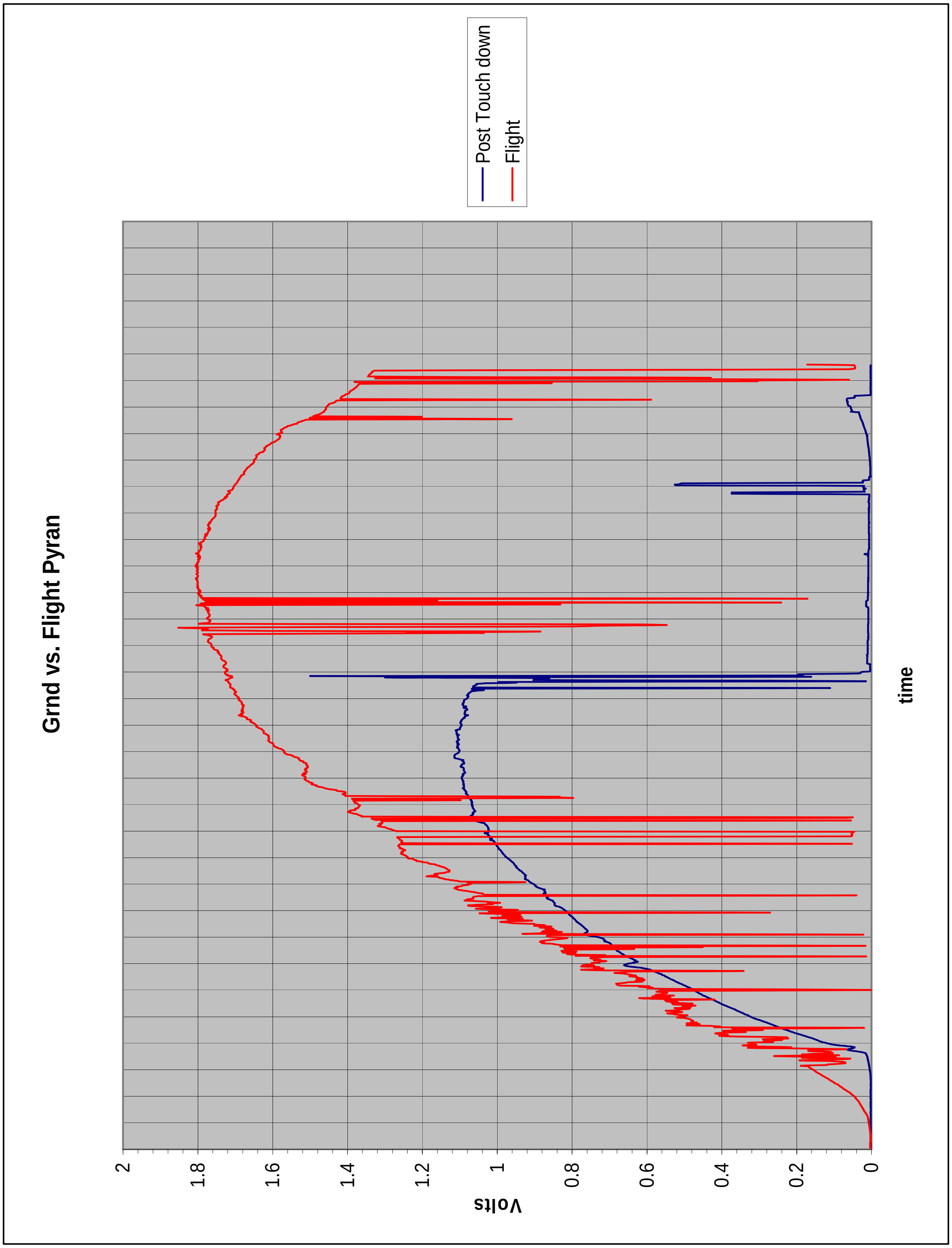

Horizontal Angle: 0.92 degrees left from CL
Vertical Angle: 9.58 degrees up from CL
to DPI point 766, 232
09-02-07
1338 UTC
0738 New Mexico time
SL- 119


Horizontal Angle: 16.43 degrees right from CL
Vertical Angle: 8.9 degrees up from CL
to OPI point: 1414, 261
09-02-07
1331 UTC
0731 New Mexico time
SL- 110

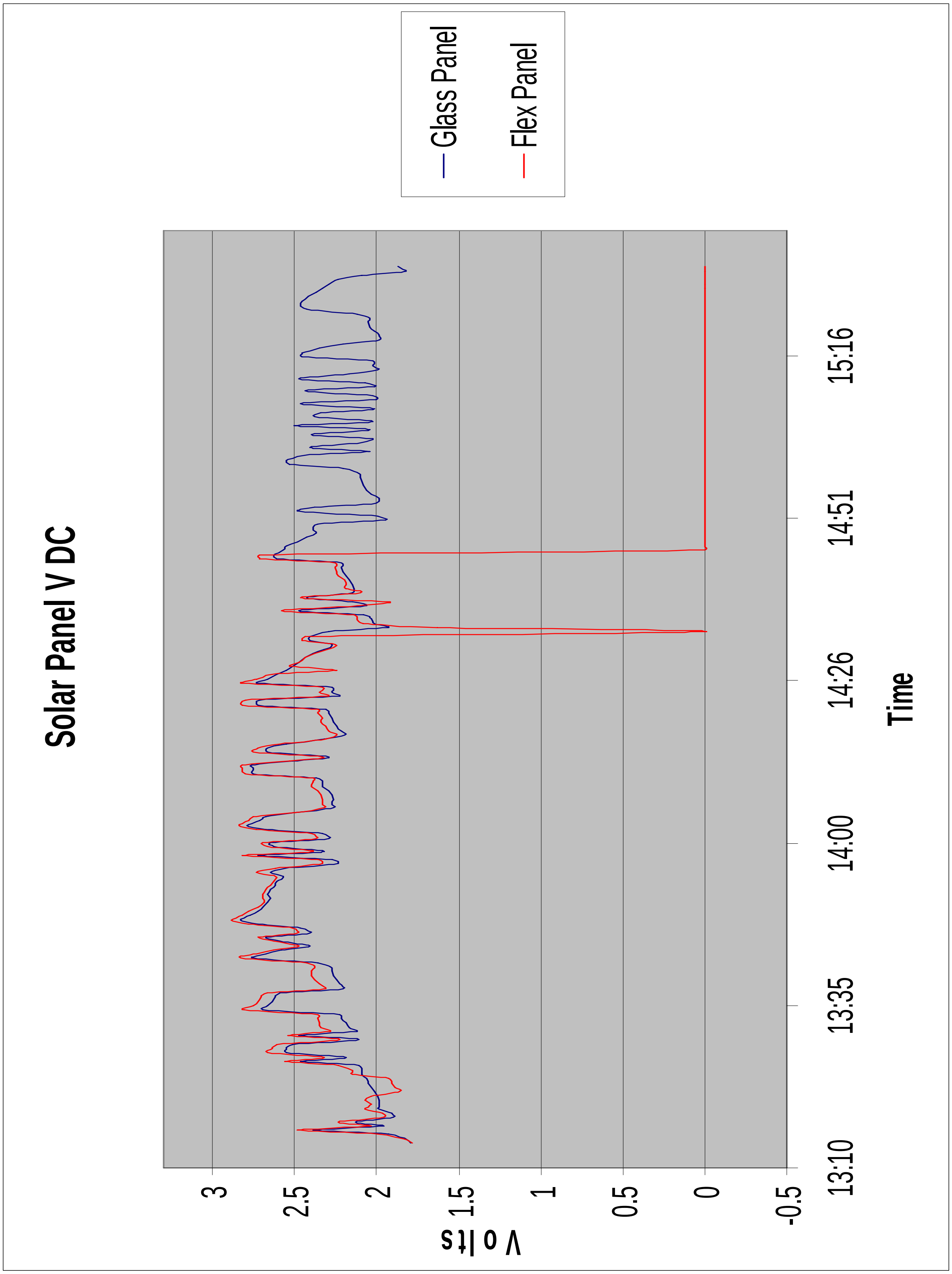

Horizontal Angle: 4.40 degrees left from the CL
Vertical Angle: 7.22 degrees up from the CL
to OPI point 628, 325
09-02-07
1330 UTC
0730 New Mexico time
SL-108

Appendix 9

Pyranometer Ground to Flight Comparison Chart



Appendix 10



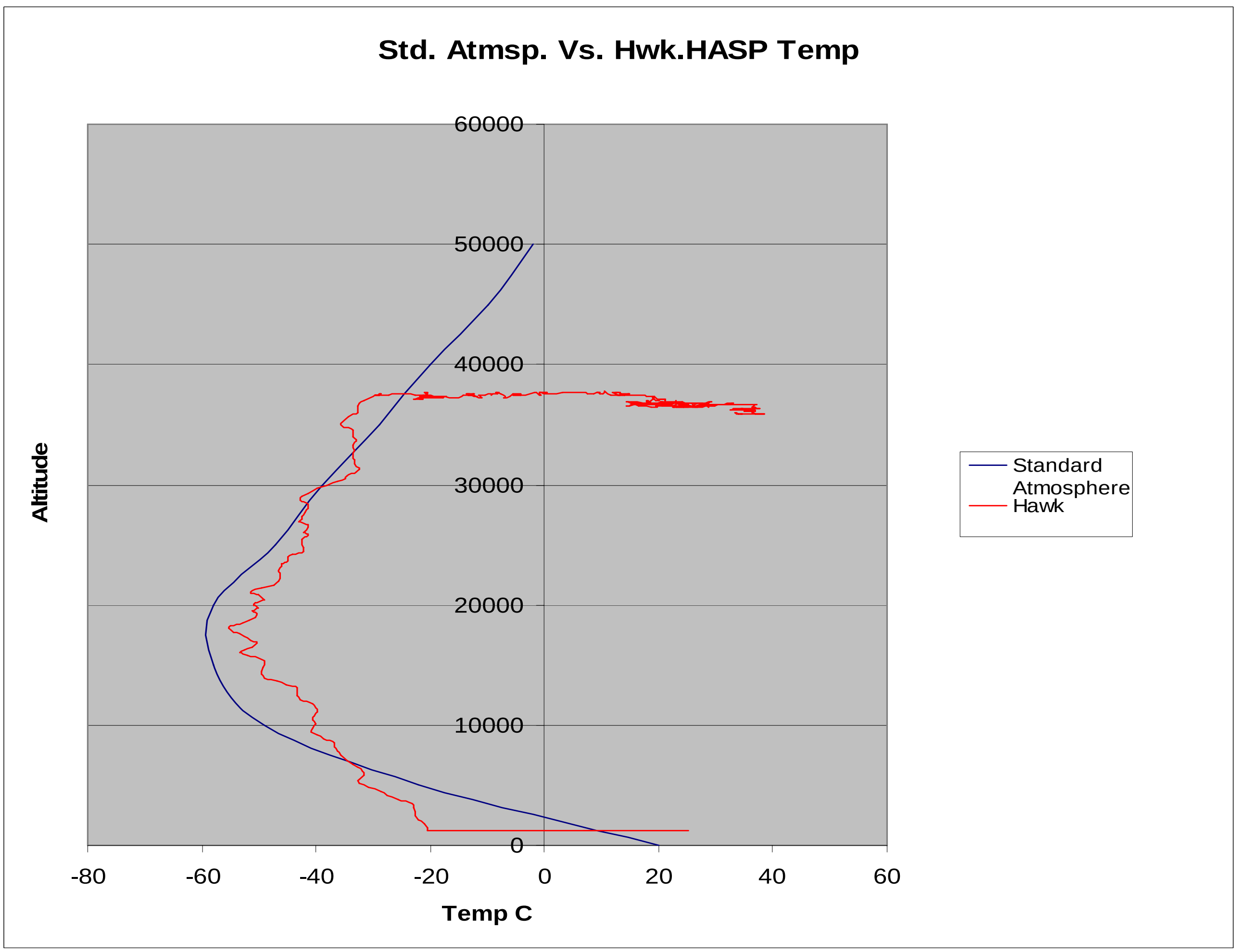
Solar Panel V DC
Glass Panel
Flex Panel
Volts
3
2.5
2
1.5
1
0.5
0
-0.5
13:10
13:35
14:00
14:26
14:51
15:16
Time

Appendix 11

Temp. Std. Atmos. Chart

Standard Atmosphere
Average Temp. based on Altitude

Altitude in Meters	Temp. C
0	20
5000	-22
10000	-49
15000	-58
20000	-58
25000	-47
30000	-39
35000	-29
40000	-20
45000	-10
50000	-2



HawkHASP 2007 Teacher's Perspective

By Robert Davis
Teaching Assistant for UMES AVSC288 Gateway to Space

The 2007 HASP payload developed by HISS and UMES was a learning experience for me also. I was the lab assistant for the AVSC288 Gateway to Space course where the HawkHASP payload originated. I also then assisted with the project's work which continued into the summer, using interns from various schools. I come from industry (NASA spacecraft), but am now an employee of HISS.

This was my first experience of managing a lab activity for college students, and my first substantial involvement with UMES, so I expected a learning curve on my part. I learned several major points:

1) The labor required for the HASP payload was under-estimated (student & mentor time). Our design schedule slipped, which cut into test & documentation time.
2) A large budget was not needed. We secured $1000 from UMES, and gave the students a budget of $750. The remainder was kept as reserve (and eventually used). We also secured considerable travel monies from the Maryland Space Grant.
3) I under-estimated the time that students will invest in a project, unless pressured. I assumed 3 hours for every hour in class, as a rule of thumb I heard as a college student.

The 2007 HawkHASP Small Payload itself was a success from two perspectives. First, we did deliver a set of experiments which flew and most worked. This was a great first accomplishment. We understand the minor failures that occurred, which is another important point. The second success was the opportunity we gave to the students of the UMES Gateway to Space course, and to student summer interns from various schools. I believe our outreach was substantial and that these students learned a lot and had fun!

I would like to thank a number of individuals who made the 2007 HawkHASP payload a reality:
Dr Marco Villa had the vision to set us on this path in the Gateway to Space course.
Ron Bettini had the vision to sustain it through interns and his leadership.
Dr Ali Eydgahi supported the creation of Gateway to Space and funded the payload purchases.
Susan Tull took the time to help us, and placed all of our orders and travel plans.
Keith Thompson trained our students on proper soldering and provided mentoring.
All of the guest speakers that lectured on technical and managerial topics.
Charlie Lipsett provided mentoring to the summer interns.
Dr Terry Teays and the Maryland Space Grant Consortium, which funded student travel for integration and flight.
The following organizations for the opportunity to fly student experiments:
The Louisiana State University HASP team, the Balloon Project Office at the NASA Wallops Flight Facility, and the Columbia Scientific Balloon Facility in Palestine, TX.
And of course the students and interns that had to put up with us and our crazy ideas!

I look forward to participating in the 2008 HawkHASP Small Payload in the upcoming Gateway to Space course at UMES and its opportunity to fly in 2008!

Dec 28, 2007