Cheyenne Mountain Charter Academy

NASA Student Launch Initiative

Flight Readiness Review

3/18/09

1) Summary of FRR report

1.1Team Summary

1.1.1 Cheyenne Mountain Charter Academy (The Vanguard School)

1.1.2 The Vanguard School
1605 S. Corona Avenue
Colorado Springs, Colorado 80905

1.1.3 Jeff Lane, Ernie Puckett, Steve Madere, Warren Layfield, George Schaffer, Jason Unwin, Ann Conner

1.2 Launch Vehicle Summary

1.2.1 Rocket is 95 inches long x 3.9 inches in diameter

1.2.2 Animal Motor Works (AMW) K475WW High Power Rocket Motor

1.2.3 Rail is 1/4 inch

1.3 Payload Summary

1.3.1 We will place a digital camera and GPS in the rocket and a known-length object on the ground, and then we will be able to determine the exact level of accuracy of the altimeter through comparison of GPS data, pixel analysis, and altimeter data.

2) Changes made since CDR

2.1 Changes made to Vehicle Criteria

2.1.1 The rocket has been painted since the CDR

2.1.2 The GPS bay has been integrated into the rocket, meaning that it no longer has its own section but is in another bay.

2.2 Changes made to Payload Criteria

2.2.1 We will drill a hole into the camera bay so we can tell if it is on as we place it its compartment, as the record button was inadvertently pushed when it was placed in the rocket. This hole will be covered before flight and after checking the record button.

2.2.2 G-Wiz has donated a flight computer to us, which we will use to more accurately deploy the parachute.

2.3 Changes made to Activity Plan

2.3.1 There have been no changes made in this area

3) Vehicle Criteria

3.1 Testing and Design of Vehicle

3.1.1Below is a copy of the stress tests on our materials:

3" Fiberglass Tube From Hawk Mountain

Specimen #	ID"	OD"	Length"	L/D Ratio	Peak Load (lbf)	Peak Stress (psi)	Load at Yield (lbf)	Stress at Yield (psi)	Notes
3	3.005	3.128	7.4365	2.377	7935.708	13,449.985	7,935.708	13,449.985	8.5 deg angle
2	3.006	3.128	7.4275	2.375	9438.735	16,056.436	9,438.735	16,056.436	
1	3.004	3.126	7.4430	2.381	9407.019	16,147.896	9,407.019	16,147.896	
Mean	3.005	3.127	7.4357	2.378					Pic of all samples
Std. Dev	0.001	0.002	0.0078	0.0015					Test machine
This was a 24" fiberglass tube from Hawk Mountain. It was sectioned into 3 pieces using a water-cooled abrasive cutoff saw. The dimensions were uniform with a nominal wall of 0.0613". The tube was loaded at a rate of 1" per minute.									

Giant Leap Honeycomb Comparison Test

Test #	Specimen	Average Weight (grams)	Average Thickness (in.)	Average Width (in.)	Average Area (in^2)	Peak Load (lbs)	Peak Stress (psi)
1	1/8” honeycomb fin material	5.900	0.118”	1.500”	0.177	69.26336	41.30181
2	1/8” honeycomb fin material					64.86910	38.68151
3	1/8” honeycomb fin material					59.40277	35.42194

This test is of three each, 1/8” and 1/4” thick by 1.5” x 5” Giant Leap Honeycomb fin material. The samples were the same dimensions tested in the “Carbon Fiber / Nomex Honeycomb Comparison Test” above with the same span being 3.0”. Remarkably, the 1/8” samples weighed virtually the same as the 1/4” samples.

Hardware - Swivels and Swivel
(Sent by Daniel Chandler)

Device	Size	SWL (lbs)	Brand	Tensile (psi)	Yield (psi)	Peak Load (lbs)
Swivel Hook	Same as large shown here					231.004
Swivel Hook						229.754
Swivel Hook						230.644
Swivel (No Hook)	Same as swivel shown here					939.224
Swivel (No Hook)						942.263
Swivel (No Hook)						950.337

National Hardware Quick Links

Test #	Specimen	Peak Stress (psi)	Peak Load (lbs)	Other Picture
1	National Zinc Plated Quick Link at 220lbs	161244.49	2338.04511	In Fixture
2	National Zinc Plated Quick Link at 220lbs	156098.17	2234.37777	
3	National Zinc Plated Quick Link at 220lbs	166287.12	2487.18464	After Test
4	National 316ss Quick Link at 300lbs	231127.07	3351.34264	In Fixture
5	National 316ss Quick Link at 300lbs	225316.22	3321.42793	
6	National 316ss Quick Link at 300lbs	238940.31	3369.69253	After Test

This test is of National Hardware brand 1/8” quick links purchased from a local Tru Value hardware store, three each: zinc plated steel quicklinks rated at 220lbs, and 316 stainless steel rated at 300 lbs. Samples provided by Jim Urrata.

The fixtures used were a set of clevis grips as seen in the picture. A ~5 lb pre-load was placed on the assembly prior to testing, but is automatically added to the test data. None of the threads on any of the samples were damaged and the barrels were easily unthreaded by hand. The points of failure were at the clevis pin as the sample was bent and flattened around them.

Other Hardware

Device	Size	SWL (lbs)	Brand	Tensile (psi)	Yield (psi)	Peak Load (lbs)
Eye Bolt	1/4 20	NA	Crown Bolt	NA	NA	436.779
Stainless Machine Screw	10-24	NA	Crown Bolt	81,513.39	71,851.622	
Standard Machine Screw	10-32	NA	Crown Bolt	70,773.11	66,532.858	

18-8 Stainless Steel All-Thread
from Roger Lipke

Size	Yield (psi)	Tensile (psi)	Peak Load (lbf)	Elongation (%)	RA (%)
10-32	76,537	102,637	1,765.7	20.6	58.8
10-32	61,137	102,505	1,763.4	19.4	53.4
10-32	76,827	103,349	1,778.0	20.3	53.4
1/4-20	154,663	177,745	4,324.3	15.1	27.4
1/4-20	123,475	176,109	4,284.5	22.9	34.9
1/4-20	102,901	176,825	4,301.9	20.4	18.9
5/16-18	115,406	163,438	6,909.1	26.0	27.9
5/16-18	117,103	162,904	6,886.5	27.3	30.8

Shear Pins

The test fixture is made of a carbon fiber coupler and a length of 38mm body tube. 3/4" plywood bulkheads were epoxied into each section and welded eyebolts were secured with nuts washers. Several holes were drilled in the assembly to test various shear pin sizes and quantities. The picture on the left shows the test fixture. The picture on the right shows it in action, testing four #4 nylon screws.

There is a high number of tests because of the variation in data. A small 500 lb load cell was calibrated from 0 to 500 lbs with 0.00005 lbs resolution. The accuracy is +/- 0.0001 lbs. The column below "Peak Load Each Pin" should all be the same for the same size pin. The rate of loading for this test was 20 IPM.

#2 Nylon Screws			#4 Nylon Screws		
# of Pins	Peak Load (lbs)	Peak Load (Each Pin)	# of Pins	Peak Load (lbs)	Peak Load (Each Pin)
2	53.123	26.56	2	81.304	40.65
2	45.952	22.98	2	85.148	42.57
2	50.848	25.42	2	75.944	37.57
2	51.799	25.90	2	80.391	40.20
2	47.924	23.96	2	80.908	40.45
Avgs	***49.93***	***24.64***		***80.75***	***40.30***
3	62.637	20.88	3	119.273	39.76
3	60.569	20.19	3	110.999	37.00
3	64.395	21.47	3	99.969	33.32
3	62.413	20.80	3	113.554	37.85
3	68.760	22.92	3	116.208	38.73
3	66.643	22.21	3	121.121	40.37
			3	123.689	41.23
Avgs	***64.24***	***21.41***		***114.97***	***38.32***
4	86.699	21.67	4	143.405	35.85
4	86.855	21.71	4	152.368	38.09
4	78.771	19.69	4	142.026	35.51
4	84.269	21.07	4	160.489	40.12
4	85.617	21.40	4	153.302	38.33
4	90.402	22.60	4	154.766	38.69
			4	160.368	40.09
Avgs	***84.44***	***21.36***		***152.38***	***38.21***

3.2 Recovery Subsystem

3.2.1 We will be using one styrene sheer pin for the scale down model and three nylon pins for the full scale model. For subsequent flights we will be using a 56 inch main parachute and 16 inch drogue parachute. On video, the time under drogue was 49.77 seconds. The descent rate under drogue is therefore 56.6 feet per second. The final 800 ft were covered in 47 seconds, for a descent rate of 17 feet per second with the main and drogue.

3.3 Mission Performance Predictions

3.3.1 If we are successful we will receive accurate video footage and will be able to determine the altitude using the video pixel analysis and the GPS data. If we succeed we will find that using a GPS or camera to calculate you altitude is actually more accurate than an altimeter.

3.4 Safety and Environment (Vehicle)

3.4.1Trenton Tulloss is our safety officer

3.4.2 High Power Rocketry Safety Code:

Certification: I will only fly high power rockets or possess high power rocket motors that are within the scope of my user certification and required licensing...

Materials: I will use only lightweight materials such as paper, wood, rubber, plastic, fiberglass, or when necessary ductile metal, for the construction of my rocket.

Motors: I will use only certified, commercially made rocket motors, and will not tamper with these motors or use them for any purposes except those recommended by the manufacturer. I will not allow smoking, open flames, nor heat sources within 25 feet of these motors.

Ignition System: I will launch my rockets with an electrical launch system, and with electrical motor igniters that are installed in the motor only after my rocket is at the launch pad or in a designated prepping area. My launch system will have a safety interlock that is in series with the launch switch that is not installed until my rocket is ready for launch, and will use a launch switch that returns to the "off" position when released. If my rocket has onboard ignition systems for motors or recovery devices, these will have safety interlocks that interrupt the current path until the rocket is at the launch pad.

Misfires: If my rocket does not launch when I press the button of my electrical launch system, I will remove the launcher's safety interlock or disconnect its battery, and will wait 60 seconds after the last launch attempt before allowing anyone to approach the rocket.

Launch Safety: I will use a 5-second countdown before launch. I will ensure that no person is closer to the launch pad than allowed by the accompanying Minimum Distance Table, and that a means is available to warn participants and spectators in the event of a problem. I will check the stability of my rocket before flight and will not fly it if it cannot be determined to be stable.

Launcher: I will launch my rocket from a stable device that provides rigid guidance until the rocket has attained a speed that ensures a stable flight, and that is pointed to within 20 degrees of vertical. If the wind speed exceeds 5 miles per hour I will use a launcher length that permits the rocket to attain a safe velocity before separation from the launcher. I will use a blast deflector to prevent the motor's exhaust from hitting the ground. I will ensure that dry grass is cleared around each launch pad in accordance with the accompanying Minimum Distance table, and will increase this distance by a factor of 1.5 if the rocket motor being launched uses titanium sponge in the propellant.

Size: My rocket will not contain any combination of motors that total more than 40,960 N-sec (9208 pound-seconds) of total impulse. My rocket will not weigh more at liftoff than one-third of the certified average thrust of the high power rocket motor(s) intended to be ignited at launch.

Flight Safety: I will not launch my rocket at targets, into clouds, near airplanes, nor on trajectories that take it directly over the heads of spectators or beyond the boundaries of the launch site, and will not put any flammable or explosive payload in my rocket. I will not launch my rockets if wind speeds exceed 20 miles per hour. I will comply with Federal Aviation Administration airspace regulations when flying, and will ensure that my rocket will not exceed any applicable altitude limit in effect at that launch site.

Launch Site: I will launch my rocket outdoors, in an open area where trees, power lines, buildings, and persons not involved in the launch do not present a hazard, and that is at least as large on its smallest dimension as one-half of the maximum altitude to which rockets are allowed to be flown at that site or 1500 feet, whichever is greater.

Launcher Location: My launcher will be 1500 feet from any inhabited building or from any public highway on which traffic flow exceeds 10 vehicles per hour, not including traffic flow related to the launch. It will also be no closer than the appropriate Minimum Personnel Distance from the accompanying table from any boundary of the launch site.

Recovery System: I will use a recovery system such as a parachute in my rocket so that all parts of my rocket return safely and undamaged and can be flown again, and I will use only flame-resistant or fireproof recovery system wadding in my rocket.

Recovery Safety: I will not attempt to recover my rocket from power lines, tall trees, or other dangerous places, fly it under conditions where it is likely to recover in spectator areas or outside the launch site, nor attempt to catch it as it approaches the ground.

3.4.3 Model Rocketry Safety Code

Materials: I will use only lightweight, non-metal parts for the nose, body, and fins of my rocket.

Motors: I will use only certified, commercially-made model rocket motors, and will not tamper with these motors or use them for any purposes except those recommended by the manufacturer.

Ignition System: I will launch my rockets with an electrical launch system and electrical motor igniters. My launch system will have a safety interlock in series with the launch switch, and will use a launch switch that returns to the "off" position when released.

Misfires: If my rocket does not launch when I press the button of my electrical launch system, I will remove the launcher's safety interlock or disconnect its battery, and will wait 60 seconds after the last launch attempt before allowing anyone to approach the rocket.

Launch Safety: I will use a countdown before launch, and will ensure that everyone is paying attention and is a safe distance of at least 15 feet away when I launch rockets with D motors or smaller, and 30 feet when I launch larger rockets. If I am uncertain about the safety or stability of an untested rocket, I will check the stability before flight and will fly it only after warning spectators and clearing them away to a safe distance.

Launcher: I will launch my rocket from a launch rod, tower, or rail that is pointed to within 30 degrees of the vertical to ensure that the rocket flies nearly straight up, and I will use a blast deflector to prevent the motor's exhaust from hitting the ground. To prevent accidental eye injury, I will place launchers so that the end of the launch rod is above eye level or will cap the end of the rod when it is not in use.

Size: My model rocket will not weigh more than 1,500 grams (53 ounces) at liftoff and will not contain more than 125 grams (4.4 ounces) of propellant or 320 N-sec (71.9 pound-seconds) of total impulse. If my model rocket weighs more than one pound (453 grams) at liftoff or has more than four ounces (113 grams) of propellant, I will check and comply with Federal Aviation Administration regulations before flying.

Flight Safety: I will not launch my rocket at targets, into clouds, or near airplanes, and will not put any flammable or explosive payload in my rocket.

Launch Site: I will launch my rocket outdoors, in an open area at least as large as shown in the accompanying table, and in safe weather conditions with wind speeds no greater than 20 miles per hour. I will ensure that there is no dry grass close to the launch pad, and that the launch site does not present risk of grass fires.

Recovery System: I will use a recovery system such as a streamer or parachute in my rocket so that it returns safely and undamaged and can be flown again, and I will use only flame-resistant or fireproof recovery system wadding in my rocket.

Safety: I will not attempt to recover my rocket from tall trees, or other dangerous places power lines

LAUNCH SITE DIMENSIONS		
Installed Total Impulse (N-sec)	Equivalent Motor Type	Minimum Site Dimensions (ft.)
0.00--1.25	1/4A, 1/2A	50
1.26--2.50	A	100
2.51--5.00	B	200
5.01--10.00	C	400
10.01--20.00	D	500
20.01--40.00	E	1,000
40.01--80.00	F	1,000
80.01--160.00	G	1,000
160.01--320.00	Two Gs	1,500

MINIMUM DISTANCE TABLE				
Installed Total Impulse (Newton-Seconds)	Equivalent High Power Motor Type	Minimum Diameter of Cleared Area (ft.)	Minimum Personnel Distance (ft.)	Minimum Personnel Distance (Complex Rocket) (ft.)
0 -- 320.00	H or smaller	50	100	200
320.01 -- 640.00	I	50	100	200
640.01 -- 1,280.00	J	50	100	200
1,280.01 -- 2,560.00	K	75	200	300
2,560.01 -- 5,120.00	L	100	300	500
5,120.01 -- 10,240.00	M	125	500	1000
10,240.01 -- 20,480.00	N	125	1000	1500
20,480.01 -- 40,960.00				

3.5 Payload Integration

3.5.1 A camera bay has been built to hold our camera in position, aimed at the ground. The camera has a cap built over it that gives it a view and then becomes flush with the rest of the rocket. The elements are currently incompatible due to the fact that the camera was turned off early due to a bad fit with the camera bay. This can be rectified by altering the size of the bay until the camera fits correctly. The payload housing needs to be changed size for the camera to fit.

4) Payload Criteria

4.1 Experiment Concept

4.1.1 To determine if altimeters are as accurate and precise are made out to be but comparing its results with those of a camera and a GPS. If the camera successfully gives a fairly accurate representation of the altitude of the rocket at a given point in time, the project will be deemed successful. There seems to be significant variation in barometric altimeters, so we want to find the true degree of accuracy of the altimeters. We will use additional instrumentation, namely, digital and pixel analysis, as a more accurate form of measurement. We will use altimeter readings, GPS data, and pixel analysis to measure the altitude of the rocket. Several variables exist, such as the possibility that the rocket will veer off course and no targets will be in view for reference. However, all variables concerning the rocket itself will be controlled. The expected data will show how accurate our altimeter is. The camera data will become less accurate the higher it gets, but hopefully we will be able to still draw accurate conclusions. We will launch the rocket, the data will be collected, then we will analyze the data to determine the accuracy of the altimeters

4.2 Science Value

4.2.1 The objective of our payload is to determine how far off our altimeters are from actual altitude (Last year in TARC, we used multiple altimeters, which constantly gave inconsistent readings).

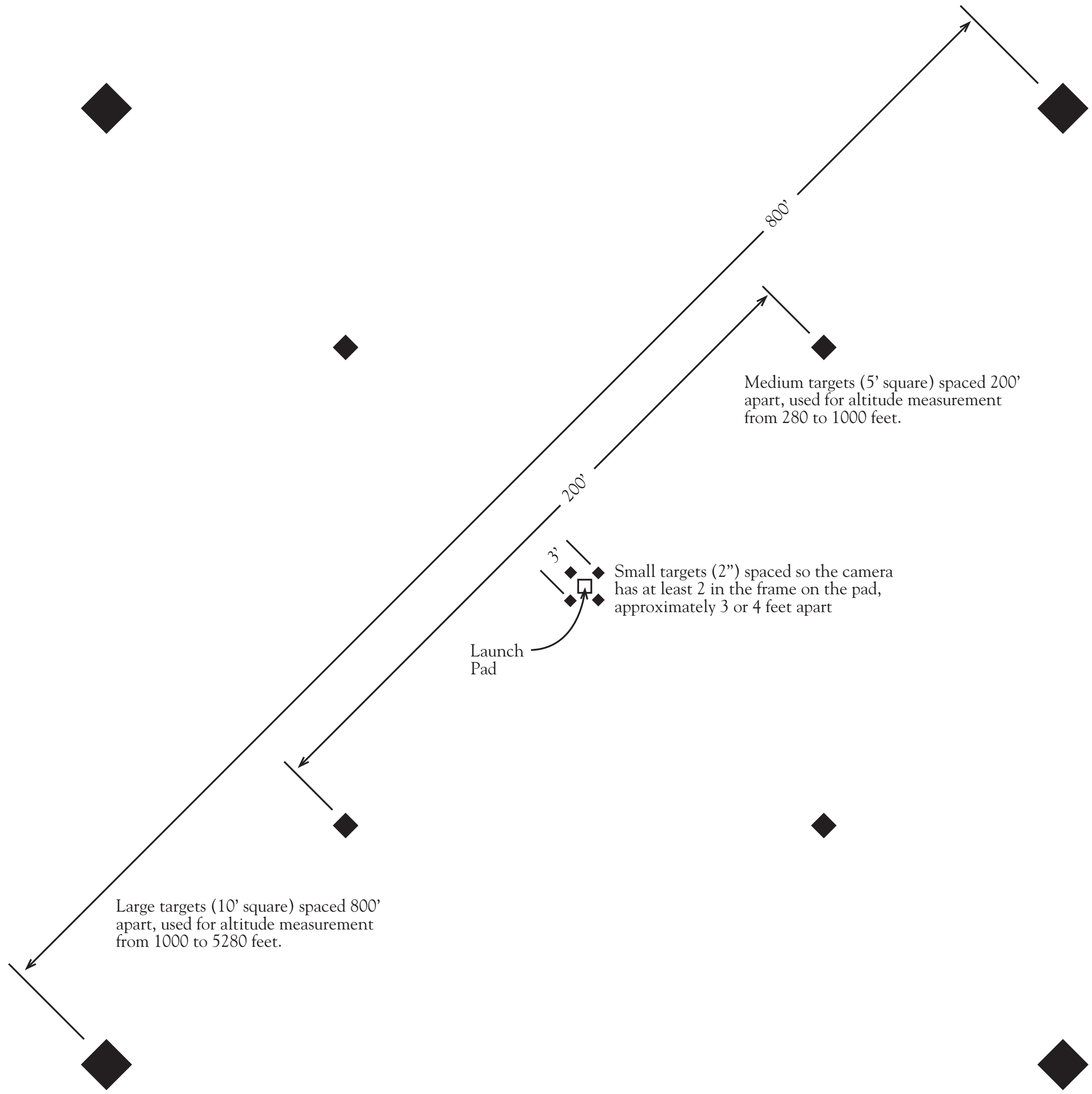
4.2.2 For this mission to be a success, we must acquire usable data from the video camera, the GPS, and the altimeters. Additionally, our rocket must not crash, or else all devices will be rendered useless.

4.2.3 To do this experiment, we will use a camera to determine the distance the rocket is from the ground by counting the pixels of a predetermined distance using Adobe Photoshop. We will lay 6" by 6" targets next to the launch pad in an "X" formation and 3' apart from each other. We will also lay 3' by 3' targets in the same "X" formation that will be 200' from each other and 100' from the launch pad. Finally, using the same pattern, we will lay 10' by 10' targets 800' from each other and 400' from the launch pad. To make sure that the "X" formation is perfectly square, we will use a 60-80-100 right triangle (a variation of the 3-4-5 triangle) to form a right angle. We also will use a GPS unit to determine how far from the launch pad the rocket has flown. Using the Pythagorean theorem (a^2+b^2=c^2), we will finally be able to determine the altitude and compare this data to that from the altimeters. The electronics all log their data from every point of the flight.

4.2.4 Our experiment is a meaningful test because all of our devices will be able to provide extremely accurate data. Our manipulated variable is the height of the rocket, while our control is the length of the targets and the distance between them, along with the distance the rocket has flown from the launch pad.

4.2.5 The expected data will provide more accurate data than that of the altimeters, which will help determine the difference from their measurement and actuality. (see table below)

4.2.6 After we have prepared the rocket for flight by loading the parachute and the engine, we will take it to the launch pad. Here, we will quickly turn on the GPS and the camera. In flight, the camera will see the targets we have laid on the ground. We will lay 6" by 6" targets next to the launch pad in an "X" formation and 3' apart from each other. We will also lay 3' by 3' targets in the same "X" formation that will be 200' from each other and 100' from the launch pad. Finally, using the same pattern, we will lay 10' by 10' targets 800' from each other and 400' from the launch pad. To make sure that the "X" formation is perfectly square, we will use a 60-80-100 right triangle (a variation of the 3-4-5 triangle) to form a right angle. The GPS will log the data as it is flying upward, so we will be able to use these numbers in the



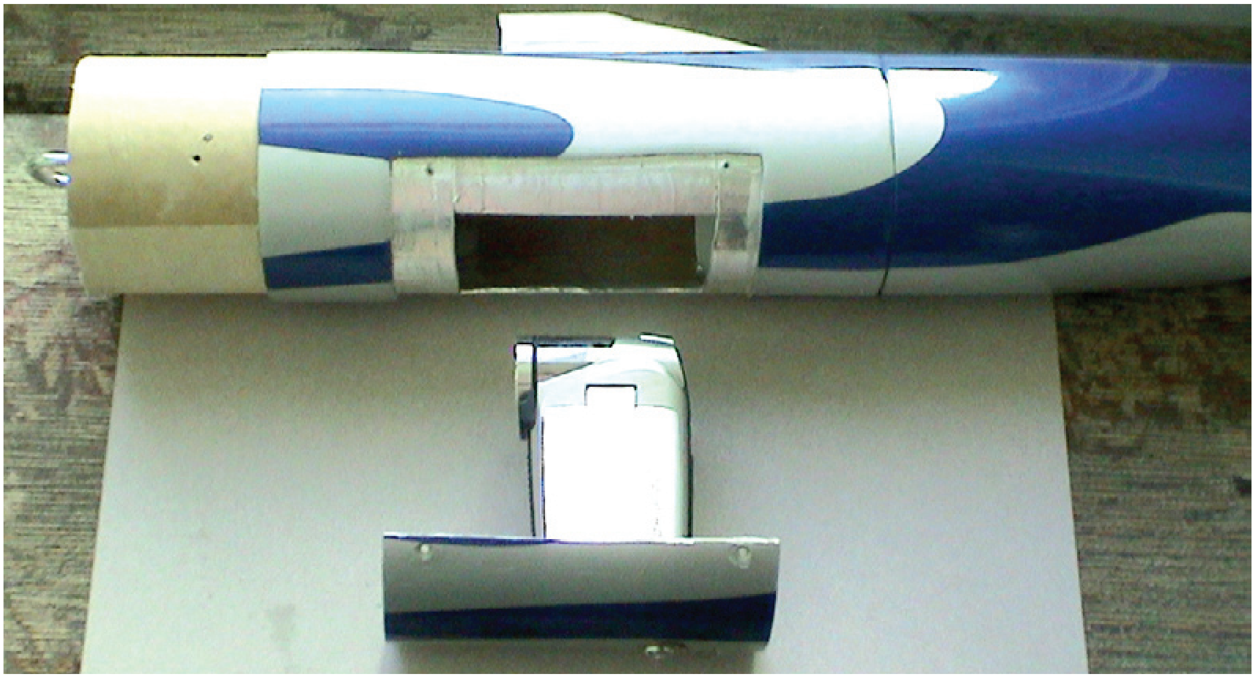
Pythagorean theorem with those that were recorded at the same moment in the video to process the altitude of the rocket at the given moment. We will compare these final numbers to those recorded by the altimeters to complete our analysis.

4.3 Experiment Design of Payload

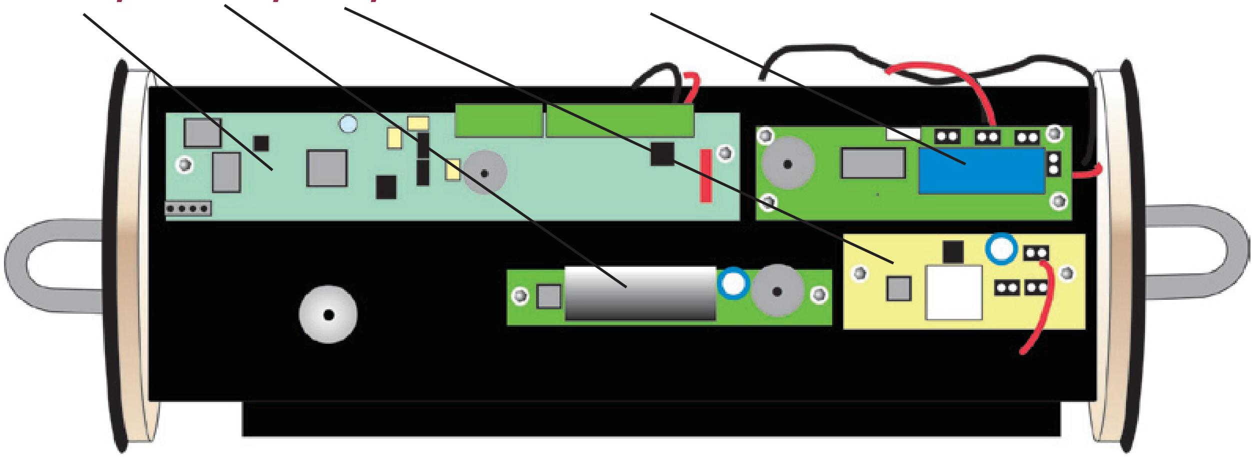
4.3.1 The camera, altimeters, and GPS will record all data necessary to derive altitude. The camera will be accurate to one pixel, the GPS to one meter, and the altimeters within 30 feet. This experiment will help to determine the best way of finding the altitude of a rocket. The rocket will fly well, fairly straight up, with targets in view. The targets will be set up, the rocket will be prepped, the camera will be turned on and set to record, and the rocket will put on the launch pad.

4.3.2 Below are photos of parts of our scientific payload:

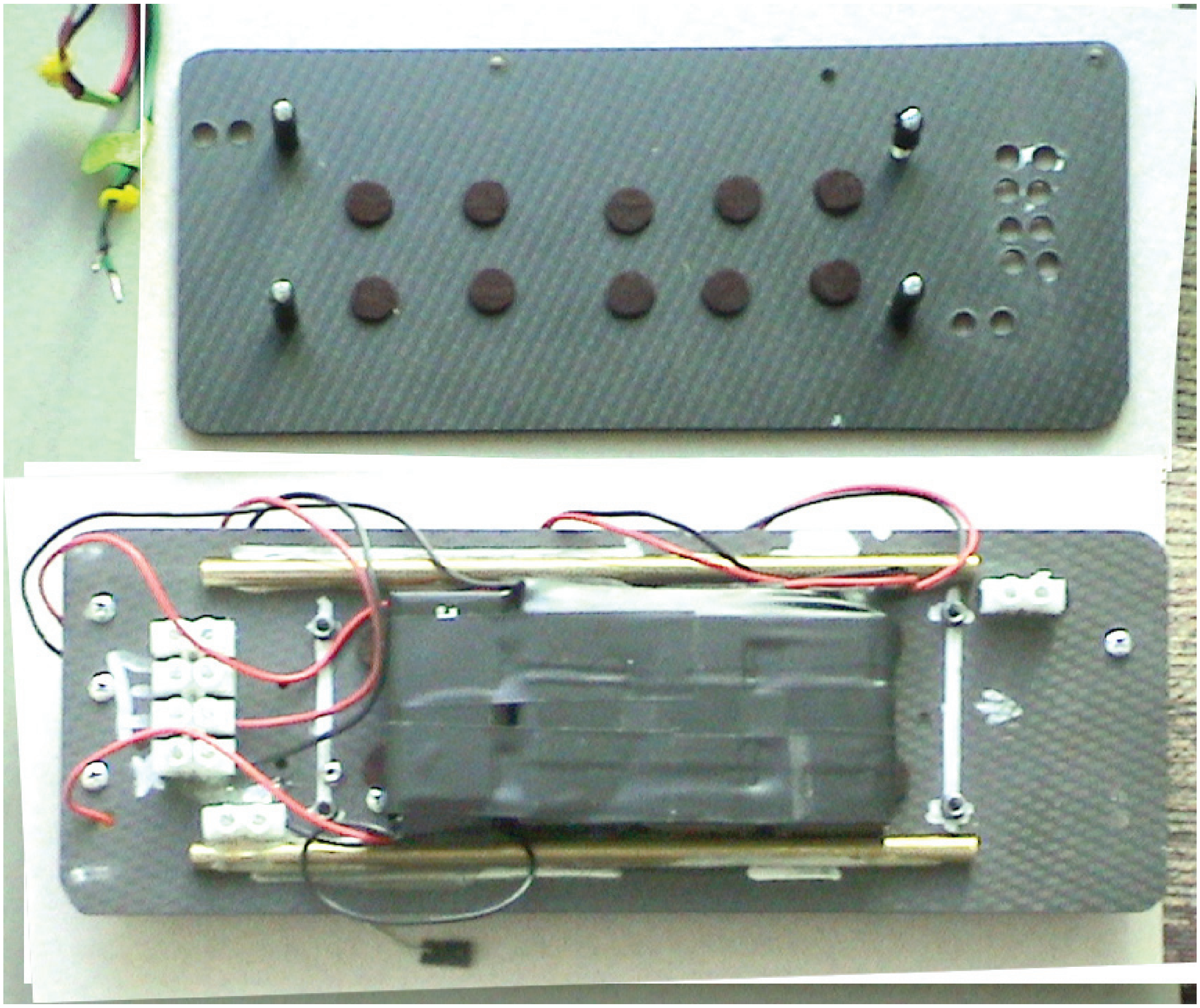
Camera and camera bay



Altimeter section consisting of G-Wiz, MAWD, Pico, and 15k altimeters



We use 5 9 volt batteries to power our altimeters



Altimeter Bay

4.4 Assembly

1. Insert motor into rocket making sure that the retention ring is secure

2. Pack and fold drogue parachute making sure all knots and links are secure

3. Attach all wires to electronics

4. Test electronics

5. Pack and secure electronics into electronic bay

6. Weigh and pack ejection charges

7. Secure ejection charges into correct terminal blocks

8. Pack main parachute

9. Make sure all cords, knots, and screws are secure

10. Put rocket together

11. Secure shear pins

12. Load rocket onto pad

13. Turn on camera and secure in place

14. Turn on electronics

15. Install igniter

5) Launch Operations Procedures

5.1 Checklist

5.2.1 Below is a copy of the check list we use at each launch:

NASA STUDENT LAUNCH INITIATIVE CHECK LIST

- ❑ Lay out camera targets
- ❑ Lay out rocket
- ❑ Build motor
- ❑ Insert motor into rocket (make sure motor retention ring is secure)
- ❑ Fold and pack drogue parachute and shock cord (make sure links and ties are secure)
- ❑ Check all connections to altimeters (turn on)
- ❑ Check all battery voltage and replace if under 9 volts
- ❑ Connect all switches and leads to altimeters
- ❑ Slide altimeter board into altimeter bay
- ❑ Connect cap leads and screw on cap (make sure markings line up)
- ❑ Attach ejection charges and e matches for both parachutes
- ❑ Connect drogue shock cord to cap
- ❑ Slide altimeter sections into drogue bay (make sure shear pin holes line up)
- ❑ Insert three black nylon shear pins

❑ Fold and pack main parachute and shock cord (make sure all knots and cords are secure)

❑ Align shear pin holes and insert shear pins

❑ Unscrew camera hatch and prep camera

❑ Bring rocket to pad with igniter nearby

❑ Load rocket onto pad

❑ Turn camera on and insert into hatch and screw on hatch

❑ Make sure camera is aligned with targets

❑ Check all shear pins and screws

❑ Turn on electronic screw switches (check that each is working)

❑ Check overall rocket one last time

❑ Step away and wait for launch

Date__________

Elevation_____________

Temperature______________

Rocket Weight___________

Altitude__________

5.2 Safety and Quality Assurance

5.2.1Our rocket is stable in flight recovery needs to be on before igniters are installed.

5.2.2 We are concerned about fire but we have taken precautions to prevent this. Such as: fire extinguishers at every pad, gravel on each side to at least 50 feet, an ATV with water jugs and fire extinguishers, and cell phones.

5.2.3 Trenton Tulloss is our safety officer

6) Activity Plan

6.1Budget

B—3.900 (98mm) 48" x 2" at $62.95; $125.90

Plastic ogive nosecone – Pinnacle 3.90" $19.95

MMT-2.152 (54mm) 18" 0.062" $7.03

¼" Nomex Honeycomb w/fiberglass sandwich, $12.76 per sq. ft. x 2'' $25.52

¼" plywood, $10.00

3.90" tube coupler, 48" 0.062" $22.99

16" parachute, $24.83

56" hemispherical parachute, $85.89

Parachute protector, $11.29 x2 $22.58

Tubular KEVLAR, ½" x 15' $23.50

Tubular KEVLAR, ½" x 20' $29.99

Various hardware $ 15.00 GPS Package $1,226.75

miniAlt/WD logging dual event altimeter $99.95

miniAlt/WD logging dual event altimeter $19.95

PICO-AA2 $120.00

USB connection cable $25.00

KODAK Zi6 Pocket Video Camera $179.95

SDHC High-Speed Card, 8 GB $69.95

AMW 54-K475WW motor reload $99.99

AMW 54 54-1400 54mm case $145.95

Plastic ogive nosecone 2.56” $13.06

B-2560 36” 0.062” $12.37 x 2 $24.74

2.56” tube coupler 36.5” 0.062” $12.68

1/8” plywood $10.00

Shock cord $8.00

Parachute protectors $15.98

Drogue parachute 16” $6.28

Main Parachute 56” $21.84

Various Hardware $10.00

Booster Vision Mini Gear Cam $69.95

Glue, Paint, etc… $30.00

AMW RR-H120 motor reload $31.95

2 Grain 38mm Casing $32.99

Subtotal for Rocket and Payload $2,687.80

Model Rocket kit, Semroc SLS Aero-Dart $51.63 x 4 $206.52

Printing for Sponsor Drive, Fundraisers, and Outreach $40.00

Postage, Federal Express PDR $56.56

Film for Santa Pictures Fundraiser $15.00

Subtotal for Fundraising & Outreach $318.08

Hotel, 5 rooms for 7 nights, $145.00 per night $5,075.00

Airfare for 2 mentors & 7 students, Roundtrip Colorado Springs to Huntsville, Alabama $4,221.00

2 SUVs or Mini Vans, Rental, 8 days $1,400.00Fuel $200.00

Food, $30 per day, per person (9) x 8 $2,160.00

Subtotal for Travel $13,056.00

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Grand Total for SLI Project and Travel $16,061.88

6.2 Outreach summary

6.2.1 We completed an outreach event on 12/4/08 in which we introduced approximately 40 teen students to the SLI program. In addition, we handed out printed contact information to 14 individuals. The event was the Third Annual Cherry Creek Association for Gifted and Talented (ChCAGT) Math and Science Career Fair at Cherry Creek High School in Denver.

COSROCS is having a rocketry class with SLI help and promotion of NASA this Saturday, Dec. 6th. During the first half of all of our classes (1:00 – 2:30), we teach a subject relating to model rocketry. Last time, we talked about the history of rocketry. This month we
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are discussing the agencies that govern model rocketry, go over definitions of rocketeers and model rocketry skill levels, and talk about the different types of model rockets.

The second half of the class (2:30 – 4:00) we have the kids work on their model rockets. Most of the kids have never built a model rocket before. Some of the kids are also 4-H members taking model rocketry as their 4-H project for the year. Most of the kids participating in the class range in ages from 12- to 14-years old.

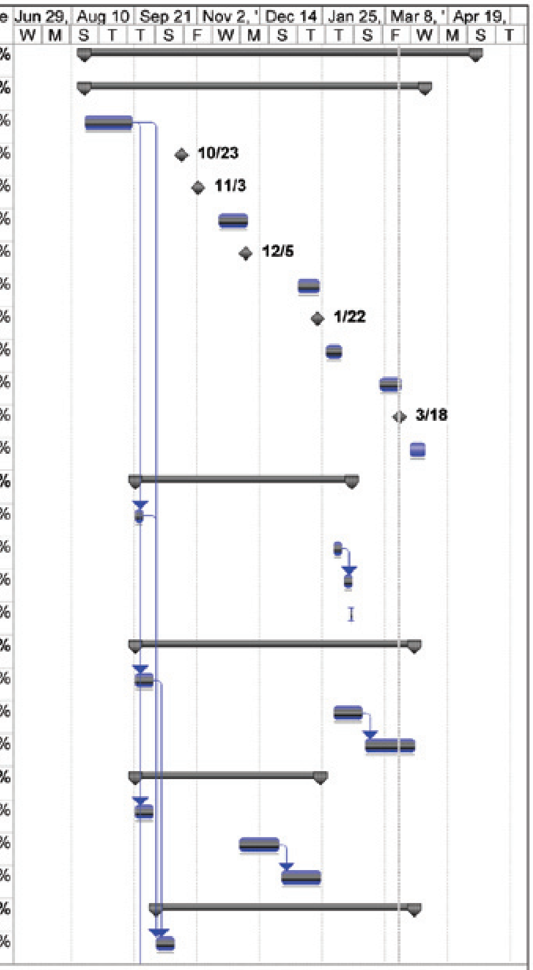
We have also participated in an explanation of rocketry with Boy-scout Troop 1 in Colorado Springs and helped the boys attain their rocketry merit badges.

We will document the number of SLI outreach contacts we make.

6.3 On the next few pages there is a copy of our gantt chart that has our goals, deadlines and completion dates for our project.

The following is our current schedule:

ID		Task Name	Duration	Start	Finish	% Complete
1		**SLI Project**	**188 days?**	**Tue 8/19/08**	**Thu 5/7/09**	**88%**
2		**Presentations**	**164 days**	**Tue 8/19/08**	**Fri 4/3/09**	**89%**
3	✓	Proposal	24 days	Tue 8/19/08	Fri 9/19/08	100%
4	✓	Proposal Review	0 days	Thu 10/23/08	Thu 10/23/08	100%
5	✓	Teams Announced	0 days	Mon 11/3/08	Mon 11/3/08	100%
6	✓	Preliminary Design Review Preparation	15 days	Mon 11/17/08	Fri 12/5/08	100%
7	✓	Preliminary Design Review Posted	0 days	Fri 12/5/08	Fri 12/5/08	100%
8	✓	Critical Design Review Preparation	10 days	Fri 1/9/09	Thu 1/22/09	100%
9	✓	Critical Design Review Posted	0 days	Thu 1/22/09	Thu 1/22/09	100%
10	✓	Critical Design Review Video Conference	8 days	Wed 1/28/09	Fri 2/6/09	100%
11	✓	Flight Readiness Review Preparation	10 days	Thu 3/5/09	Wed 3/18/09	100%
12		Flight Readiness Review Posted	0 days	Wed 3/18/09	Wed 3/18/09	0%
13		Flight Readiness Review Video Conference	8 days	Wed 3/25/09	Fri 4/3/09	0%
14	✓	**Recovery**	**105 days?**	**Mon 9/22/08**	**Fri 2/13/09**	**100%**
15	✓	Design	5 days	Mon 9/22/08	Fri 9/26/08	100%
16	✓	Construction	5 days	Mon 2/2/09	Fri 2/6/09	100%
17	✓	Testing	5 days	Mon 2/9/09	Fri 2/13/09	100%
18	✓	Ejection Test	1 day?	Fri 2/13/09	Fri 2/13/09	100%
19	✓	**Payload**	**135 days**	**Mon 9/22/08**	**Fri 3/27/09**	**100%**
20	✓	Design	10 days	Mon 9/22/08	Fri 10/3/08	100%
21	✓	Construction	15 days	Mon 2/2/09	Fri 2/20/09	100%
22	✓	Testing	25 days	Mon 2/23/09	Fri 3/27/09	100%
23	✓	**Scale**	**90 days**	**Mon 9/22/08**	**Fri 1/23/09**	**100%**
24	✓	Design	10 days	Mon 9/22/08	Fri 10/3/08	100%
25	✓	Construction	20 days	Mon 12/1/08	Fri 12/26/08	100%
26	✓	Testing	20 days	Mon 12/29/08	Fri 1/23/09	100%
27	✓	**Airframe**	**125 days?**	**Mon 10/6/08**	**Fri 3/27/09**	**100%**
28	✓	Design	10 days	Mon 10/6/08	Fri 10/17/08	100%



Project: SLI
Date: Tue 3/17/09

Task | Milestone | External Tasks
Split | Summary | External Milestone
Progress | Project Summary | Deadline

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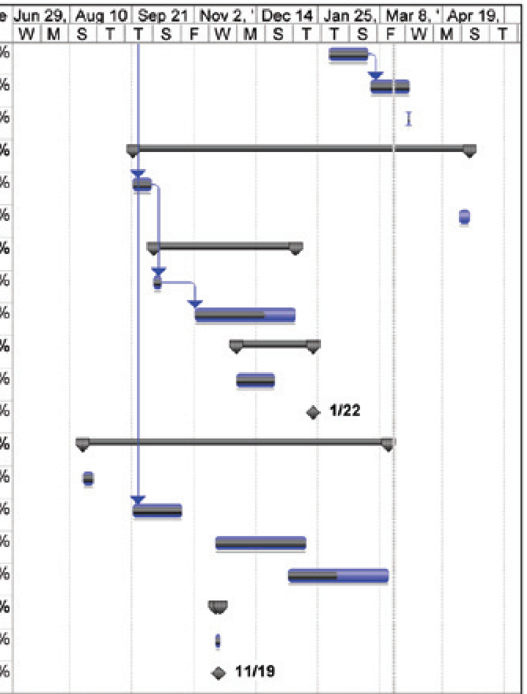
ID		Task Name	Duration	Start	Finish	% Complete
29	✓	Development	20 days	Mon 2/2/09	Fri 2/27/09	100%
30	✓	Testing	20 days	Mon 3/2/09	Fri 3/27/09	100%
31	✓	String Test	1 day?	Fri 3/27/09	Fri 3/27/09	100%
32		**Publicity**	**164 days**	**Mon 9/22/08**	**Thu 5/7/09**	**67%**
33	✓	Initial Material	10 days	Mon 9/22/08	Fri 10/3/08	100%
34		Report to Sponsors	5 days	Fri 5/1/09	Thu 5/7/09	0%
35		**Fundraising**	**70 days**	**Mon 10/6/08**	**Fri 1/9/09**	**73%**
36	✓	Planning	5 days	Mon 10/6/08	Fri 10/10/08	100%
37		Execution	50 days	Mon 11/3/08	Fri 1/9/09	70%
38	✓	**Propulsion**	**38 days**	**Mon 12/1/08**	**Thu 1/22/09**	**100%**
39	✓	Simulations	20 days	Mon 12/1/08	Fri 12/26/08	100%
40	✓	Motor Selection Due	0 days	Thu 1/22/09	Thu 1/22/09	100%
41		**Safety**	**149 days**	**Tue 8/19/08**	**Fri 3/13/09**	**80%**
42	✓	Initial Planning	5 days	Tue 8/19/08	Mon 8/25/08	100%
43	✓	Design Oversight	25 days	Mon 9/22/08	Fri 10/24/08	100%
44	✓	Development Oversight	45 days	Mon 11/17/08	Fri 1/16/09	100%
45		Testing Oversight	50 days	Mon 1/5/09	Fri 3/13/09	50%
46	✓	**Website Work**	**3 days**	**Mon 11/17/08**	**Wed 11/19/08**	**100%**
47	✓	Production Original Setup	3 days	Mon 11/17/08	Wed 11/19/08	100%
48	✓	Production Original Setup Completion	0 days	Wed 11/19/08	Wed 11/19/08	100%



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