Experiments

Our over arching goals are to gather data, analyze the data, draw conclusions and communicate the results.

What can be learned from measuring and analyzing roll and vibration during a rocket's flight?

It is quite apparent that if roll and/or vibration have a significant impact on flight characteristics, it will be in the best interest of rocket designers and builders to reduce and hopefully eliminate the detrimental force.

We want to measure roll and vibration with two stock rocket kits and build them per instructions with the only modification being an upgrade to the recovery system so that it will withstand relatively high-speed deployment incase of a miss-timed deployment event.

We are going to monitor altitude, vibration and roll of two same-kit rockets built by two different students. If, after data analysis, there are significant differences, we will then examine the rockets to see if we can determine what caused the differences. Each rocket is a LOC Hi-Tech H45. The specifications are:

Length: 49.75 inches
Diameter: 2.625 inches
Weight: 20 ounces
Motors: H73J-10

Mariya Williams and Kyle Koos are building the rockets. Neither student has built a rocket before, nor have they any experience in building anything beyond plastic snap together kits. Construction is carefully monitored to ensure strength and durability. Kyle is the chief electronics engineer and programmer backed by Mariya. Data measuring and logging will be done by the Basic Stamp microcontroller with a TSL230R Light-to-Frequency Converter from Texas Advanced Optoelectronic Soloutions and a Piezo Film Sensor from Measurement Specialties Inc. We are using a memory stick data logger that will host a USB drive for holding the collected data. Everything will be mounted on a printed circuit board and securely fastened in the payload bays of the rockets. The TSL230R will turn on the data logging by having its viewing portal uncovered upon takeoff. The data logging will be terminated after five minutes via program control.

For our first data gathering exercise we want to acknowledge that in addition to the four main forces that affect a rocket's travel; lift, drag, thrust, and weight, there two additional dynamic forces that we want to measure and analyze. These two are roll and vibration. We want to monitor roll and vibration so that we can compare the differences, if any, between the two rockets. We will analyze the data and provide comparative graphs and analysis.

Here are the possible outcomes where R1= Mariya's, R2 = Kyle's, V= vibration, R=roll:

Compared Individually	
Roll	**Vibration**
R1R = R2R	R1V = R2V
R1R > R2R	R1V > R2V
R1R < R2R	R1V < R2V
data incomplete	data incomplete

Compared Together
R1R = R2R and R1V = R2V
R1R = R2R and R1V > R2V
R1R = R2R and R1V < R2V
R1R > R2R and R1V = R2V
R1R < R2R and R1V = R2V
R1R > R2R and R1V > R2V
R1R > R2R and R1V < R2V
R1R < R2R and R2V > R2V
R1R < R2R and R1V < R2V

We will consider each of the two forces separately and together

1. what are the forces data; maximum, mean, median, average?
2. what are the differences?
3. are the difference statistically significant?
4. what are the possible explanations for the differences

and if there are significant differences, applying what we've concluded to modifying our rocket construction techniques. We hope to continue this experiment afterwards to verify construction modifications have changed the data.

Variable to consider and measurement tools:
Since there will be two separate launches, this data needs to be logged:

1. Wind direction – portable weather station
2. Wind speed – portable weather station
3. Temperature – portable weather station
4. Barometric pressure – portable weather station

And for each rocket:

1. Weight - scale
2. Quality of finish - subjective
3. Straightness of fins – level/subjective
4. Fin finish and shape - subjective

5. Straightness of launch lugs – level/subjective
6. Length of flight – R-DAS Tiny flight computer
7. Altitude – R-DAS Tiny flight computer
8. Acceleration – R-DAS Tiny flight computer
9. Velocity – R-DAS Tiny flight computer
10. Deployment time – R-DAS Tiny flight computer and motor delay rating
11. Deployment altitude – R-DAS Tiny flight computer
12. Vibration - student built sensor
13. Roll - student built sensor
14. Motor variation (hmmm manufacturer's data?)

How much does the temperature in the recovery bay increase during ejection charge detonation?

We want to collect data on the temperature in the recovery bay for our second experiment. The temperature in the parachute bay is particularly useful so that we can establish a baseline and then test various heat barriers in future experiments. The rocket carrying this experiment will be the Mad Cow Patriot.

The electronics will be based upon a Basic Stamp microcontroller with a DS2760 thermocouple that has a temperature range of 200-2300F. We are using a memory stick data logger that will host a USB drive for holding the collected data. Everything will be mounted on a printed circuit board and securely fastened in the payload bay of the rocket. The TSL230R light-to-frequency counter will turn on the data logging by having its viewing portal uncovered upon takeoff. The data logging will be terminated after five minutes via program control.

This will be a data gathering and analysis project which will become baseline data for future experiments.

Experiment Hardware

Each of the experiments is based upon Parallax's Basic Stamp. We are using a memory stick data logger that will host a USB drive for holding the collected data. Everything will be mounted on a printed circuit board and securely fastened the in payload bays of the rockets. Each experiment package weight 8.25 ounces and this additional mass has been accounted for in our Rocksim profiles.

The TSL230R light-to-frequency counter will turn on the data logging and thus the experiment, by having its viewing portal uncovered upon takeoff (similar to a breakwire). The data logging will be terminated after five minutes via program control.

The data will be downloaded from the USB drive by attaching it to a computer and moving/copying the data to the computer. We have plotting and graphing software that will allow us to analyze our data.

Team Members and Advisors

		T-shirt	Job
Robert	Skaggs	XXXL	Team Leader
Mariya	Williams	S	Launch Safety
Kyle	Koos	XL	Electronics
Tad	Enholm	XXL	Equipment
Talia	Graves	S	Project Leader
Gary	Brandt	L	Advisor
Shelley	Macy	S	Advisor
David	Orerio	XL	Advisor
Sheryl	Caldwell	M	Guest

Rocket Data is an Excel Spread Sheet

Photos – here are three of our rockets. We are still waiting for the kits to be delivered so that we can build them. Pictures will be forthcoming as soon as we get them built.

PML Ariel

LOC Hi Tech H45 – Mariya

LOC Cyclotron