ORCA

PROJECT PROPOSAL

2015-2016

FIRST DRAFT

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§1 Introduction

The goal of this project is to compete in the Midwest High Powered Rocket Competition, hosted by NASA This competition entails the designing of a single high-powered rocket with an active braking system to be launched twice, once with and once without the activation of the brake system. Along with the physical launches of the rocket, two reports are to be submitted for the competition. Especially with the dawn of private space flight, the research done for this competition is highly applicable to real world situations pertaining to controlling the velocity of a rocket once it has been launched.

§2 Significance

Rocketry is a constantly growing field, with many companies, such as SpaceX and Virgin Galactic, pioneering the private sector approach to space travel. The field of rocket science is generally acknowledged as a complicated field, to the point where it is often used as a synonym for 'complicated,' with many different approaches being applied to equally as many aspects of any single attempt to launch a rocket. Specifically, this research is focused on maintaining control of a rocket once it has been launched from the launch pad, particularly in regards to its velocity.

This study will be done on a much smaller scale than the rockets developed by the aforementioned entities, but the conclusions made by it will also be applicable on a larger scale. The competition not only requires that the rocket be stable and have an active drag system to control the velocity, but also that there be systems in place for the safe recovery of the rocket, i.e. a parachute to ensure that the rocket lands softly on the ground without breaking any parts.

At the time of this proposal's writing, there are no major implementations of such a system to actively control the velocity of a rocket. Most similar concepts are applied strictly to the recovery of the vessel, be it during regularflight or in emergency. With the ability to control the velocity, there is the possiblity of compensating for irregularities in a launch without having to completely abort the mission, which is especially useful in regards to the budget of such launches. This project will not be covering such situations, bfurther study could be done based on the conlusions of this project to test the applications of a drag system in the event of a launch irregularity.

§3 Objectives

The objectives of this project are fairly straightforward, pertaining signifcantly to the requirements of the Midwest High Powered Rocket Competition in which we intend to compete:

1. Build a high-powered rocket with a built-in active drag system
2. Complete the requirements for the Midwest High Powered Rocket Competition (i.e. write the two required reports as well as launch the rocket on May 15-16, 2016)
3. Present the findings of the research as well as the results of the Competition

§4 Methods

As the motor of the rocket requires a refill for every launch, it is most economical to do the majority of the research in a theoreticl sense beforehand. This would mostly comprise simulations using software provided by the Physics Department. The results of this process will be qualitative, returning the effectiveness of

a given method of drag as a coefficient. Much of these tests will also be ran purely for the development of the rocket that is to be used as a platform for the drag system.

After the simulations are ran, there are to be several test launches. These will be done in moderation, again, each launch requires refilling the motor, which is not an expense that can be easily overlooked. These test launches will also serve to train the team to be able to prepare the rocket for launch in a timely manner (the competition requires it to be done within the span of a single hour).

The final test of the system will be the launch as part of the competition, this will show the effectiveness of our approach compared to that of other teams from throughout the country (while the competition is called the "Midwest High Powered Rocket Competition, there are many teams from outside the region that participate as well). This competetive approach to research promotes creative approaches to solving a problem. In a sense, our team's competing is a contribution to the total research done for the competition, which is designed to efficiently pick out the most effective approach to building an active drag system.

§5 Dissemination

As the competition launch is not until May, our work would not yet be ready for presentation at any of the spring dissemination opportunities. This means that we will not be presenting at any large-scale events until the Fall Gala the following academic year. The launch is after finals for the spring semester as well, and so we will also need to wait until the following fall to present our work at the regular Society of Physics Students meetings, which we intend to do.

§6 Detailed Budget

Equipment Budget	**Dim.**	**Ppu**	**Quant.**	**Total**
G12 Fiberglass	5.5" x 48"	$175.10	2	$350.20
G12 Coupler	5.5" x 12"	$60.67	2	$121.34
Blue Tube - Motor Mount Tube	75mm	$29.95	1	$29.95
Fiberglass Nosecone	5.5"	$110.20	2	$220.40
G10 Centering Rings	75mm/5.5"	$17.10	4	$68.40
808 Keychain Camera		$41.35	2	$82.70
Thrust Plate	75mm/5.5"	$59.21	1	$59.21
Bulkhead Disk	5.5"	$7.25	2	$14.50
Angel Parachute	60"	$105.00	2	$210.00
Fruity Chute Drogue	24"	$63.70	1	$63.70
Shock Chord U-Bolt	1/4"	$4.29	1	$4.29
Sunward Black Parachute Protector	18"	$9.99	1	$9.99
Madcow Parachute Protector	12"	$8.51	1	$8.51
Kevlar Cord 1500#	1'	$0.92	10	$9.20
Airfoiled Rail Buttons		$7.00	1	$7.00
Large Capacity Ejection Canister	5pk	$12.50	1	$12.50

Blue E-Bay	5.5”	$56.95	1	$56.95
Fiberglass Fin Stock	1/4” x 1sq.ft.	$51.43	2	$102.86
Tracking Powder		$6.25	1	$6.25
Ace Premium Spray Paint	12oz	$23.94	3	$71.82
Tube Cutting Guides		$12.83	1	$12.83
Large Guillotine Fin Jig		$195.00	1	$195.00
Arduino Mega 2560 Rev3		$51.07	1	$51.07
Sparkfun Mpu6050 Triple Axis Accelerometer And Gyro		$39.95	1	$39.95
Raven III Altimeter		$155.00	1	$155.00
G5000 Rocket Epoxy	2pint	$38.25	1	$38.25
Total Equipment Budget				$2,001.87

Compensation Budget	**Rate**	**~Hrs.**	**Total**
Mitchell Ahlswede	$5.00	70	$350.00
Roman Alvarado	$5.00	70	$350.00
Mark Christenson	$5.00	70	$350.00
Brian Miller	$5.00	70	$350.00
Trevor Hoglund	$5.00	70	$350.00
Riandro Vogt	$5.00	70	$350.00
Total Compensation Budget			$2,100.00

§7 Total Request

Main Budget	
Equipment	$2,001.87
Registration	$400.00
Poster Printing	$75.00
Compensation	$2,100.00
Total	$4,576.87