TOLEDO

ROCKETRY CLUB

FLIGHT READINESS REVIEW

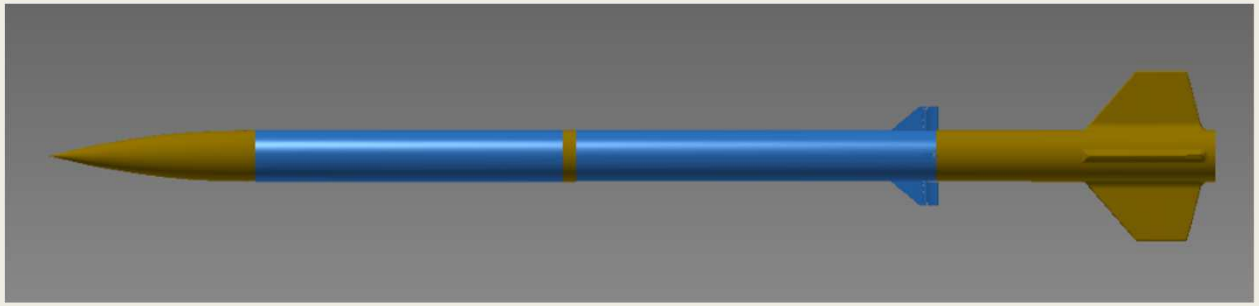
Team Structure

- Team Leader:
  Michael Blackwood
  NAR #101098 L2 Certified
- Safety Officer:
  Pierce McGowan
- Team Mentor:
  Art Upton
  NAR #26255 L3 Certified
- NAR Section:
  Jackson Model Rocketry Club
  Section #620

Team Leadership:

- Michael — Team Lead, Payload System Lead
- Andrew — Vehicle Body Lead, Treasurer
- Peter — Propulsion Lead, Secretary
- Pierce — Safety Officer
- Patrick — Recovery Lead
- Marwan — Payload Electronics Lead
- William — Education/Outreach Lead

Vehicle Design Overview



Details

- Length: 86.97 inches
- Diameter: 4 inches
- Weight with motor: 22 lbs

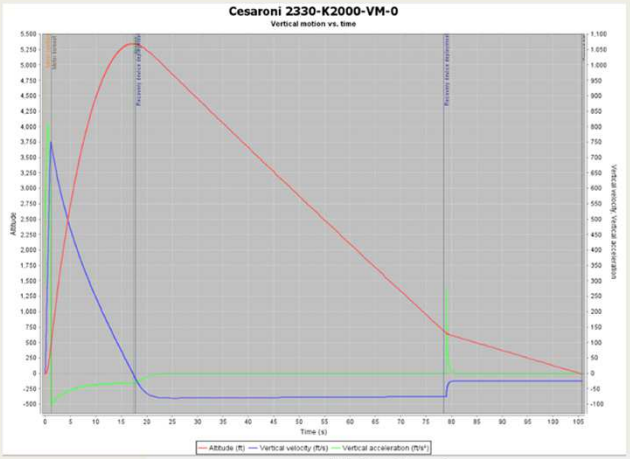
Materials

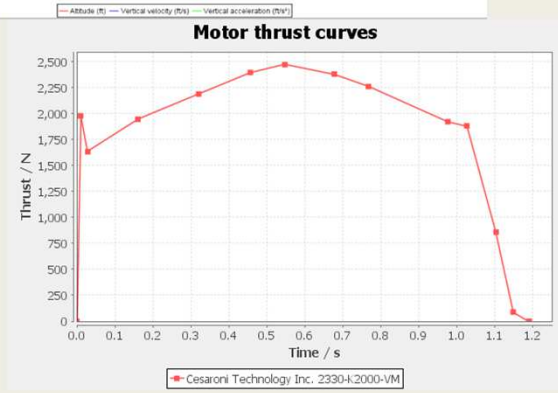
- Airframe: G12 Fiberglass
- Fins: G10 Fiberglass

Flight Overview and Motor Choice

- Cesaroni 2330-K2000-VM-0
  - *Launch mass: 89.9 oz*
  - *Projected apogee: 5350 ft*
  - *98.1 ft/s off launch rod*
  - *Max velocity 750 ft/s*
  - *0.67 Mach*

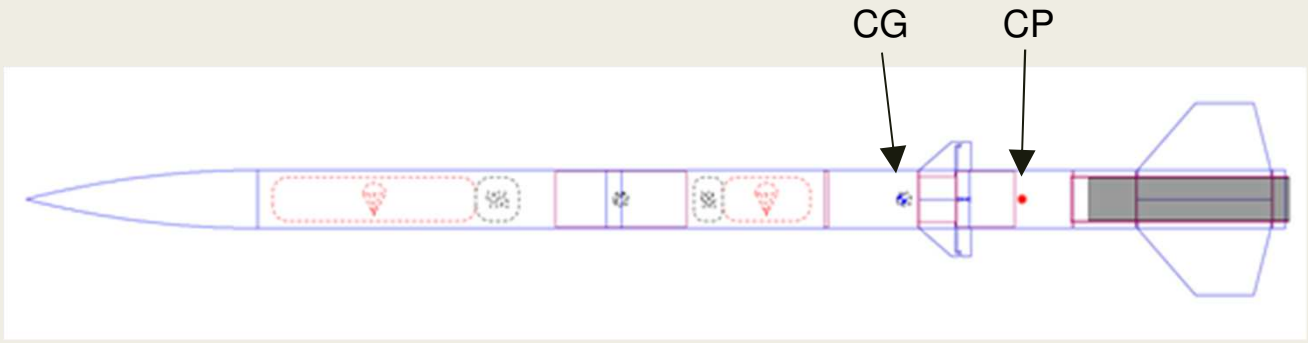
- Thrust Curve
  - *Maximum thrust: 2474 N*
  - *Burn Time: 1.15 s*



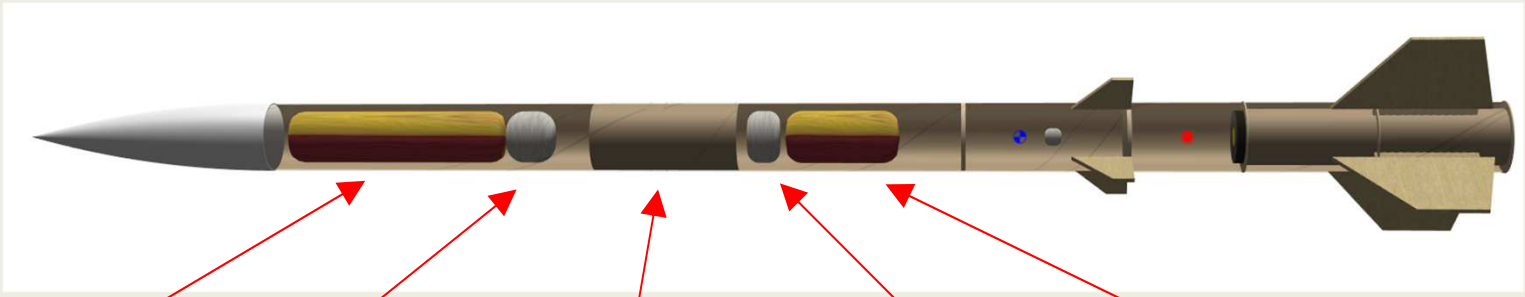


Stability

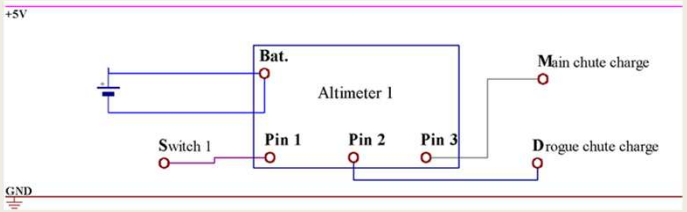
- Static Stability Margin: 2.07
- Distance to stable velocity: 1.97 feet
- Rail exit velocity: 98.1 ft/s
- Center of Pressure (CP): 68.59 inches
- Center of Gravity (CG): 60.33 inches



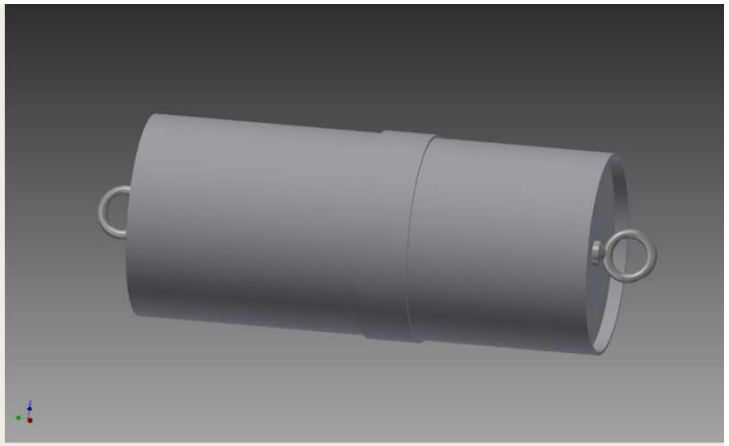
Recovery Subsystem



- Drogue Chute:
  - 26.75”
  - Deploys at apogee
- Main Chute:
  - 60”
  - Deploys at 700ft
- Altimeter
  - StratologerCF
  - Programmed to trigger blast caps at apogee for drogue and 700 ft for main.
  - Two units
    - 2 grams of black powder are used for each blast cap.
    - Each unit given independent battery.
    - Each unit connects to a blast cap for the drogue and main chutes.

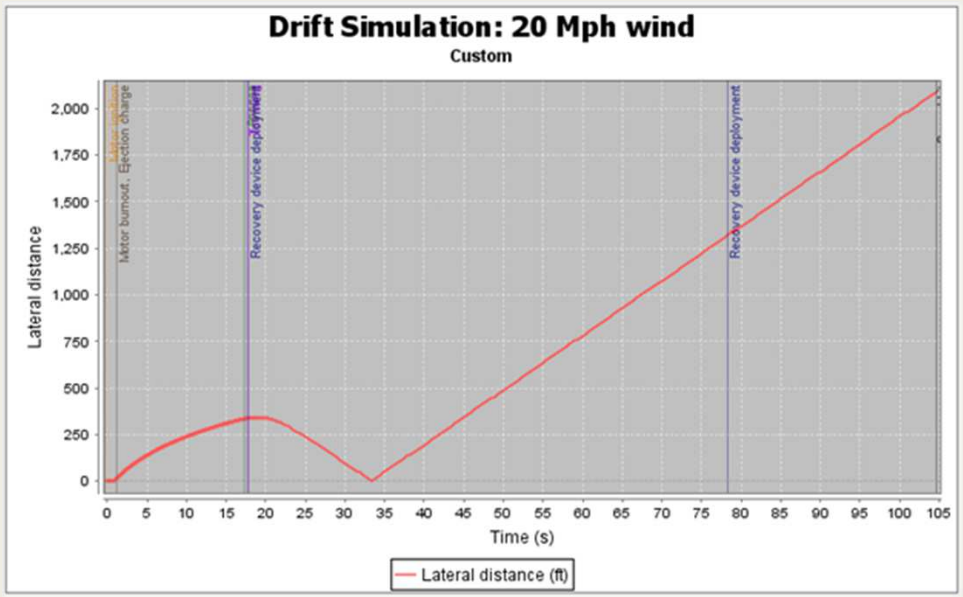


Recovery Subsystem (Cont.)



- TeleGPS Tracker unit
  - *434.55 MHz Ham Band*
  - *Interfaces with ground station to output altitude, velocity, and GPS location*
- Kinetic Energy at Impact
  - *Energy: 65.0 ft-lbf*
  - *Maximum permissible Energy is 75 ft-lbf*
- Nylon Rip Stop Shock Cords
- Nomex Fire Resistant Blankets
- 2 StratologgerCF altimeters

Drift Distances

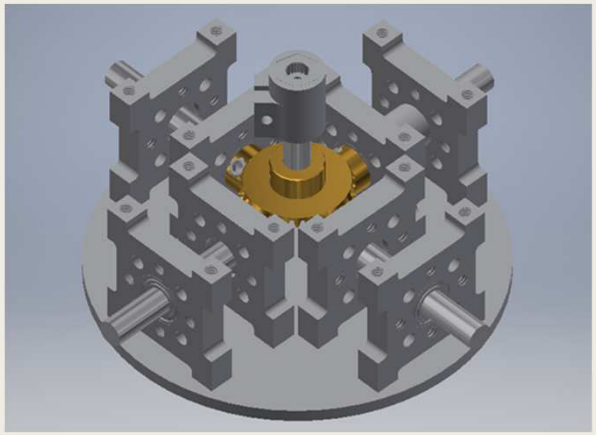


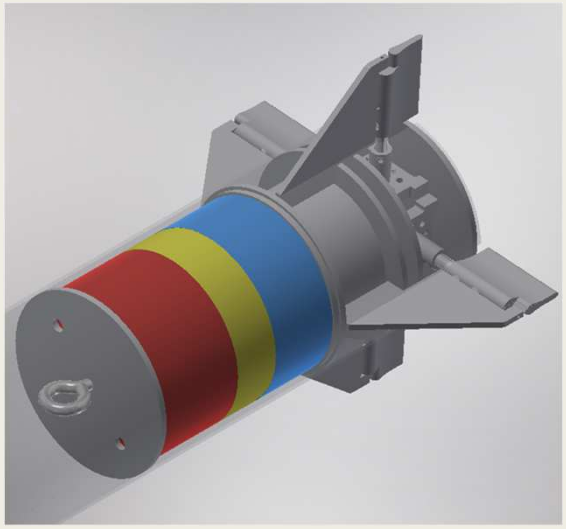
Wind Speed (mph)	Drift Distance (ft.)
0	7
5	500
10	1000
15	1550
20	2090

Payload Subsystem

- The payload will consist of an active surface controlling the roll of the rocket during flight.

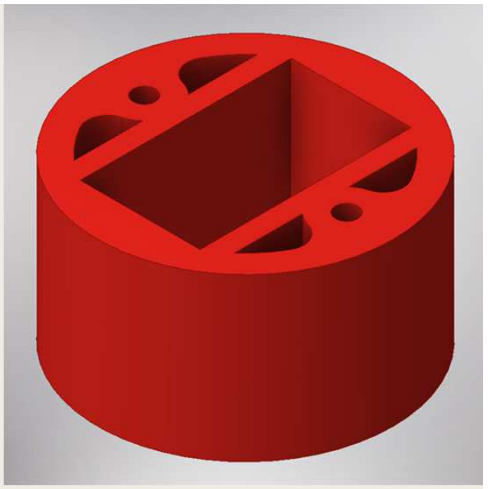
- Single Servo controlling a differential
  - All four control surfaces will move in sync
- Control surfaces will be connected via a rod system which will secure using set screws
  - Control surfaces are 3D printed with high strength ABS plastic
- Electronics
  - Reads and stores sensor data
  - Directs control loop
  - Includes 9DOF inertial measurement unit
    - Gyroscopes
    - Accelerometer
    - Magnetometer

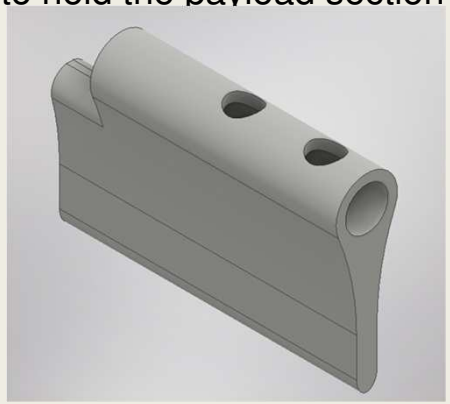


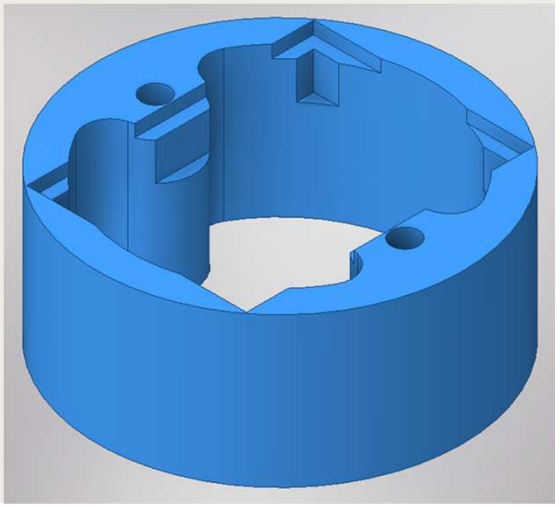


Payload Integration

- Electronics bay sits above the motor mount
- Electronics will be held in place by a series of 3D printed parts
  - *The red section is used to hold the batteries*
  - *Blue and yellow will hold the PCB between them*
- The servo will be fixed to a fiberglass support mount
- A second fiberglass support mount will hold the eye bolt and one side of the threaded rods used to hold the payload section together



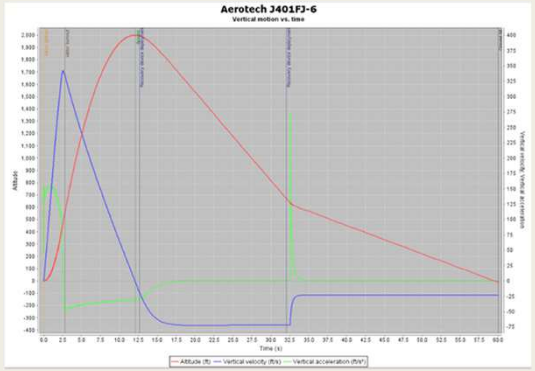




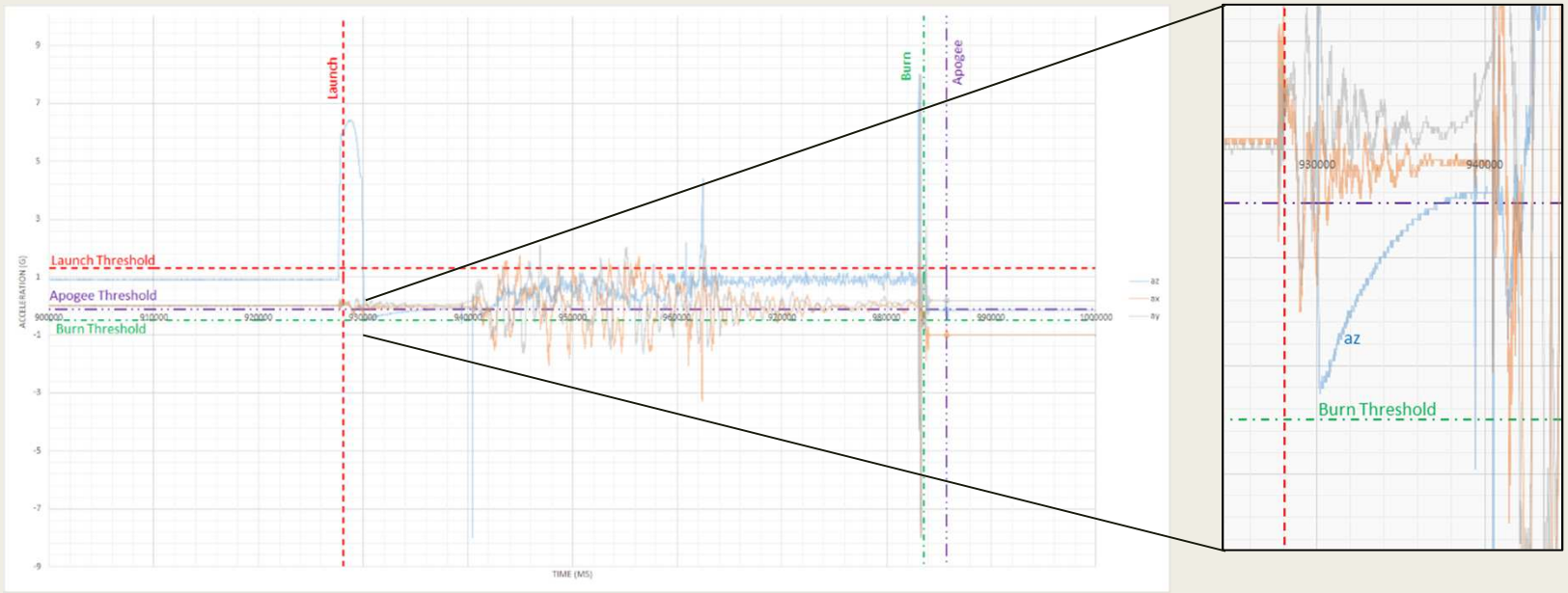
Full Scale Test Flight

- Motor Used: Aerotech J401FJ-P

- In simulation the rocket reached an apogee of 2001 ft. During the actual flight, apogee was 1978 ft. The simulation was off by 23 feet, or 1.09%.



Full Scale Test Flight (Cont.)



- Payload Analysis
  - *Raw Accelerometer and gyroscope data was obtained*
  - *Launch was detected, burnout was detected late*
    - G threshold for burnout was too high for the motor used

Launch Day Preparations

- Checklist for Safety Precautions
- Checklist for Payload setup
- Checklist for Recovery preparation
- Checklist for Motor preparation
- Checklist for setup on launchpad

Educational Engagement

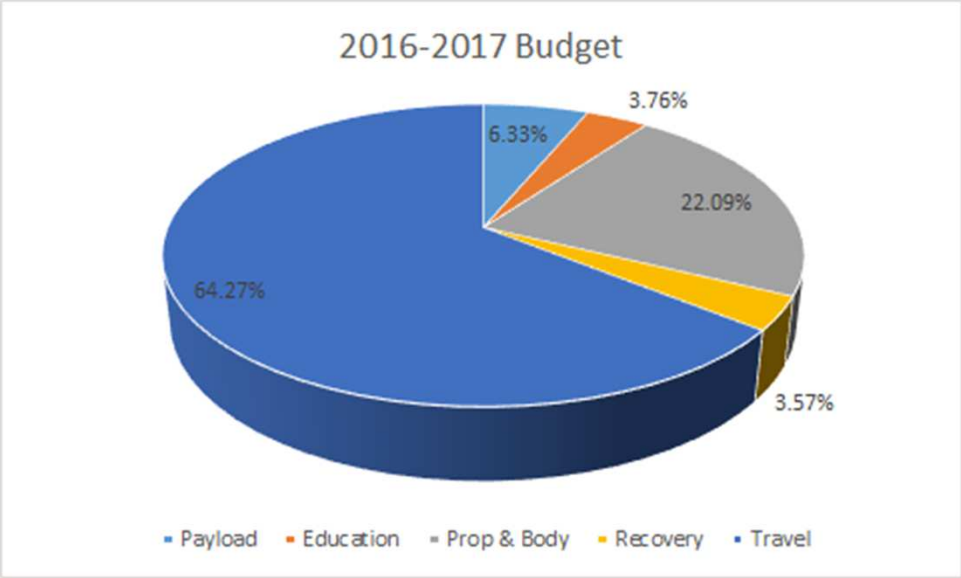
Past:

- Presented to Ida Middle School
  - *Subscale launch*
- Engineering Week (E-Week) Balloon rocket activity

Future:

- UTEC Easter Egg hunt
- St. Bernard Grade School

Budget



2016-2017 Funding Plan		
Source	**Amount**	**Status**
2015-2016 Excess	$ 2,658.31	Acquired
Marathon	$ 2,000.00	Acquired
DTE Energy	$ 250.00	Awaiting
Rotary Club	$ 500.00	Awaiting
UT MIME Department	$ 1,500.00	Acquired
Total	$ 6,908.31	

Future Work

- Paint Cairo
- Pack for Huntsville!