High Power Rocketeers

University of Minnesota Duluth

Competition Objectives

- Maximize altitude of the dart
- Maximize separation between the dart and booster
- Record rotation of the dart about the X, Y, and Z axes
- Downward facing video of the flight

Competition Objectives

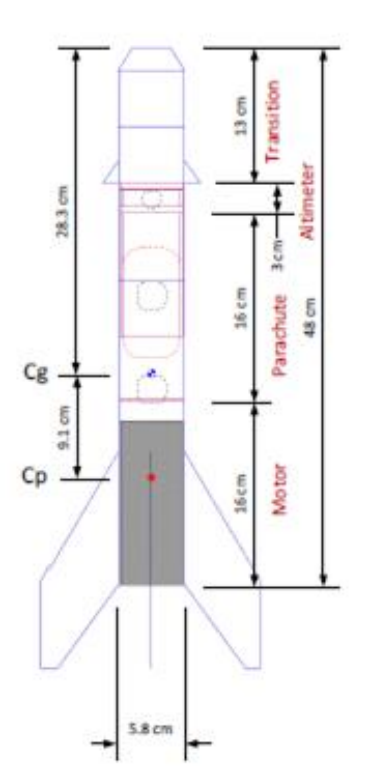
- Rocket must be recovered safely and in flyable condition
- Minimum of 1 caliber of stability

Design Philosophy

- Dart
  - Maximize altitude
  - Low drag coefficient
  - Maximize momentum by optimizing weight
- Booster
  - Maximize separation
  - High drag coefficient
  - Minimize momentum by decreasing weight

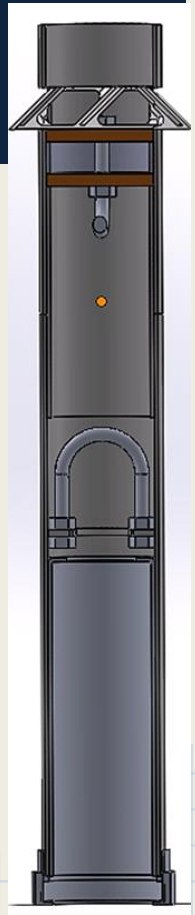
Design Tools

- Excel simulations (beginning point)
  - Parachute size, body tube length
- OpenRocket
  - Fin Design
  - Dart weight optimization
  - Stability of dart and booster



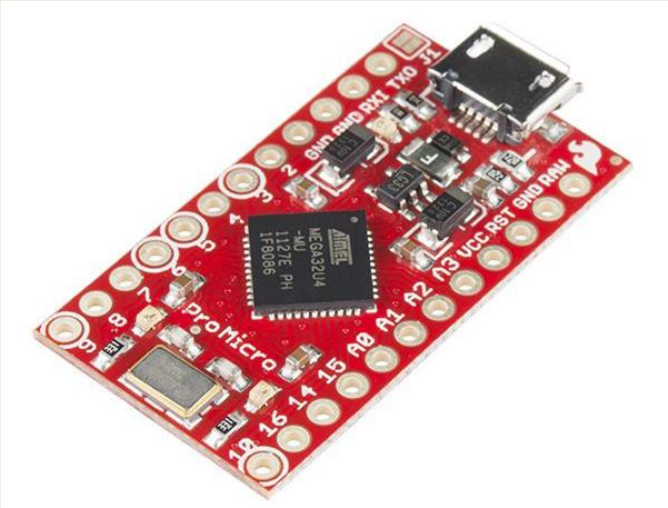
Design Tools

- Solidworks
  - Rocket modeling
  - DXF files for 3D printer and waterjet
  - Finite element analysis
- 3D printing/waterjet
  - Fins
  - Mirror device
  - Transition section
  - Dart tail cone/camera case
- Arduino Design Environment

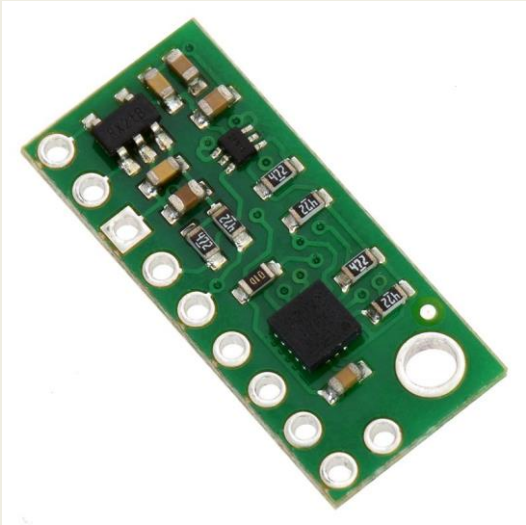


Dart Avionics

- Arduino Pro Micro

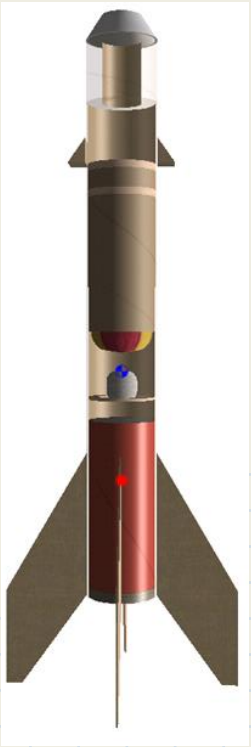


- Inertial Measurement Unit (IMU)



- Data collection package for characterizing rotation in the X, Y, and Z axes over time

Booster Construction



Dart Construction

Test Launch

Quantity	Simulation	Stratologger (dart)	Alt. Two (booster)	Alt. Two (dart)
Thrust Duration (s)	1.1	1.1	.25	1.4
Max. Acceleration (G)	27.7	23.6	23.1	23.0
Average Accel. (G)	21.7	14.0	19.8	21.5
Max Velocity (m/s)	234.8	217.0	40	219
Altitude at burnout (m)	105	76.2		
Apogee	1451 (dart) 830 (booster)	1711	856	1712

Conclusion

- Predict a maximum altitude of the dart to be 1700 meters and separation of 850 meters
- We expect a safe stable flight and recovery

Questions

Thank you to the Minnesota Space Grant for your support