Drag Racing

GROUP 13
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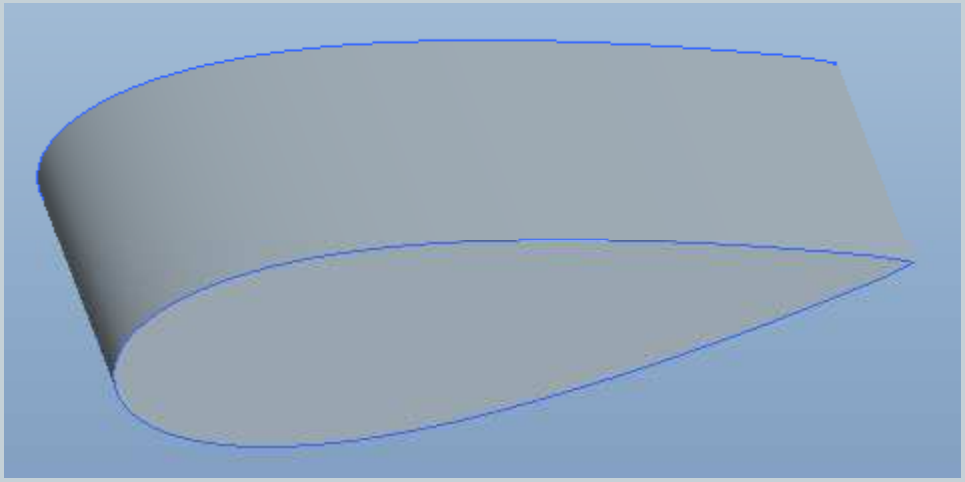
Scope

- Demonstrate properties of aerodynamics to young minds (K-12)
- Low maintenance
- Interactive
- Robust and simple as to facilitate many repeated demonstrations

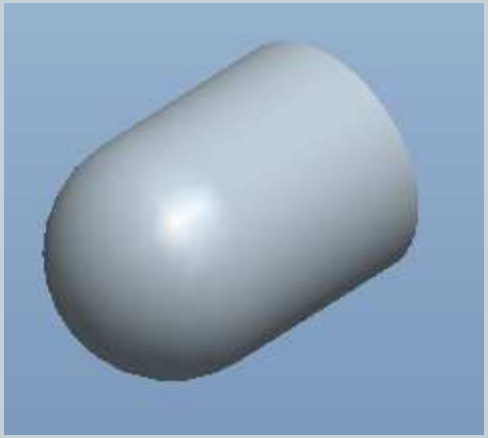
Current Status

- Ordered aluminum from McMaster-Carr
- Waiting on materials for shapes
- Program for displays ready
- Electronics determined and chosen
- Finalizing materials for starting and stopping Mech.

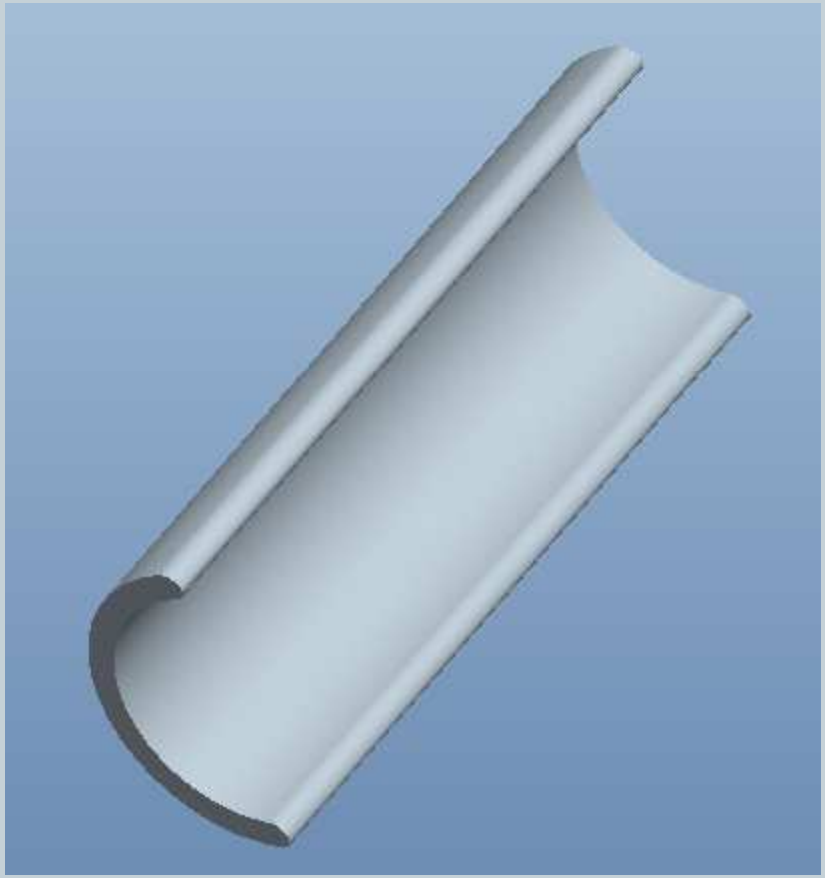
Streamlined Body



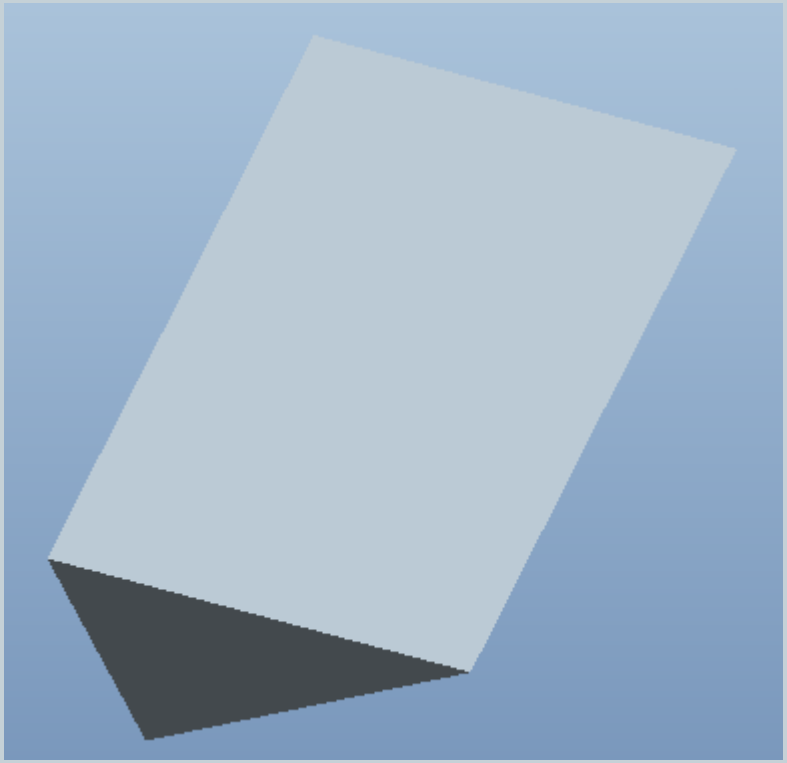
Bullet



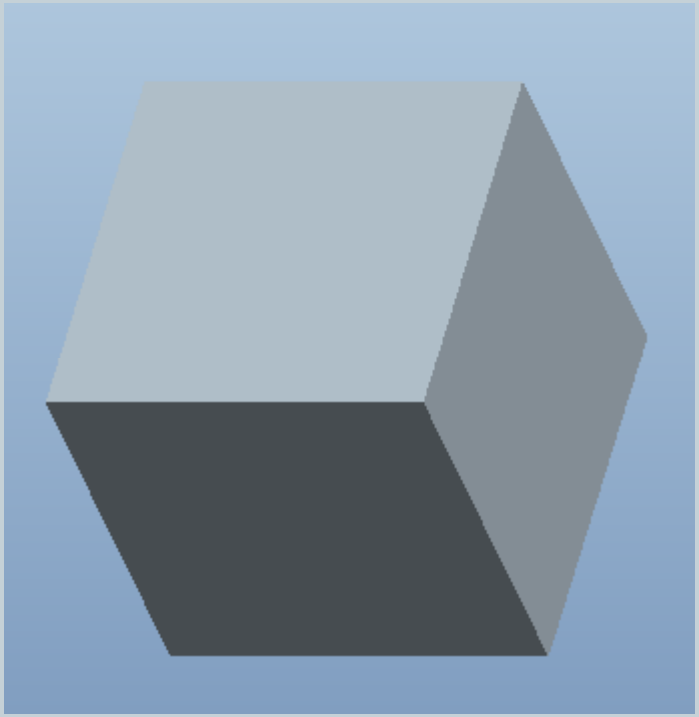
Shell Rod



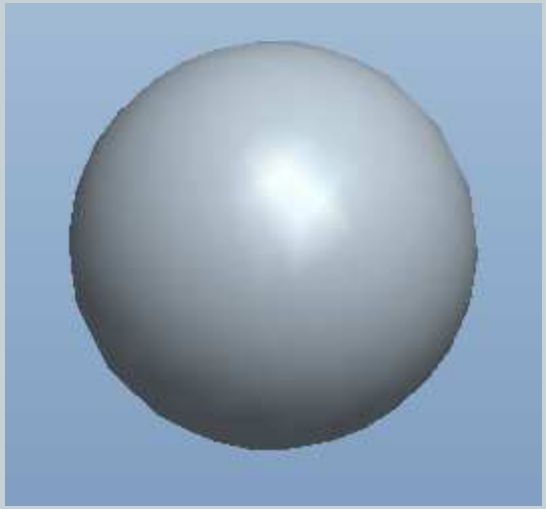
Triangle Rod



Cube

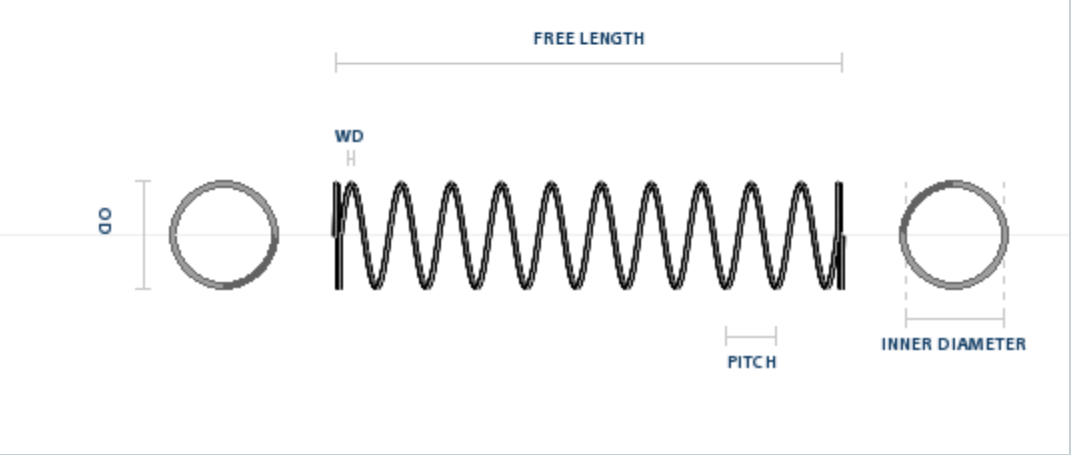


Sphere



Launching Mechanism

- Order springs at Planet Spring
- Two different types of springs

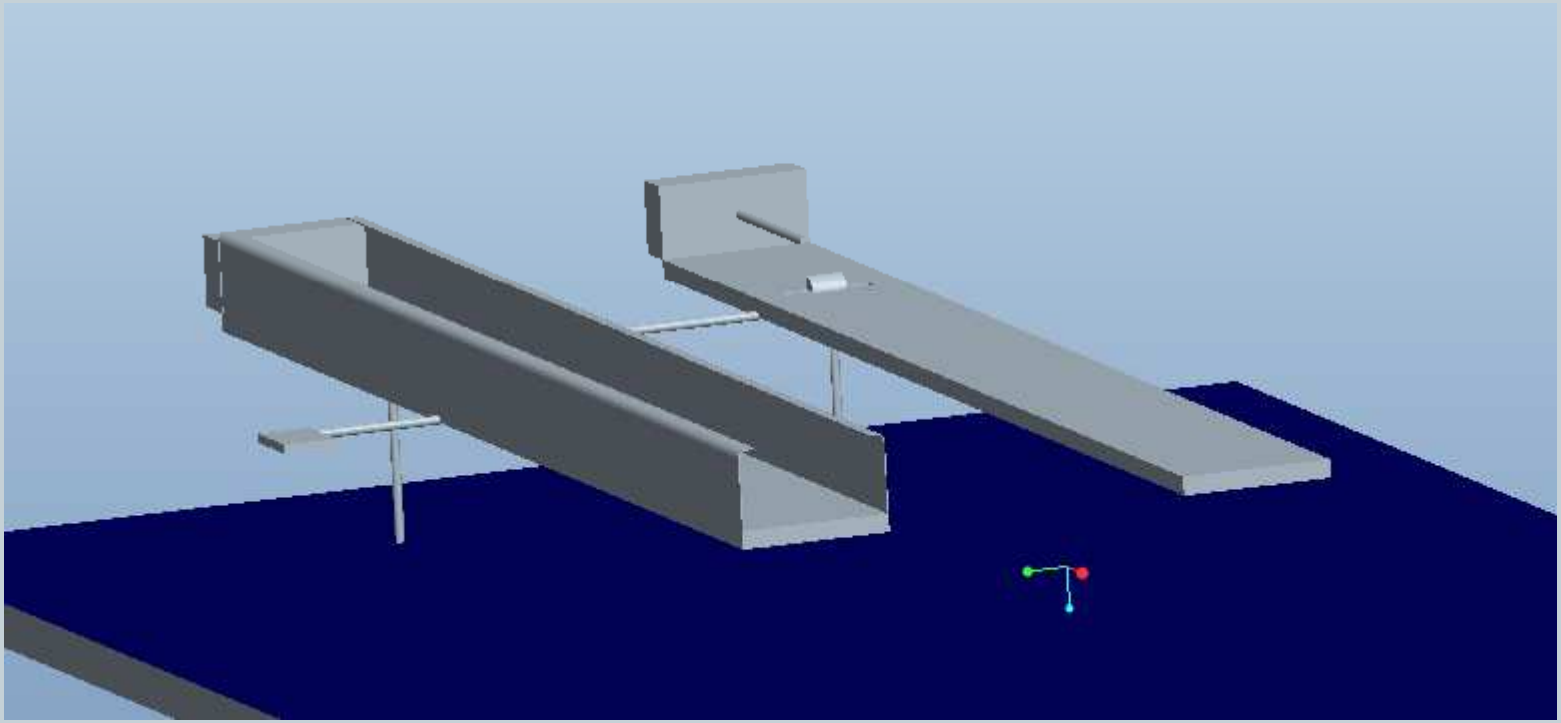


Launching Mechanism

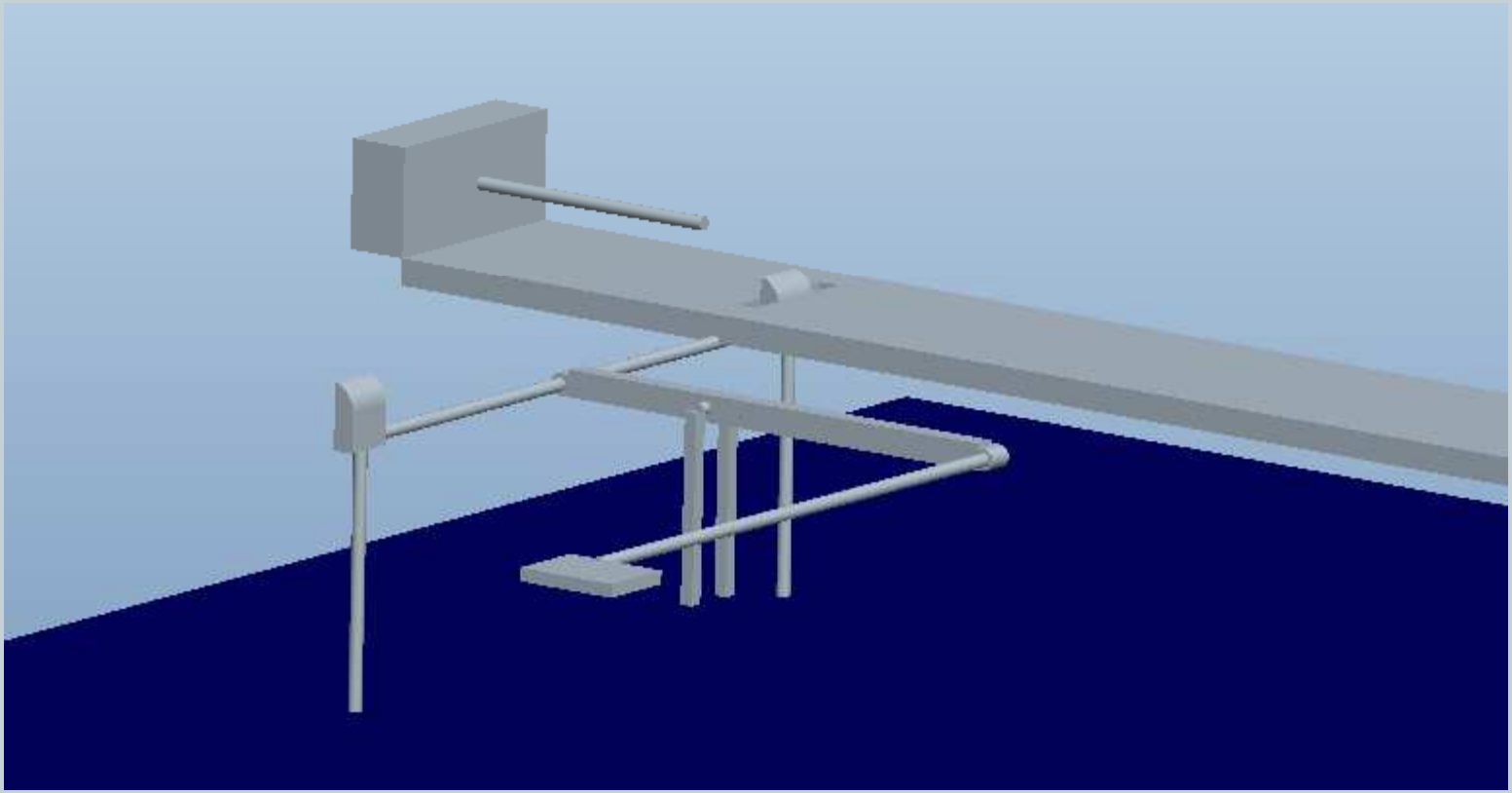
- Cart Springs Parameters:
  - Maximum Load: 12.5N
  - Spring Constant: 0.144 N/mm
  - Price: $20,00

Answers	
Loads & Rates	
True Maximum Load, *True* F_{max} :	**19.830 N**
Maximum Load Considering Solid Height, *Solid Height* F_{max} :	**12.564N**
Spring constant (or Spring rate), k :	**0.144N/mm**
Safe Travel	
True Maximum Travel, *True* $Travel_{max}$:	**137.319 mm**
Maximum Travel Considering Solid Height, *Solid Height* $Travel_{max}$:	**87.000 mm**
Physical Dimensions	
Diameter of spring wire, d:	**1.000 mm**
Outer diameter of spring, D_{outer}:	**20.000 mm**
Inner diameter of spring, D_{inner}:	**18.000 mm**
Mean diameter of spring, D_{mean}:	**19.000 mm**
Free length of spring, L_{free}:	**100.000 mm**
Number of active coils, n_a:	**10**
Number of total coils, n_T:	**12**
Solid height, L_{solid}:	**13.000 mm**
Type of ends:	**closed & squared**
Spring index, C:	**19.000**
Distance between coils, $Coil_{pitch}$:	**9.700 mm**
Rise angle of coils:	**9.23**
Material Type	
Material type:	**Music Wire ASTM A228**
Weights & Measures	
Weight of one spring, M:	**0.004425 Kg**
Weight per one thousand springs, M:	**4.424593 Kg**
Length of wire required to make one spring, L_{wire}:	**716.283 mm**
Stress Factors	
Material shear modulus, G:	**79,241,245,136.187Pa**
Maximum shear stress possible, t_{max}:	**1,030,490,425.037**
Wahl correction factor, W:	**1.074**
Suggested Part Number	
Suggested Part Number:	**PC100020000-12-MW-100.000**

Launching Mechanism



Launching Mechanism



Stopping Mechanism

- Magnet attached to the cart
- Metal surface at the finish
- Elastic material to absorb kinetic energy

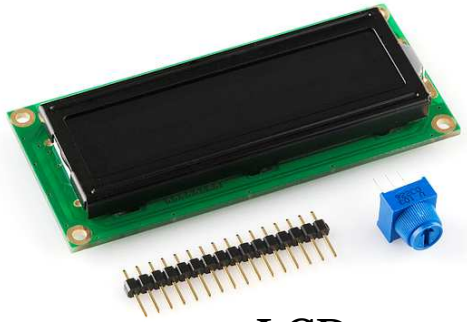
Electrical System

- Arduino Board controlling the system
- LCD showing data
- Photo receiver used for velocity calculation
- Relay to control power of the fans
- IR Transmitter
- Wires for fans
- Wires for circuits

Electrical System

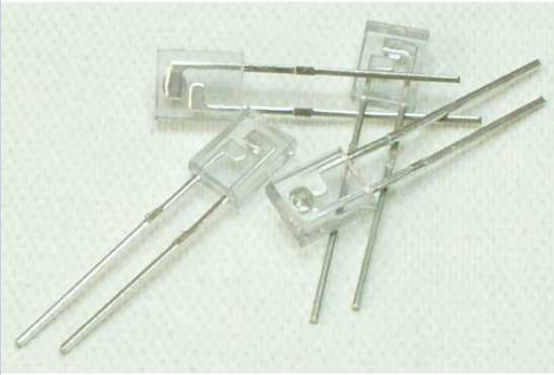
Quantity	Product	Price	Store
1	Arduino Mega	$58,95	Sparkfun Electronics
1	LCD	$15,95	Sparkfun Electronics
4	IR emitters/detectors	$1,95 each	Sparkfun Electronics
2	Relay 10A 5V	$7,85 each	Ebay

Electrical Systems

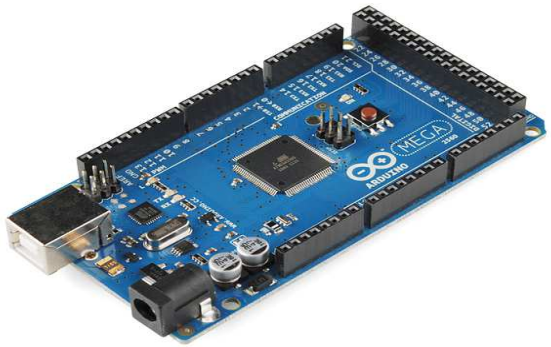


LCD

Relay



IR emitters/detectors



Arduino Mega

Budget

- Total cost for shapes - $254.31
- Estimated cost for electrical ~ $107,14

Future Steps

- Machine shapes
- Assemble shapes to fit on carts
- Implement electrical systems
- Run tests on entire system
- Machine components of starting and stopping mechanisms
- Assemble starting and stopping mechanisms