Miniature Modular Rack Launcher Combo

Senior Design Group 3

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Overview

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- Product Specifications
  - Tigershark UAV Platform
  - Constraints
- Latch System
- Mechanical Safety System
- Sway Brace
- Ejector Mechanism
- Engineering Analysis
- Conclusion/Next Steps

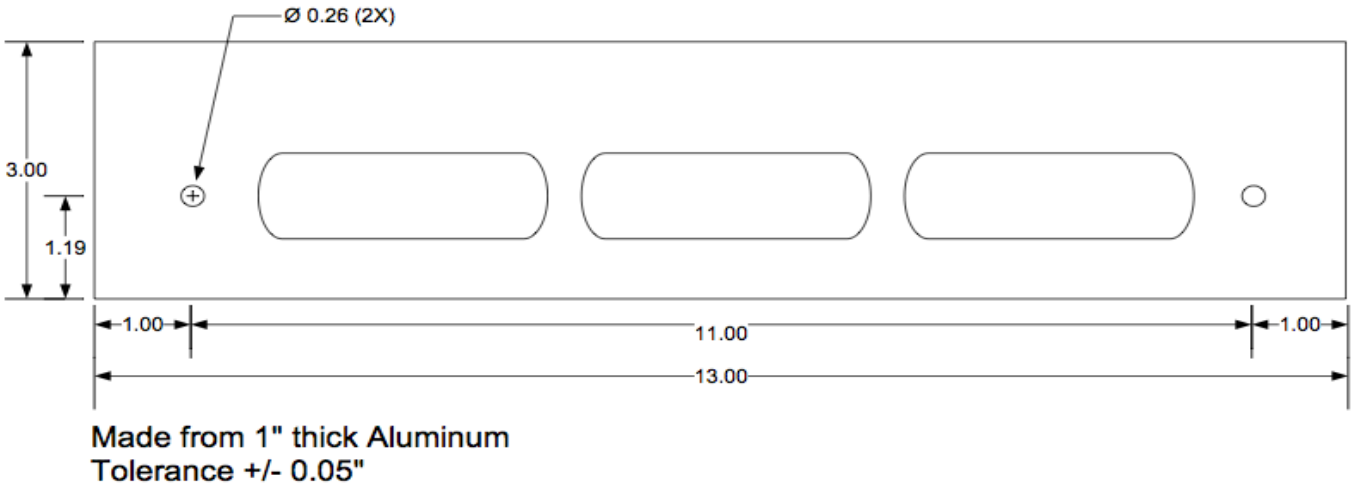
Problem Statement

- Design and develop a Bomb Rack Unit (BRU) that is attached to the Tigershark UAV capable of housing and launching a cylindrical payload.
- BRU must contain an electrical interface that allows the user to go through a safety sequence before the payload is released
- Provide budget analysis for MMRLC
- Prototype and fit check

Tigershark UAV Platform

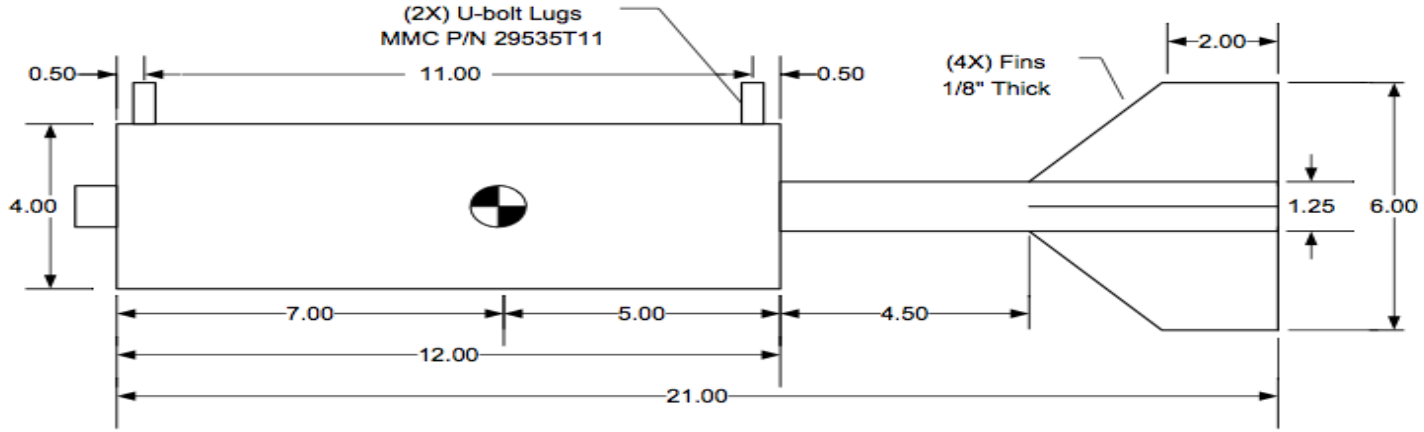
Specifications:

- Wing span 21 feet
- Propulsion - 372cc two stroke
- 20 gallon fuel tank
- Empty airframe weight - 150 lbs.
- Gross take off weight - 300 lbs.
- Payload capacity – 50 lbs.
- One hard-point location per wing for launcher attachment



Constraints

- BRU must not exceed 5 lbs.
- Capable of holding a payload that is 10lbs
- Operation in temperature range -20 to 60 degrees C and during rain exposure
- Retain payload during aircraft maneuvers up to 2GS lateral load and 1G landing shock.

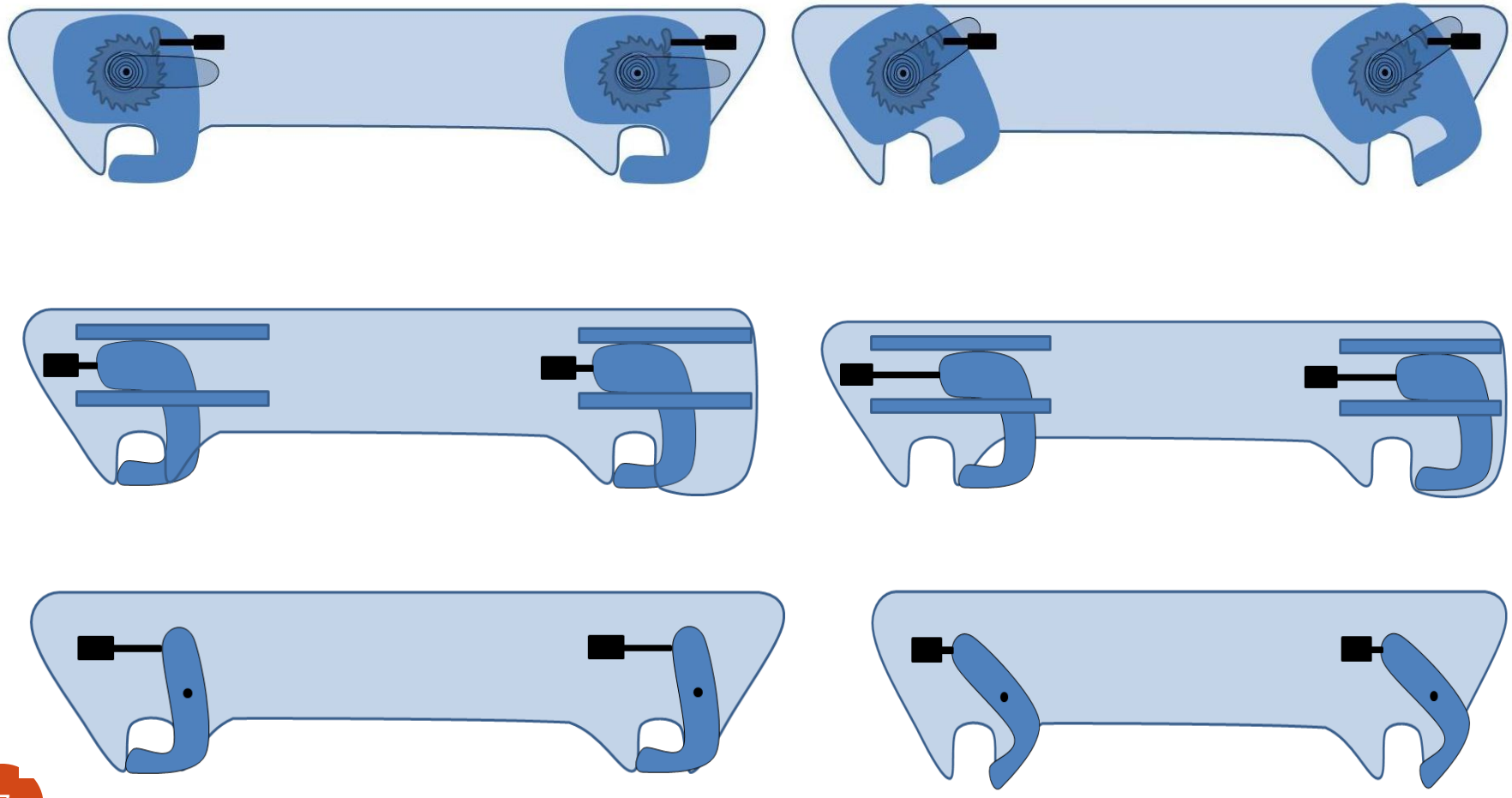


Weight = 10lbs
Tolerance +/- 0.125"

Latch System

- Hold payload in place during aircraft maneuvers
  - 2Gs lateral load
  - 1G Landing shock
- Integrated with safety system that prevents hooks from opening before “ARM” signal is received.
- Integrated into electrical interface allowing the hooks to swing away during the “RELEASE” command

Latch System Designs



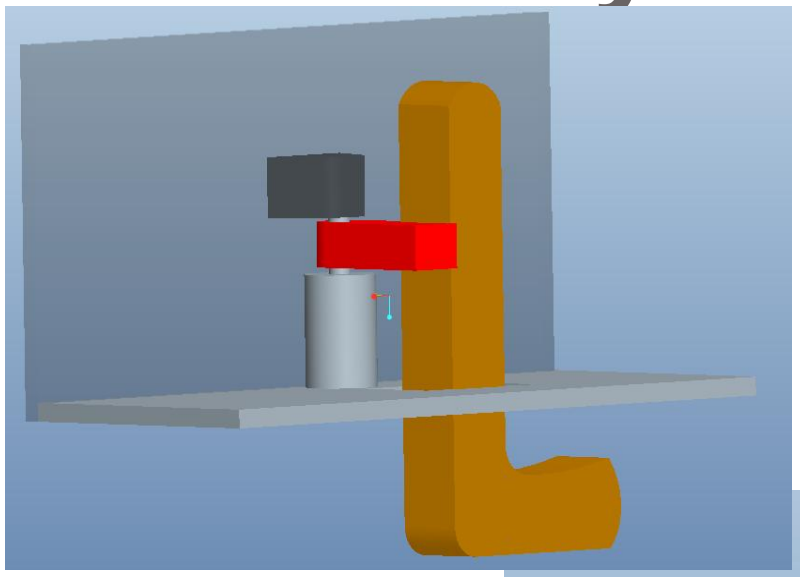
Mechanical Safety System

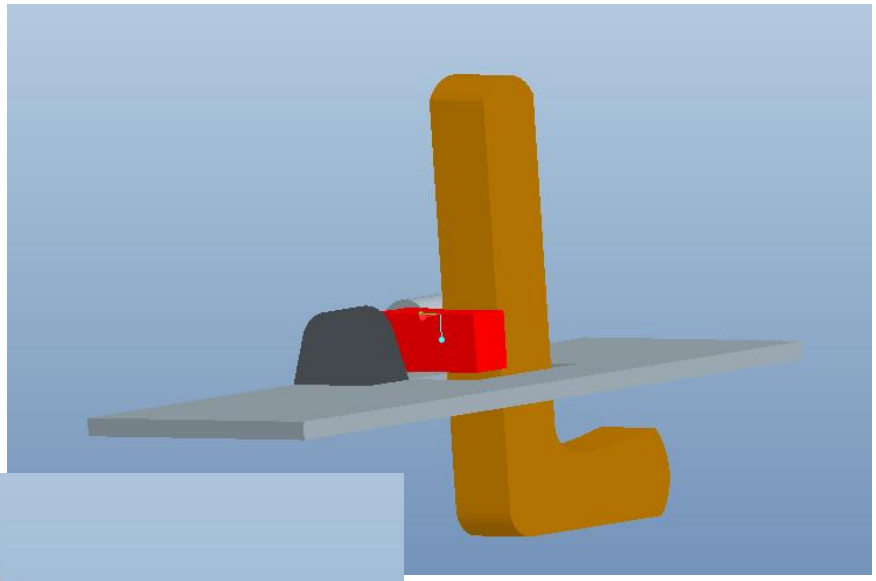
- Moves to allow the hook to open when the system is put in “Armed” mode
- Uses a servomotor to achieve this motion

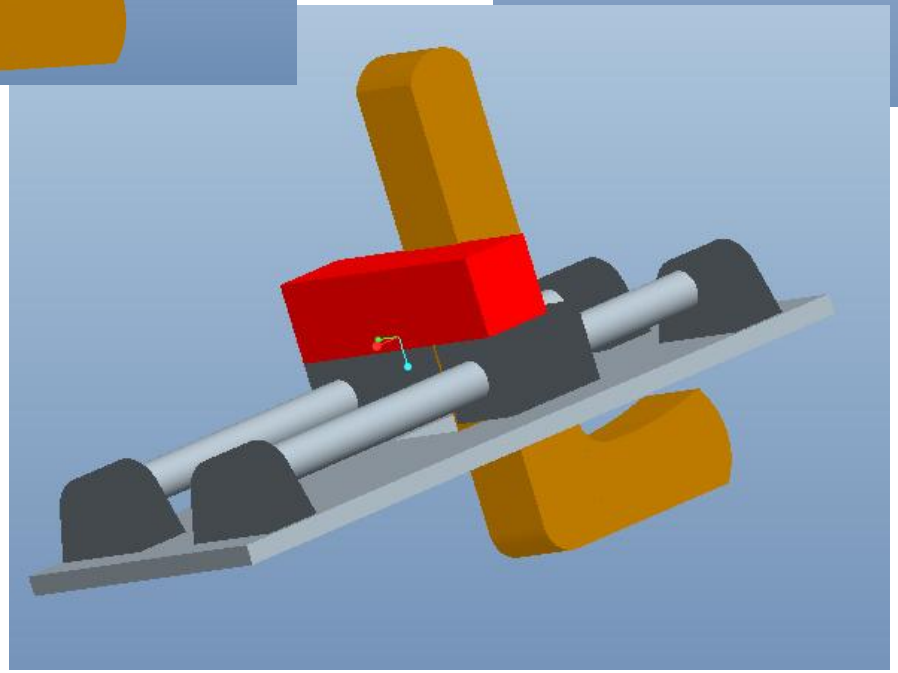
Constraints:

- Safety pins that mechanically inhibit launching mechanisms during ground procedures
  - Pins labeled with red “Remove Before Flight” flags
- Safety feature that interrupts launch mechanism until “ARM” command is received from the aircraft.
- Launcher shall eject payload when “RELEASE” command is received from the aircraft

Mechanical Safety System Designs



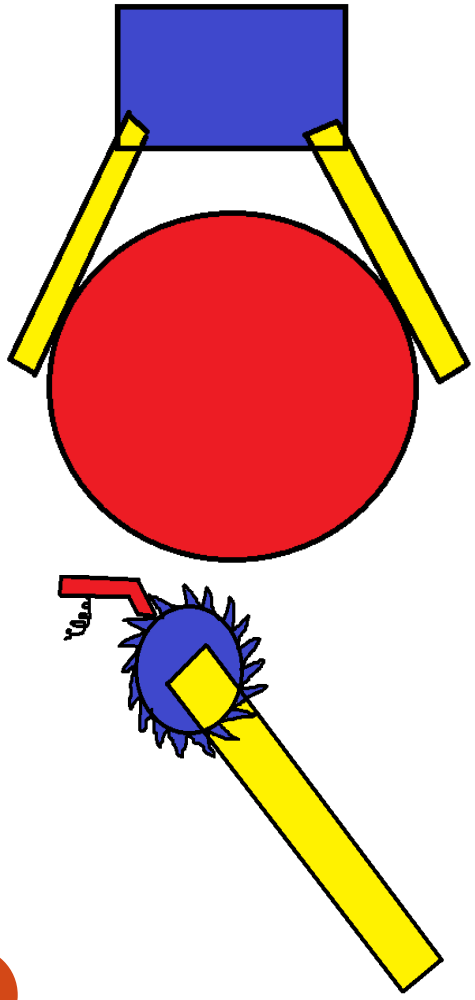


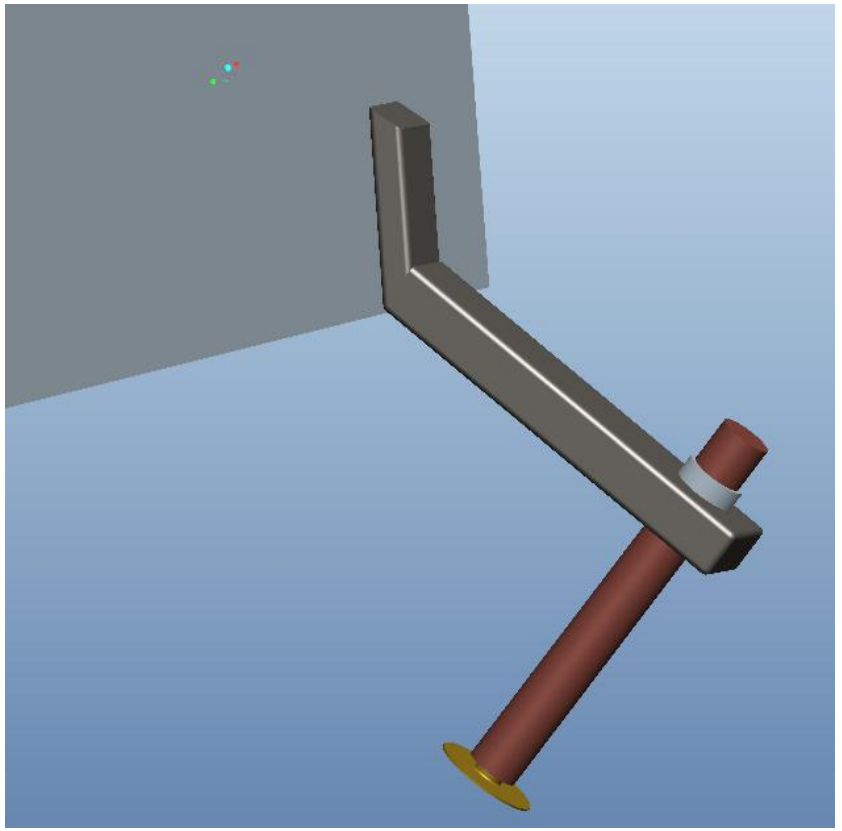


Sway Brace

- Designed to keep payload stable during air operations
- Must be able to withstand aircraft maneuvers up to 2GS lateral load and 1G landing shock
- Sway brace may be able to adjust depending on the size/shape of payload
- Brace must be easy to use allowing the ground crew easily add and remove payloads.

Sway Brace Designs

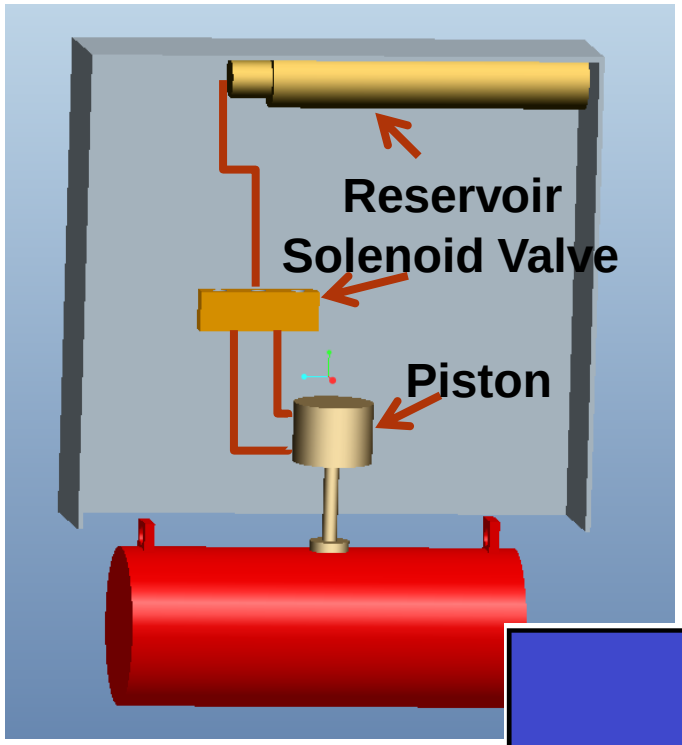


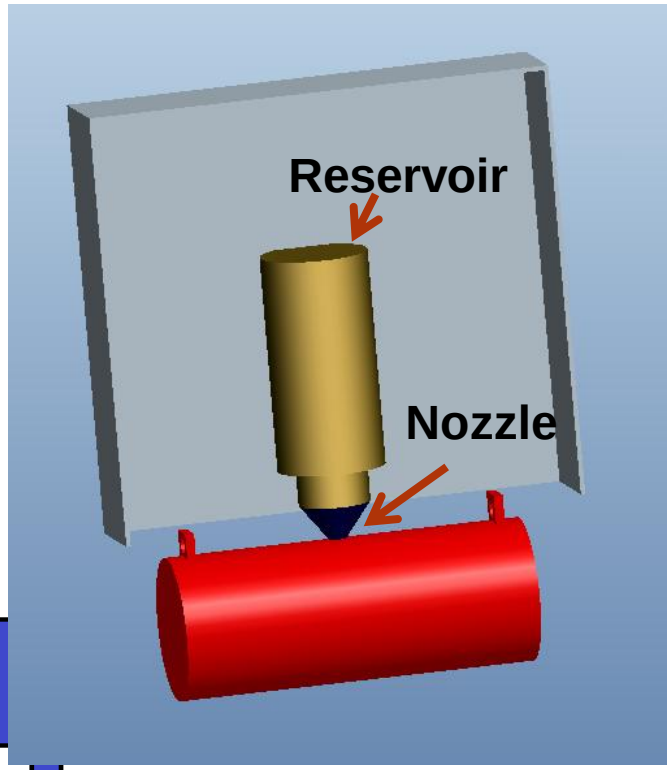


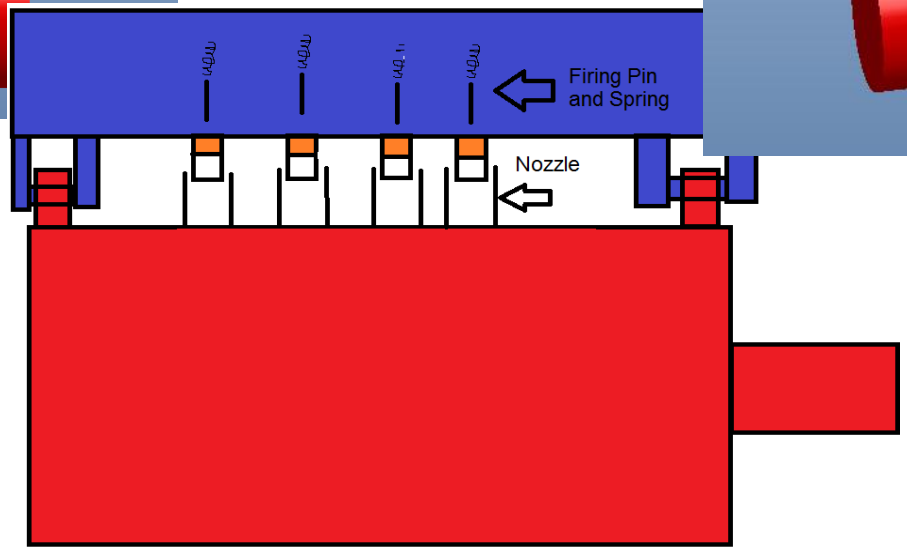
Ejector Mechanism

- Launcher will eject payload when “RELEASE” command is received from the aircraft.
- Free fall will not allow enough separation between the wing and payload
- Ejection velocity shall be a minimum of 10ft/s
- Net ejection energy of no more than 75 ft-lbs

Ejector Designs







Engineering Analysis

Latch System

- **F = -k * x** spring force
- **F = m * a** weight force
- **T = r x F** torque

Mechanical Safety System

- **∑F = 0 – Motor Strength**
- **Shear Forces – Block Size**
- **Bending Moment – Material Selection**
- **Speed of the System**

Sway Brace

- **Shape**
- **Stress Concentrations**
- **Bending Moment**
- **Bolt Properties**
- **Lightweight, High Strength**

Ejection System

- **Ejection Speed / Linear Momentum**
- **P=(314.04 psi)*exp(T/69.64˚F)**
  - Pressure inside CO_2 Reservoir
  - Based on outside air temp
  - Only holds when CO_2 liquid is present
- **Safety Precautions**
- **Ejection Energy**

Conclusion/Next Steps

- Complete energy analysis on subsystems
- Integrate subsystems into one cohesive system
- Finalize design
- Order parts
- Present final design

Remaining Fall Schedule				
I.D.	Description	Start	Finish	Duration
1	Engineering Analysis	11/10/2011	11/29/2011	19 days
2	Part/Material Selection	11/18/2011	11/29/2011	11 days
3	Finalize Design	11/22/2011	11/30/2011	8 days
4	Order Parts	11/30/2011	12/06/2011	6 days
5	Present Final Design	12/06/2011	12/08/2001	3 days

Questions ????