Compact Pneumatic UAV Launcher

FAMU - FSU College of Engineering

Sponsored By Eglin Air Force Base

Launch Team - Group 3

Enye' Blocker

Jared Rodriguez

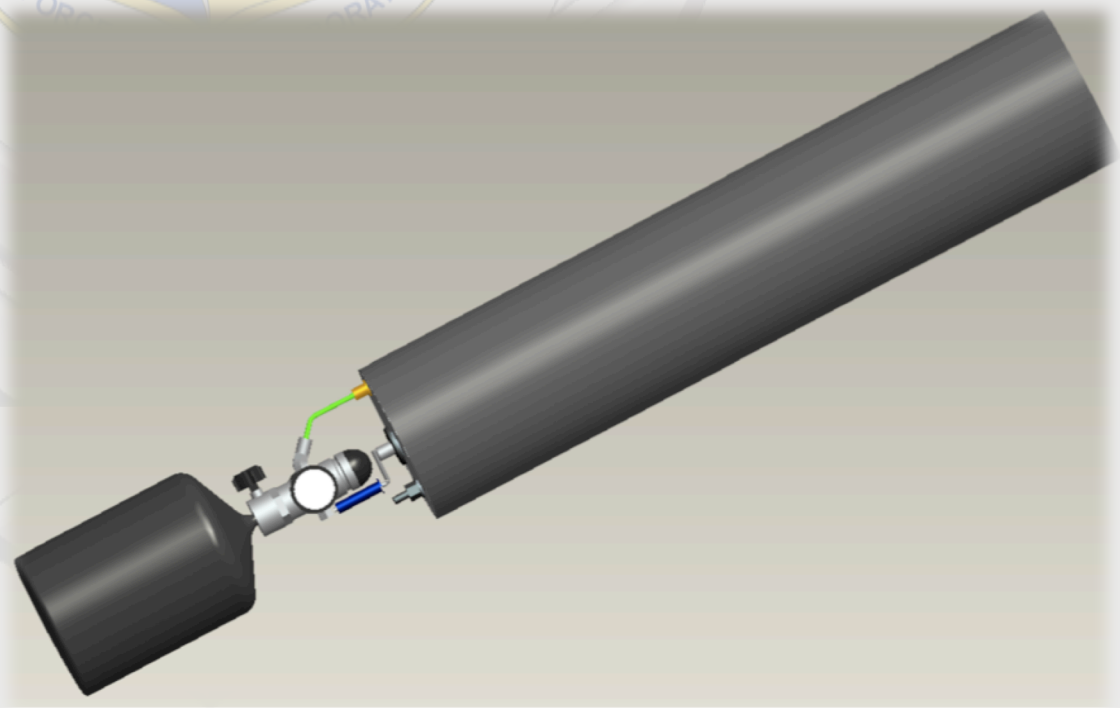
Timothy Bartlett

Adewale Adelakun

Overview

- Problem Statement & Background
- Design Specifications
- Progress To Date
- Interim Design
- Anticipated Prototype
- Experimental Plan
- Final Design

- Assumptions
- Theoretical Calculations



Explanation

Problem Statement

Eglin Air Force Base needs a safe, efficient, and effective method of launching their current UAV prototype into flight.

Needs Assessment

The objective of this design is to provide a means of propelling an Unmanned Aerial Vehicle (UAV) into flight, which will be provided by Eglin Air Force Base.

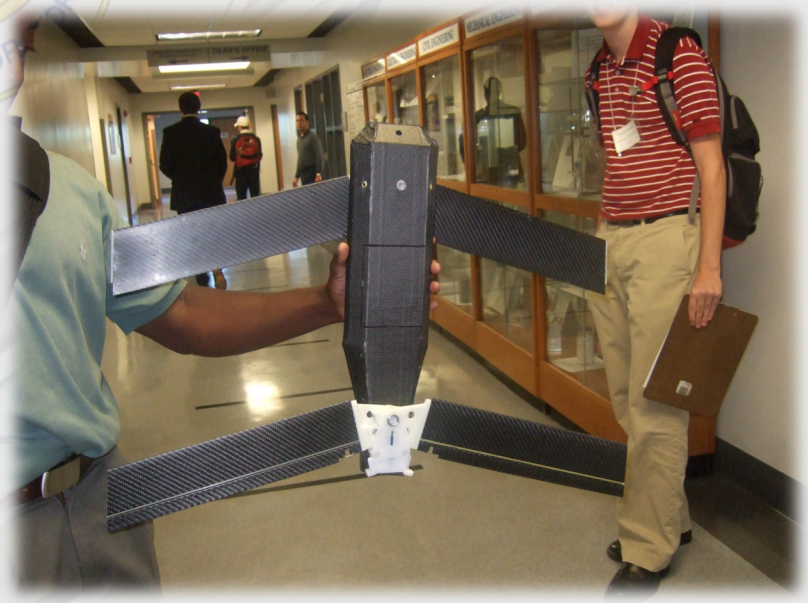
Background

- Currently launched by hand, tubing, or other aircraft
- Methods do not meet the EAFB standards
- Better means of launch must be developed

Design Specifications

Launcher

- 60 ft/sec min exit velocity
- Max 600Gs Instantaneous acc
- Launcher weight limit: 2.5 lbs -> 5.5lb (due to requisition and approval)
- Estimated 30-45 deg launch angle
- No energetic methods or accelerants
- Must be repeatable a min of 5x
- Customer prefers a tubular design
- Max dim 36” L x 4.5”W x 4.5”H square or 36” L x 5.5” OD
- Unimproved surface conditions

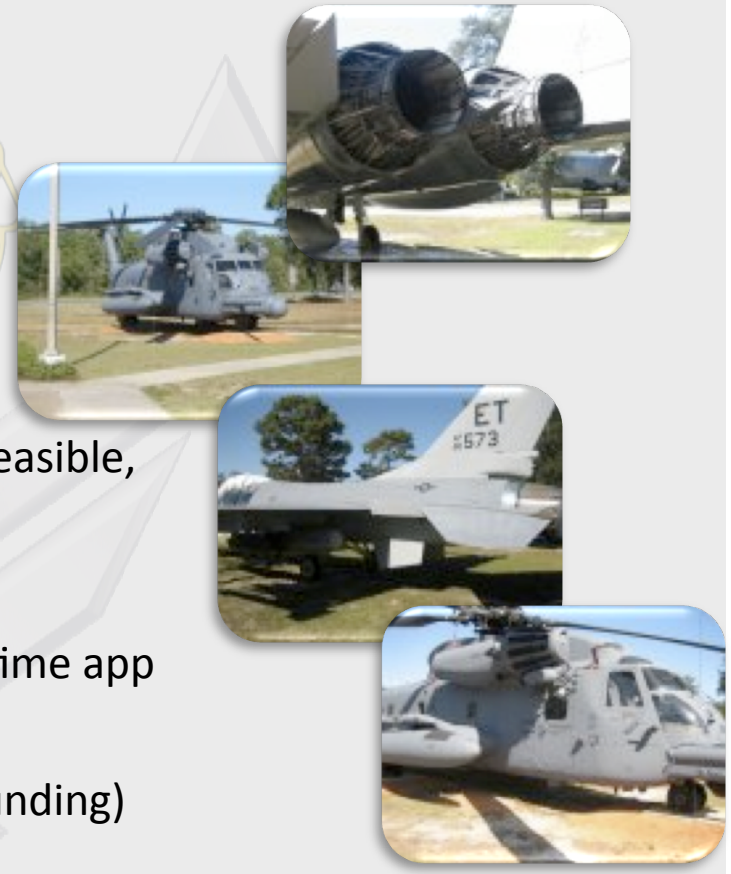


UAV

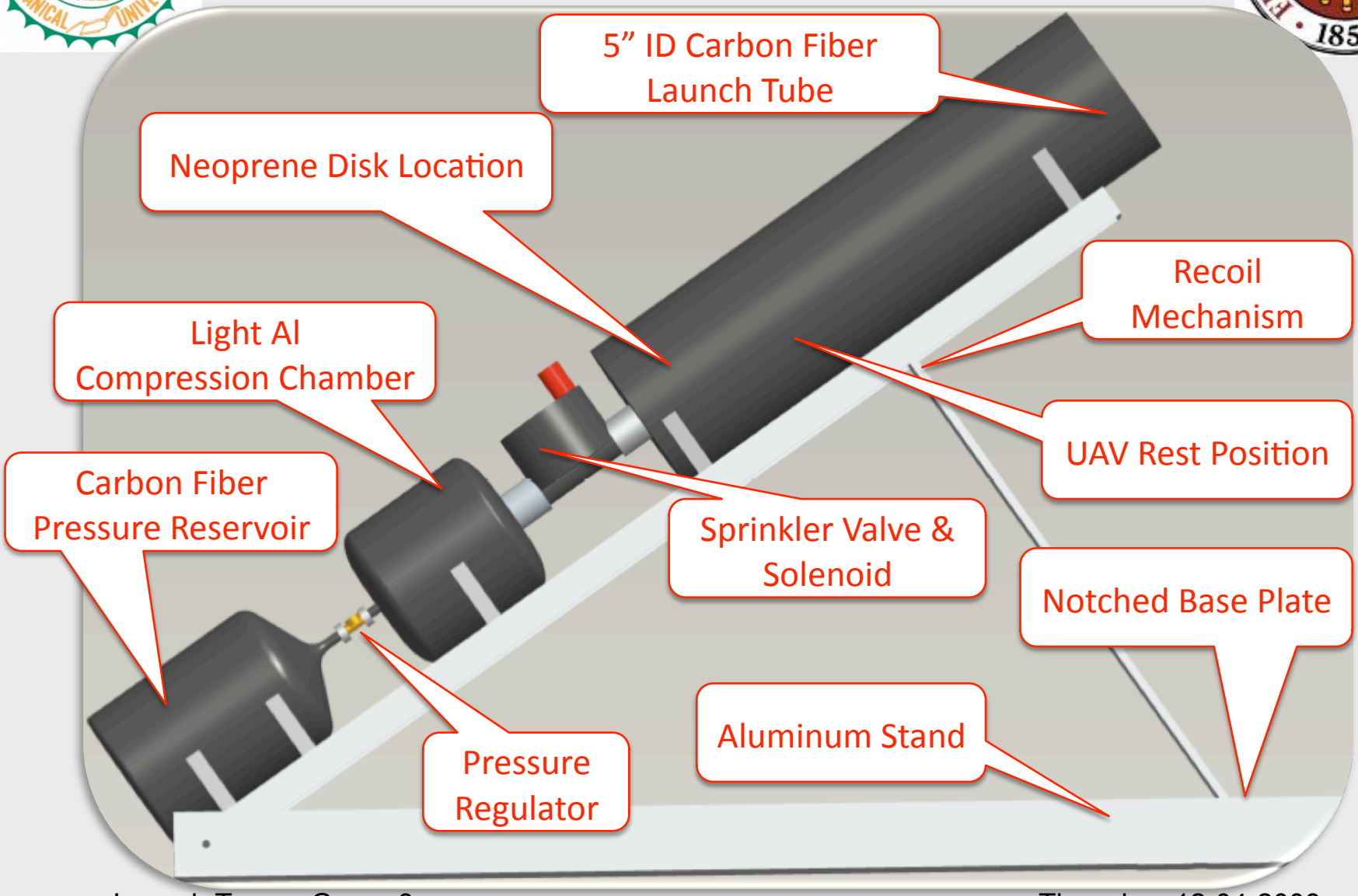
- Approx 3.5lb fully equipped
- Estimated 18” L x 4” W x 2.5” H in launch position

Progress to Date

- Thorough research
- Proper theoretical mathematical analysis
- Completed a feasible conceptual design
- Altered the conceptual design to a more efficient, feasible, & safe interim design
- Visited sponsor to assess situation & visualize real-time app
- Derived a feasible prototype for testing (awaiting funding)
- Optimized the interim design to more effectively meet requirements



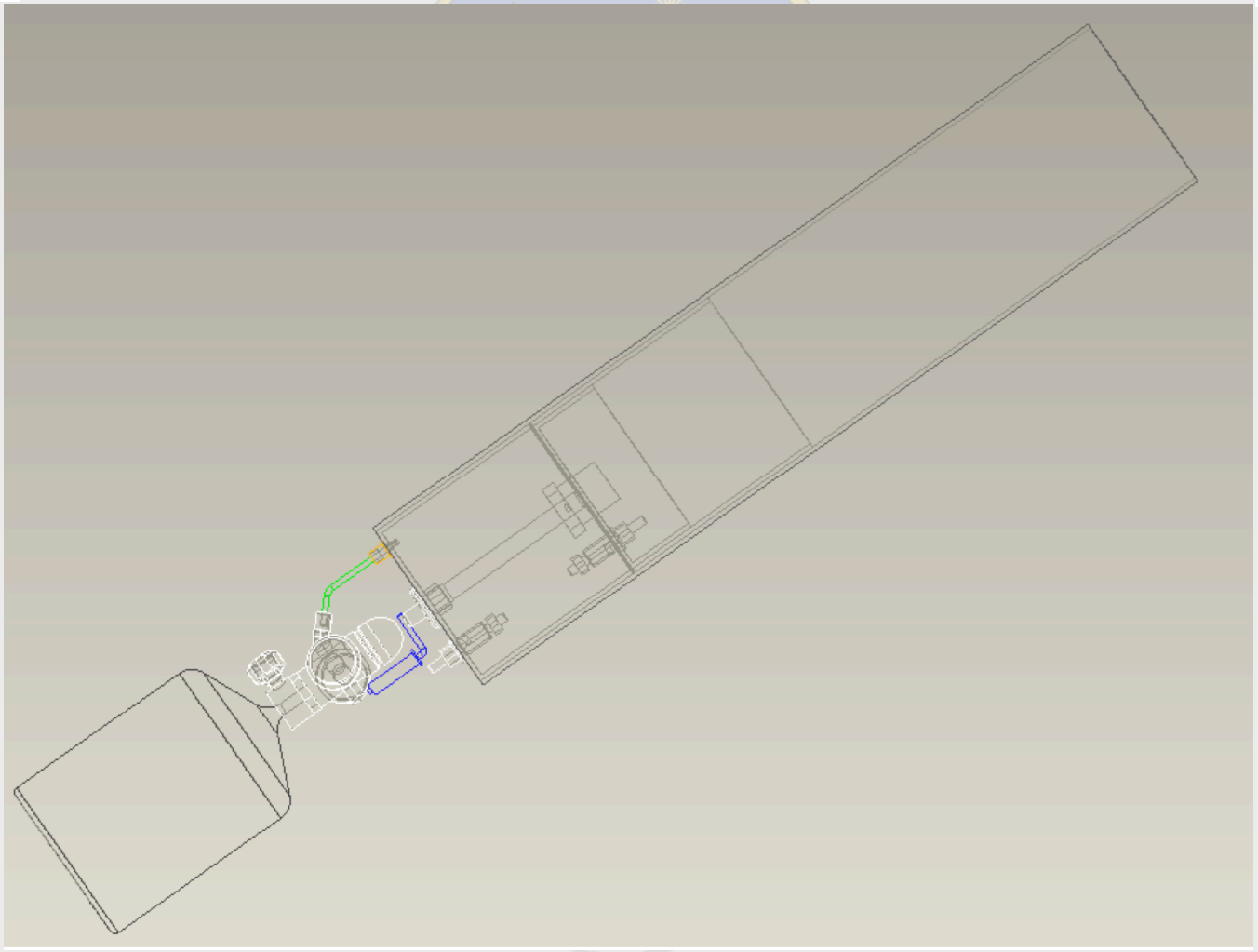
Interim Aspiration



Final Design Changes

- Implemented
  - Rear positioned quick release push pin
  - Tethered cable stopping mechanism
  - Prefabricated bipod legs as a stand option
  - Internal charge chamber
- Removed
  - Valve component for simplicity
  - External compression chamber

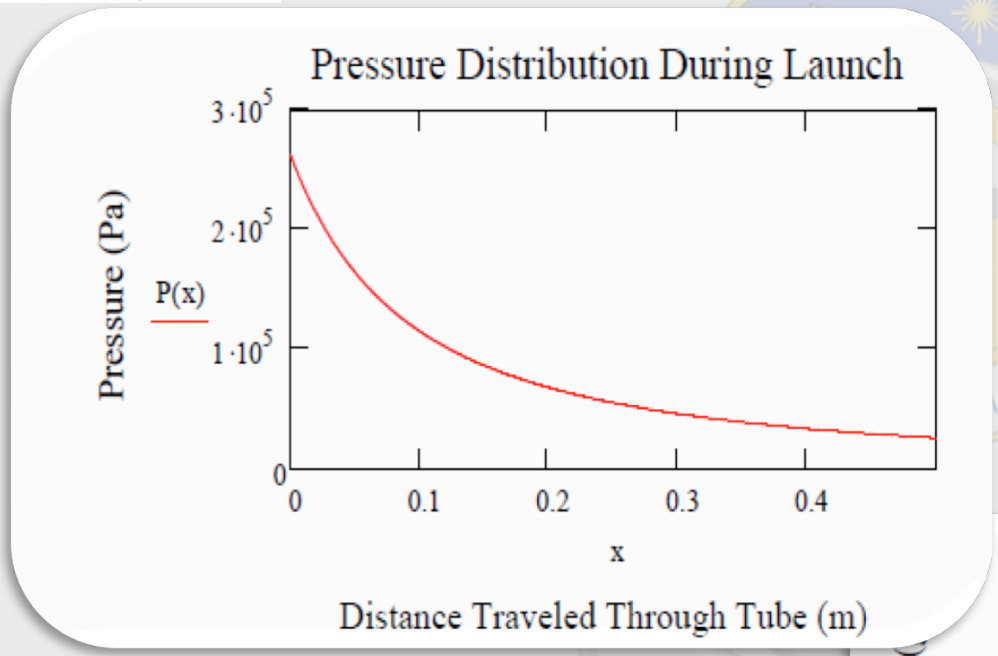
Final Design

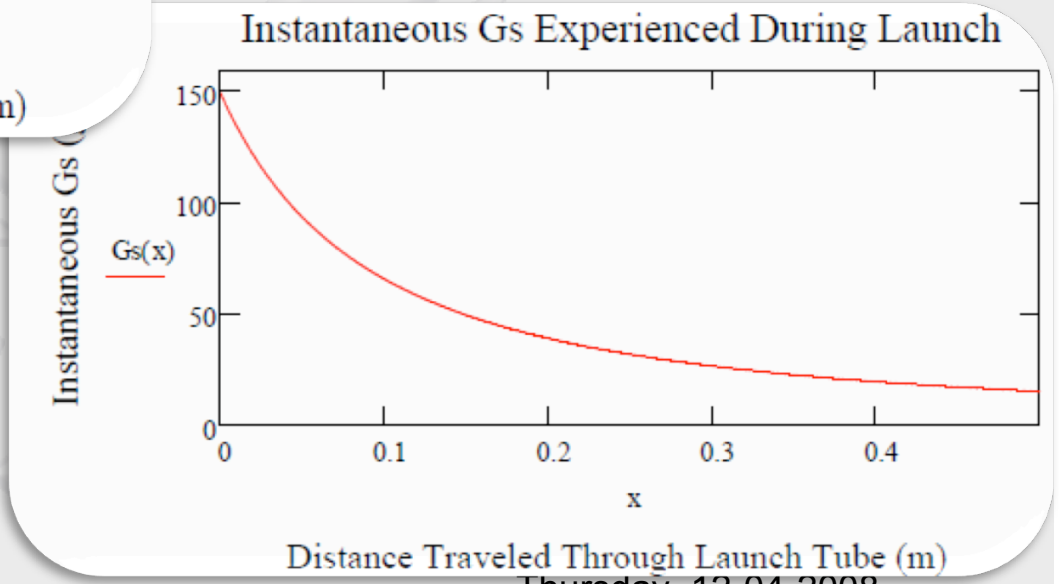


Mathematical Assumptions

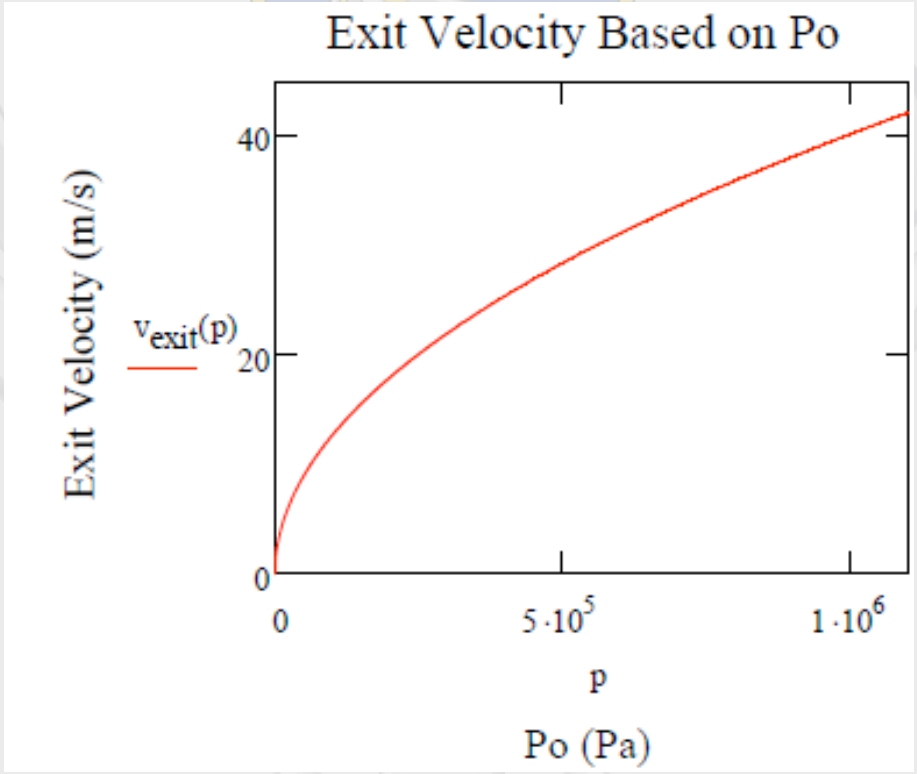
- Adiabatic, isentropic expansion
- Launch angle 45 degrees
- Neglecting vibrations & friction
- Factors of safety
- Impulse stopping force

Mathematical Analysis





Mathematical Analysis



Financial Aspect

Prototype Component	Qty	Price	Vendor	Final Design Component	Qty	Price	Vendor
PVC Cleaner	1	4.94	Lowes				
PVC Primer	1	2.52	Lowes	Carbon Fiber Reservoir	1	154.95	Guerrilla Air
Clear Cement	1	3.48	Lowes	In-Line Pressure Regulator	1	39.95	Lowes
Gas Tape	1	2.63	Lowes	Gas Tape	1	2.63	Lowes
5"x3' Acrylic PVC Pipe Sch 40	1	109.36	MMC	4"x2' PVC Pipe Sch 40	1	4.97	Lowes
4"x2" PVC Coupling	1	4.93	Lowes	Steel Braided Line	1	19.90	Lowes
1" PVC Ball Valve	1	5.17	Lowes	1" PVC Ball Valve	1	5.17	Lowes
2"x2' PVC Pipe Sch 40	1	2.53	Lowes	Aluminum Stand Fabrication	1	200.00	Eglin AFB
2"x1' Sch 20 Bushing	1	1.76	Lowes	Carbon Fiber Fabrication	1	375.00	Eglin AFB
5" PVC Cap	2	5.44	Lowes	4" PVC Cap	2	5.44	Lowes
1" Rainbird Valve	1	15.78	Lowes	Rainbird Valve	1	15.78	Lowes
5" Neoprene Backing Disk	1	30.00	MMC	Neoprene Backing Disk	1	-	MMC
5" Foam Backing Disk	1pk	15.00	MMC	Foam Backing Disk	1pk	-	MMC
Total with 7.5% Tax		**224.65**		**Total with 7.5% Tax**		**891.4**	
				Total with Eglin Supplement		**267.5**	

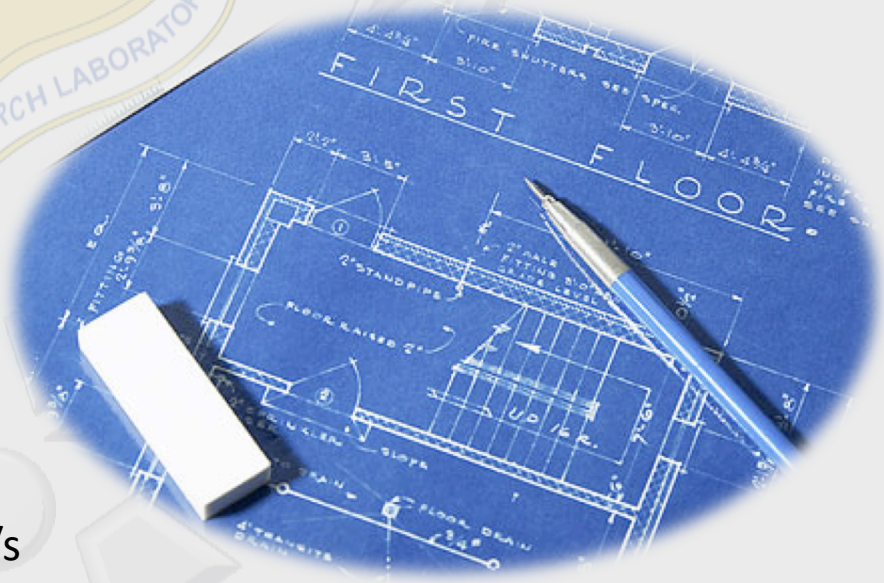
Experimental Plan

Purpose

To better understand the processes and theories associated with launching a non-uniform projectile from a tube & to collect actual data to manipulate launcher performance.

Components

- Using the prototype PVC launcher
- 50yrd open field



Data Collection

- Methods to reduce “blow-by”
- The effects of barrel length
- Effects of recoil
- Assuring minimum exit velocity of 60ft/s
- Assuring not to exceed maximum acceleration of 600Gs
- How the pressure increases or decreases over the distance of the launch tube

About to Take Flight…

72hr Plan:

- Revise & submit "Spring Proposal"
- Meet with customer for update

7 Day Plan:

- Finalize & check status of all machining, testing, and equipment

14 Day Plan:

- Concentrate on executing spring semester plan effectively

For further info see geocities.com/jrod23dhs/group3.html

Recognition

Sponsor – Eglin AFB

- John Deep
- Jeff Wagener

Technical Support

- Dr. Alvi - Calculations
- Dr. Shih - Guidance
- Hobby Town USA - Guidance

THANKS TO ALL