

# Maritime Drone Launcher System (MDLS)

Brody Baker  
Connor Barrett  
Richard Garcia  
Alex Moeller

[1] SCIFIN.net



# Team Members

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- **Brody Baker:**

Senior Mechanical Engineering student at Florida State University Panama City. Experienced in 3-D modeling and design conceptualization. Brody has the role of Team Leader for the Maritime Drone Launcher Team.

- **Connor Barrett:**

Senior Mechanical Engineering student at Florida State University Panama City. Areas of interest include materials, robotics, and 3-D CAD. Connor will act as the systems engineer on the project.

- **Richard Garcia:**

Senior Mechanical Engineering student at Florida State University Panama City. Newest addition to the class with experience in creativity. The role in the project is to make sure all of the mathematics line up and double checking the values.

- **Alex Moeller:**

Senior Mechanical Engineering student at Florida State University Panama City. Alex has the role of logistics and prototyping pertaining to cost analysis and data acquisition.

# Need Statement

There is a large gap in technology between the military and commercial market when it comes to mid sized, long distance drone launchers.

Commercially available drone launchers would allow for greater distances of travel and longer flight times due to the drone not having to expend its own energy to take-off and climb to altitude.

The ability to launch a drone from a boat would be very beneficial to organizations such as law enforcement and the coast guard as they will have the ability to conduct longer searches for people stranded at sea or criminals in or around the water.



[3] [bucketlistly.blog](https://www.bucketlistly.blog)

[4] CBS News



Garcia 3

# Significance

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## Rescue:

- Rescue teams will be able to locate people in need of emergency service at remote locations.
- Larger search areas will be possible than what is currently feasible.
- More areas can be searched simultaneously.

## Supply:

- Deliver crucial supplies and medicine to rural locations that would otherwise be impractical to reach.

## Patrol:

- Law Enforcement will be able to locate criminals by surveying larger areas of open water, rural land, and waterways.

# Objectives and Scope

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The objective of our project is to design a drone launching system capable of interfacing with various small watercraft used by state and federal organizations.

- System should be capable of launching mid-sized fixed-wing drones that can carry payloads and reconnaissance suites. Various commercial drones may be suitable.
- Transportable and deployable by at least two people.
- Should not interfere with the safe operation of the vessel on which it is mounted.
- End product should be affordable enough to supply different agencies and organizations with sufficient systems to support operational tempos and requirements.

# Constraints



[5] GCaptian



[6] Pensacola News Journal

- The Launcher should be able to mount on any boat over 19 feet in length. This would make it functional for most Coast Guard and law enforcement vessels. [7][8]
- Capable of launching drones weighing up to 15 pounds and with a wingspan of up to 8 feet. [9]
- The entire launcher system should weigh less than 100 pounds to allow for safe two person carry. [10]
- The launcher prototype should cost under \$4000 for all components and assembly costs.
- Must comply with all U.S. Coast Guard requirements for safe boat operation.[11]

# Collaboration

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## Engineering Aspects of the Project:

- Electrical Systems
- Computer-Aided Design
- Material Selection, Strength, and Testing
- Systems Engineering
- Dynamics
- Aerodynamics

## Technical Advisors:

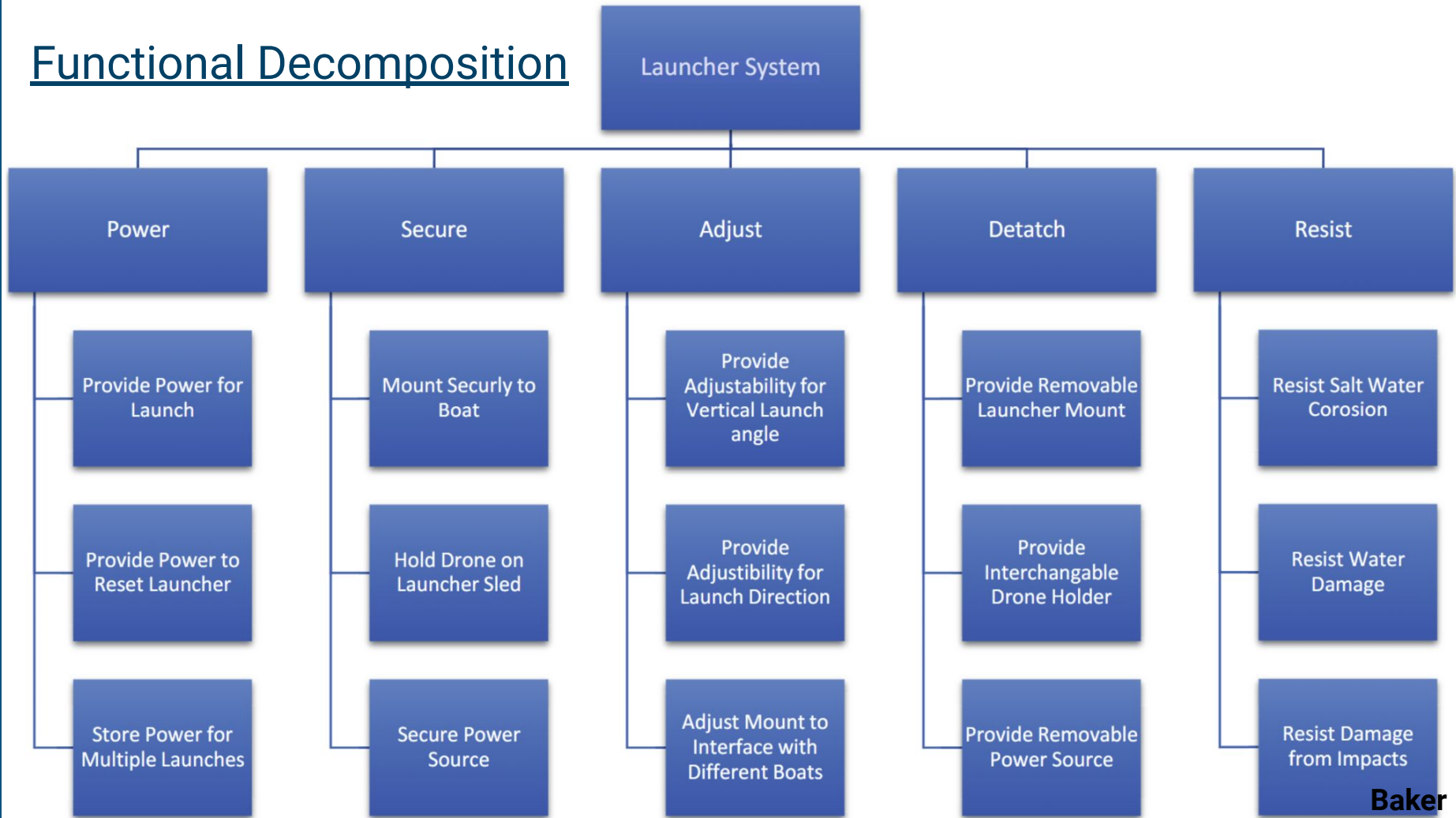
Due to the complexity of the project, we have sought after several sources of technical advice. *Dr. Mauricio Chagas* has agreed to be a technical advisor for the project. We are also collaborating with the senior electrical engineering students at FSU PC for technical assistance in the electrical field.

## Florida Fish and Wildlife Conservation Commission:

To design the best product for our target customer, we have reached out to the *Florida Fish and Wildlife Conservation Commission (FWC)* to gain a better understanding of their possible uses for the Drone Launcher. We have discussed the project with *Captain Mark Clements* from the FWC and we plan on having continued communication with FWC throughout the project duration.



# Functional Decomposition





# Benchmarking

Zipline [9]

Launcher Price: ~ \$ NA  
\$2.75 Billion Company

- UAV Specs
  - Weight: 44 lbs
  - Payload: 4 lbs
  - Wingspan: 11 ft
- Launcher
  - Steel rail with electric motor
  - Accelerates drone to 67 mph in 0.3 seconds



ElevonX Scorpion Launcher and SKYEYE DELTA UAV [12]  
Launcher Price: ~ \$4000 - \$6000

- UAV Specs
  - Weight: 13.8 lbs
  - Payload: 4.4 lbs
  - Wingspan: 7.5 ft
- Launcher
  - Elastic bands are put under tension with a winch to provide power
  - Accelerates UAV to 44.7 mph
  - 22 lbs max take-off weight
  - Length is 7.87 ft
  - Weighs less than 44 lbs
  - Foldable
  - CNC machined aluminum and stainless steel



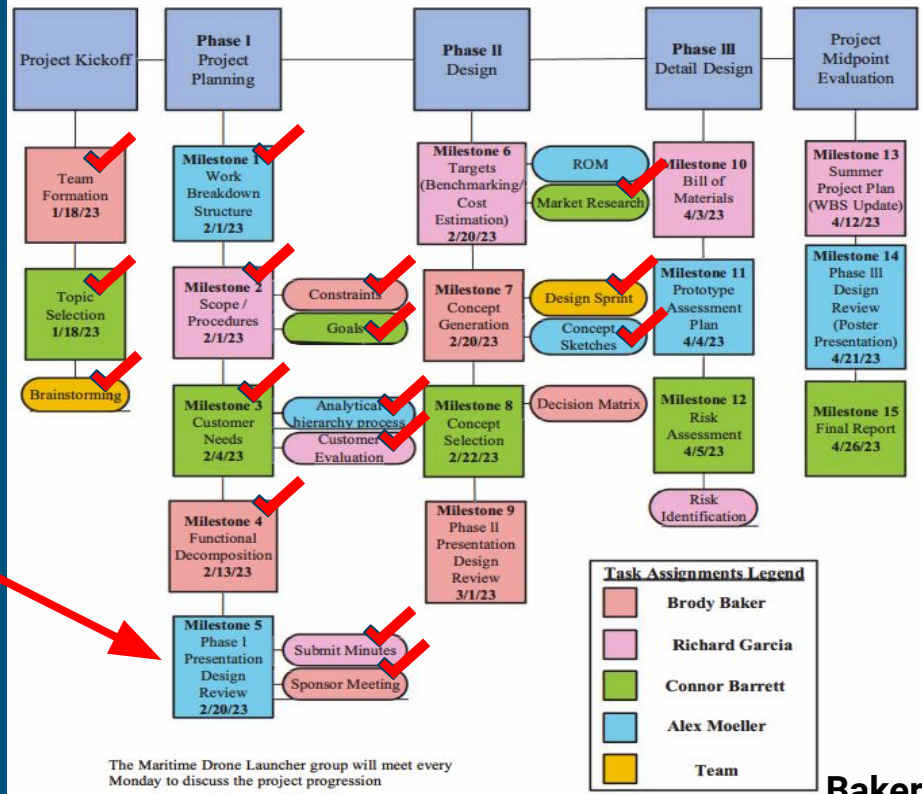
Schedule: EML4551 Senior Design I- Spring 2023  
 WEEK (M Date) TOPIC

Revision 2 (2/6/2023)  
 Key Events in Green

- 1 (10 Jan) Lecture: EML4551 Introduction PPT  
 Attendance Individual Assignment: Pre-Emergency Survey (due 1/11)  
 Reading Review Individual Assignment: Senior Design Website (due1/11)  
 Review EDM design pitches  
 Project Kickoff: Initiate topic & team selection  
 \*\*\*\*\* MLK (Mon 1/16/2023)\*\*\*\*\*
- 2 (16 Jan) Team Topic / Members confirmed/ Project Manager Selected  
 Project Manager confirms Team Members & Topic via email by 1/18
- 3 (23 Jan) **STEM FAIR & Danfoss Plant Tour:** Tallahassee (Tuesday 24, 2023)  
 Milestone 1 (WBS) preliminary on-paper submittal due 1/25, **Electronic upload by 2/1**  
**Trane Plant Visit Friday 1/27**
- 4 (30 Jan) Milestone 2 (Scope/Procedures) submittal due 2/1  
 Advisor / Sponsor Selection Process: Pre-Advisor/Sponsor Meeting- Submit Agenda  
**Eastern Shipbuilding Visit Friday 2/3**
- 5 (6 Feb) **Note: Lecture Class moved to Wednesday 2/8 with Guest Sponsors: Mr. & Mrs. J. Dafoe**  
 Individual Homework Assignment: Professional Communication (e.g. Letter of Submittal) due 2/8  
 Milestone 4 (Functional Decomposition) submittal due **2-6-2/13**
- 6 (13 Feb) Meeting 1 (minimum of 3 meetings Advisor or 2 meetings Sponsor during the semester) with  
 Advisor/Sponsor Meeting- Submit Minutes  
 Milestone 5: Design Review Presentation 1 (245 2/20)
- 7 (20 Feb) Milestone 8: Concept Selection submittal due 2/22
- 8 (27 Feb) Submittal due for Student Research Symposium <https://pc.fsu.edu/student-research/symposium>  
 Milestone 9: Design Review (Conclusion of Preliminary Design with Concept Selection): 3/1
- 9 (6 March) "Embodiment Design Phase" in work  
 Peer Evaluation 1 due 3/8, **FSU-PC STEM Career Fair**  
 \*\*\*\*\* Spring Break (March 13-17, 2023) \*\*\*\*\*
- 10 (20 Mar) "Embodiment Design Phase / Detail Design Phase" in work  
 Advisor / Sponsor Meeting- Submit Minutes  
 Reading Assignment: Ethics due 3/22
- 11 (27 Mar) Individual Homework Assignment: Biographical Sketch  
 "Detail Design Phase" in work  
 Milestone 10 (Bill of Materials) due 4/3
- 12 (3 Apr) Individual Homework Assignment: Linked In setup  
 Milestone 12 Risk Assessment due 4/5  
**ENGINEERING DAY- Tallahassee (Thursday April 6)**
- 13 (10Apr) Milestone 13 (Summer Project Plan) due 4/12
- 14 (17 Apr) *Order all Materials for EML4552- include needs for prototype as well as project construction.*  
 Milestone 14: Poster Presentation 4/21  
**Friday April 21: FSU Panama City Undergraduate Research Day**  
<https://pc.fsu.edu/student-research/symposium>

**Maritime Drone Launcher**  
**Team Members:**  
 Alex Moeller, Connor Barrett, Richard Garcia  
**Project Lead:**  
 Brody Baker

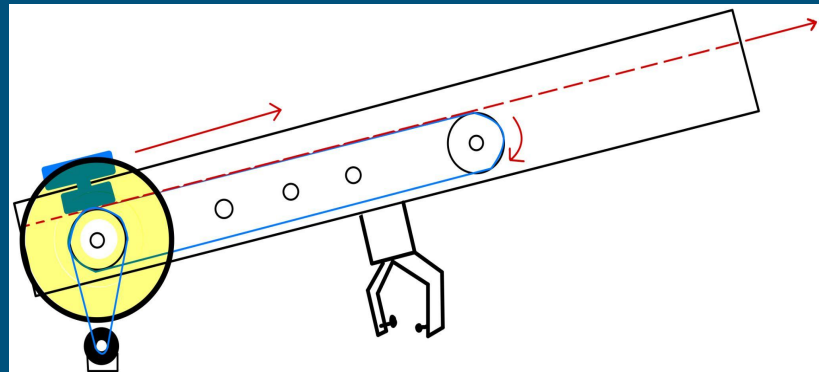
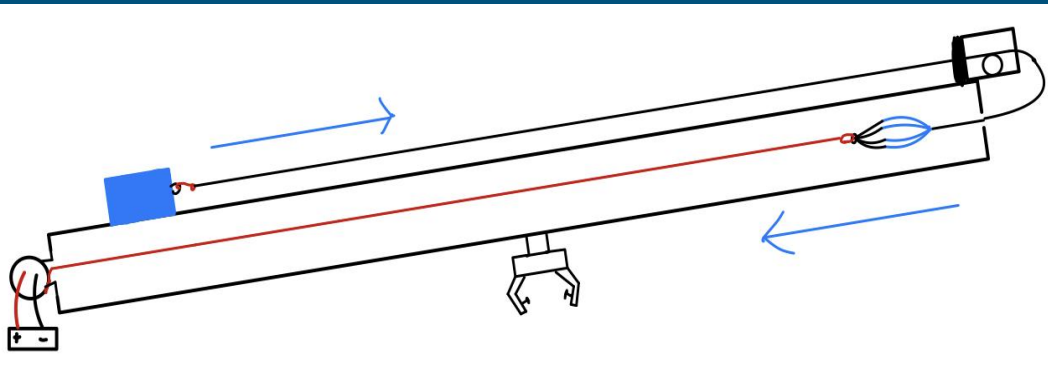
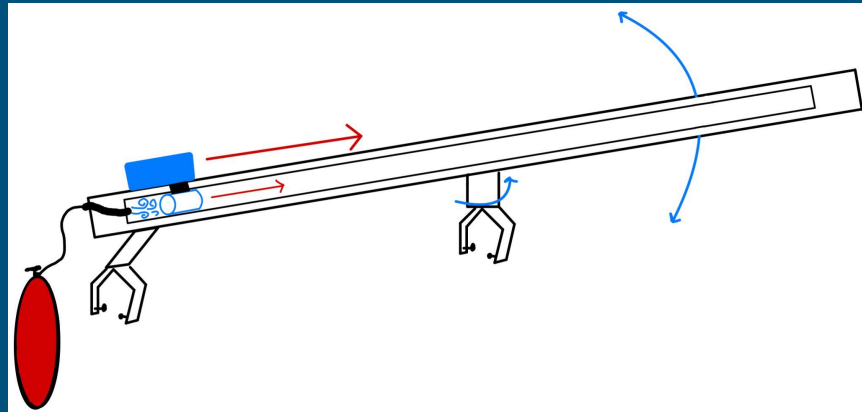
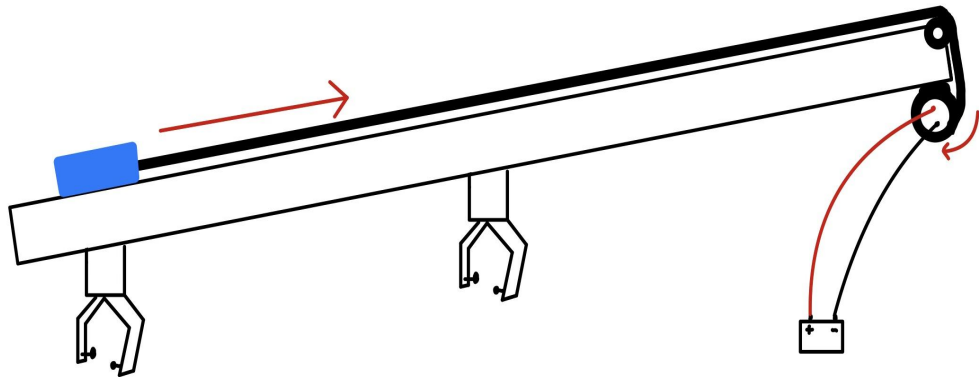
Date: 1/30/23  
 Revision: 0



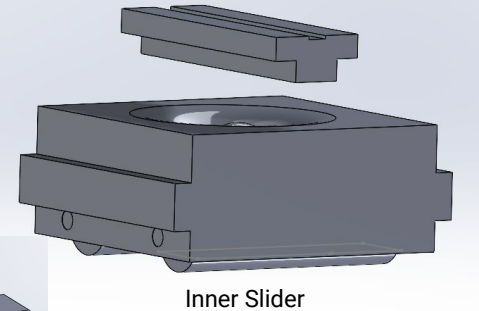
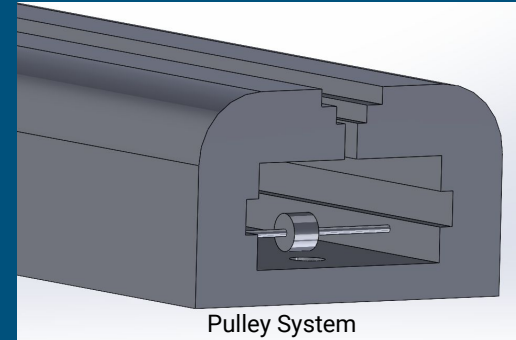
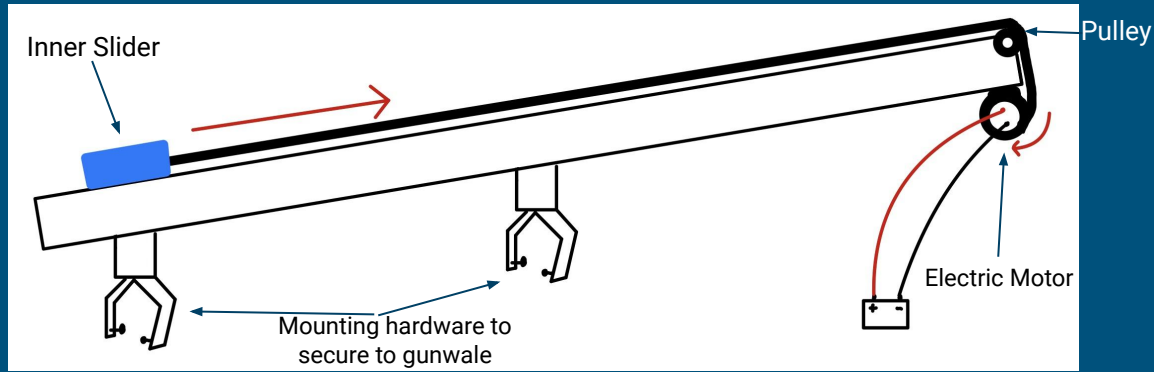
We Are Here

The Maritime Drone Launcher group will meet every Monday to discuss the project progression

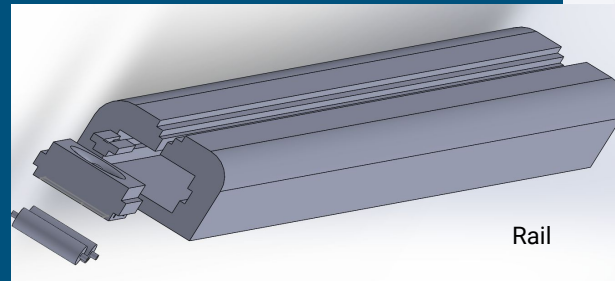
# Concepts



# Concept 1: Electric Motor



- Features**
- Driven by an electric motor
  - Easy to swap drone mounts
  - Clamps securely to gunwale of boat



# Concept 1: Rough Cost Estimation

## Electrical:

- Marine Grade Battery ~ \$100 [13]
- DC Motor ~ \$1000 [14]
- Motor Driver ~ \$700 [15]
- Microcontroller ~ \$50 [16]
- Electrical Wire ~ \$50 [17]
- Capacitor ~\$100 [18]

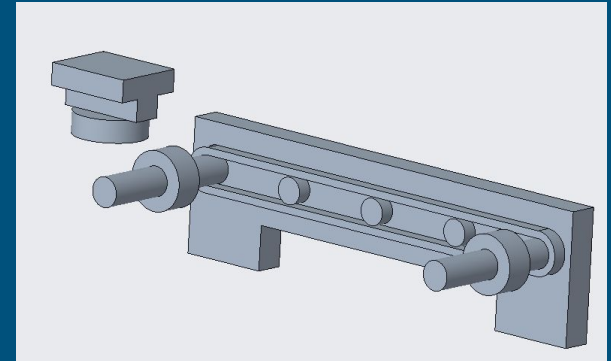
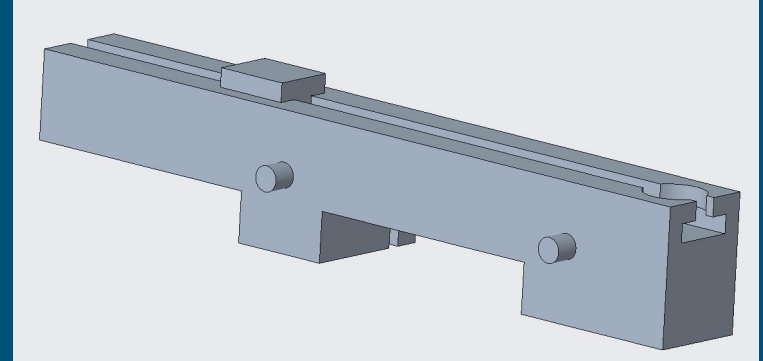
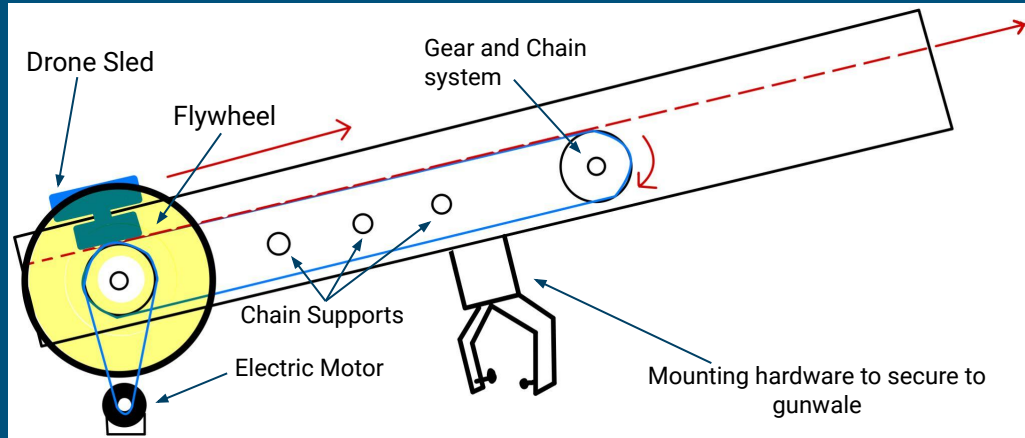
**Total Estimated  
Cost for Launcher  
Prototype**

**~ \$2,450**

## Materials:

- Aluminum Stock ~\$200 [19]
- Cable ~\$50 [20]
- Miscellaneous Hardware ~\$100
- Linear Rail Guide ~\$100 [21]

# Concept 2: Flywheel



## Features

- Electric motor gear and chain system to control both spinning wheels
- Modular launcher rail system

# Concept 2: Rough Cost Estimation

## Electrical:

- Marine Grade Battery ~ \$100 [13]
- DC Motor ~ \$1000 [14]
- Motor Driver ~ \$700 [15]
- Microcontroller ~ \$50 [16]
- Electrical Wire ~ \$50 [17]
- Capacitor ~\$100 [18]

**Total Estimated  
Cost for Launcher  
Prototype**

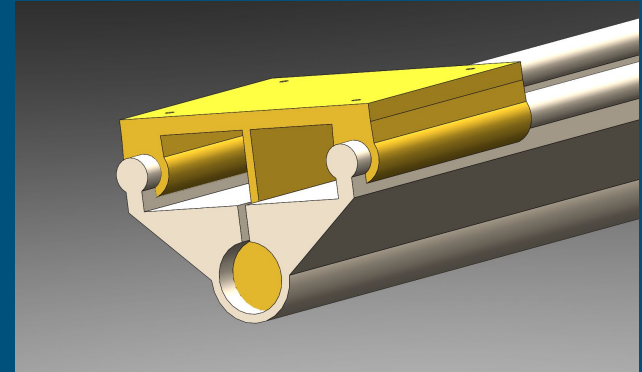
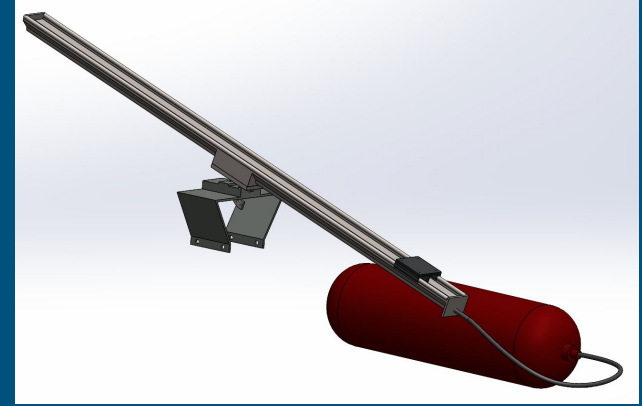
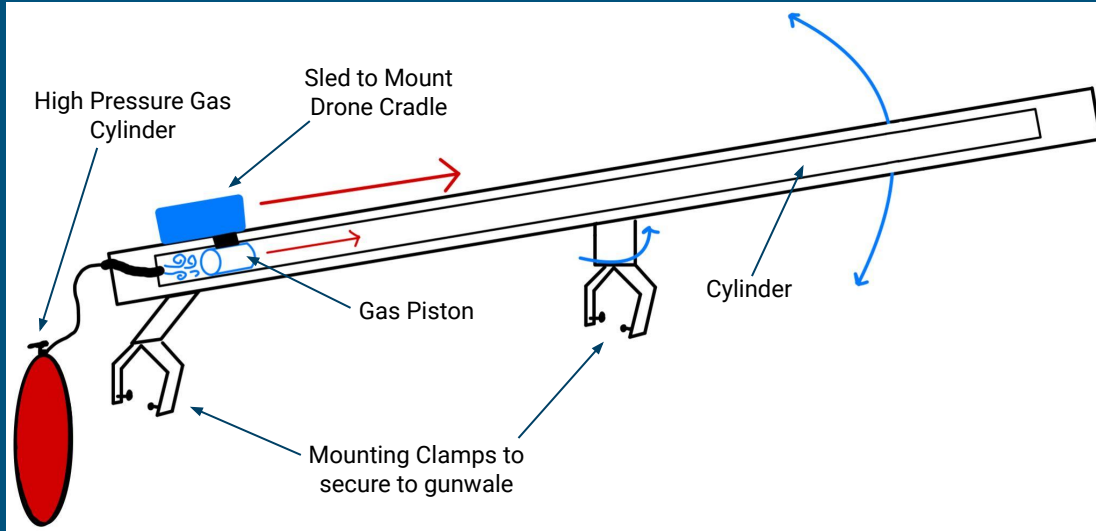
**~ \$2,750**

## Materials:

- Aluminum Stock ~\$250 [19]
- Gear and Chain ~\$350 [22]
- Flywheel ~\$50 [23]
- Linear Guide Rail ~\$100 [21]



# Concept 3: Gas Piston



## Features

- Gas piston driven
- Adjustable launch angle
- Swivel mount to adjust direction
- Easy to swap drone mounts
- Linear bearings

# Concept 3: Rough Cost Estimation

## Gas System:

- High Pressure Gas Tank ~ \$250 [24]
- High Pressure Regulator ~ \$650 [25]
- High Pressure Hose ~ \$40 [26]
- High Pressure Fittings ~ \$20 [27]

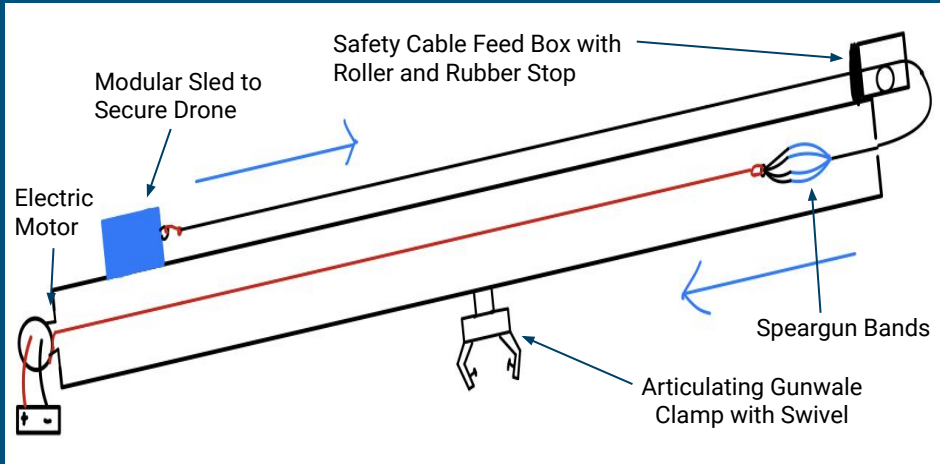
**Total Estimated  
Cost for Launcher  
Prototype**

**~ \$1,420**

## Materials:

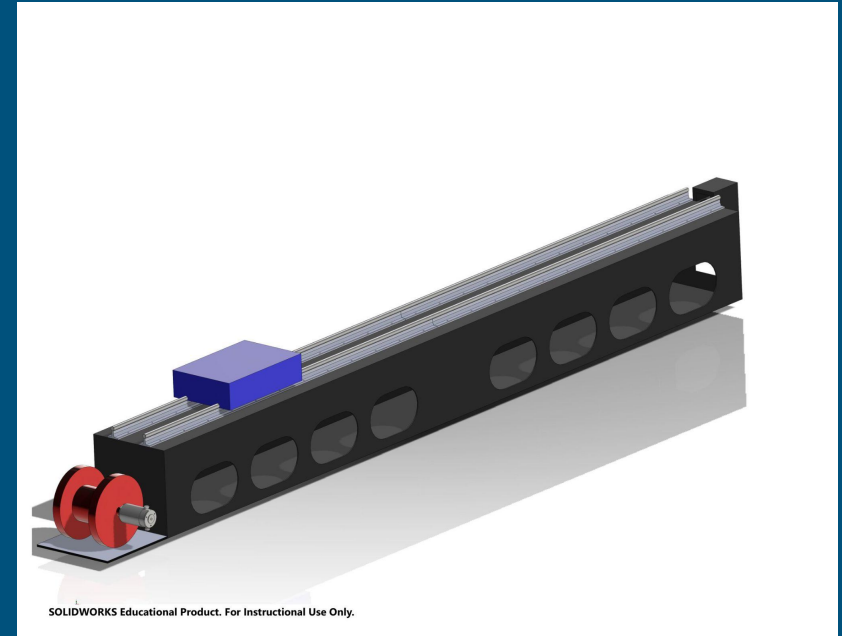
- Aluminum Stock ~\$200 [19]
- Stainless Steel Tubing ~\$60 [28]
- Miscellaneous Hardware ~\$100
- Linear Rail Guide ~\$100 [21]

# Concept 4: Elastic Bands



## Features

- Tensioned with electric motor
- Powered by PE to KE from speargun bands
- Adjustable launch angle
- Swivel mount to adjust direction
- Modular drone mount
- Rubber stop to cushion sled and smooth release
- Linear rail guide



# Concept 4: Rough Cost Estimation

## Electrical:

- Marine Grade Battery ~ \$100 [13]
- DC Motor ~ \$30 [29]
- Motor Driver ~ \$20 [30]
- Microcontroller ~ \$50 [16]
- Electrical Wire ~ \$50 [17]
- Elastic Bands ~\$100 [31]

**Total Estimated  
Cost for Launcher  
Prototype**

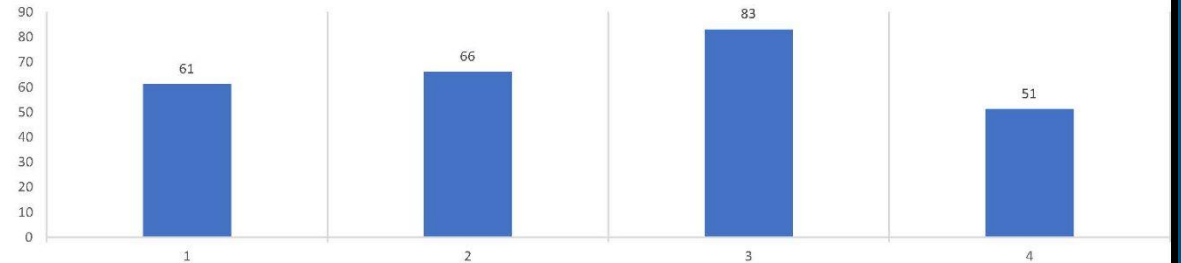
**~ \$800**

## Materials:

- Aluminum Stock ~\$200 [19]
- Cable ~\$50 [20]
- Miscellaneous Hardware ~\$100
- Linear Rail Guide ~\$100 [21]

# Concept Decision Matrix

		Ratings			
Criterion	Weight	Gas Piston	Electric Motor	Elastic Bands	Fly Wheel
Ease of Use	20	4	4	5	2
Durability	10	1	4	3	2
Ease of Manufacturing	10	1	5	5	4
Load Capacity	10	3	5	3	3
Safety	20	2	4	3	2
Weight	10	5	1	5	1
Power Consumption	5	5	1	4	3
Cost	15	4	1	5	4
<b>Total</b>	<b>100</b>	<b>61</b>	<b>66</b>	<b>83</b>	<b>51</b>



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# Questions?

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# Resources



## Scope of Work

### **Maritime Drone Launcher**

#### **A) Overview of Project**

The current systems commonly used to launch long-distance fixed-wing drones have many shortcomings. They are typically large, complex, and not intended for small vessel operations. Our end goal is to design and create an improved launching system that is designed for the maritime environment, small enough to be easily transportable, and durable enough to work reliably in remote locations. This system would prove useful to stakeholders that conduct ship-to-shore reconnaissance and search and rescue operations, such as the military and law enforcement. The civilian market may prove to be a possible customer as well with the growing popularity of drones. The primary design requirement is that the launch system shall be fully capable of interfacing with small watercraft such as recreational fishing boats, law enforcement patrol boats, and small military vessels. Two operators should be able to safely deploy the launcher. The system must be capable of launching fixed-wing drones of varying sizes and weights. We are assuming that the material and production costs will not change throughout the design process and that our definition of a small watercraft aligns with military and law enforcement regulations.

#### **B) General Obligations**

The Maritime Drone Launcher project is a two-phase project (Design and Build) where both the design and construction of the project will be carried out by the Maritime Drone Launcher team. The four team members include Connor Barrett, Richard Garcia, Alex Moeller, and the team leader Brody Baker. The design and construction process will be carried out by the four team members as described in the Work Breakdown Structure. The intellectual input of an outside advisor along with technical resources (textbooks, websites, industry standards, etc.) will be utilized as necessary.

#### **C) Deliverables**

The Maritime Drone Launcher Team is obligated to deliver multiple Milestones throughout both the design and the construction phases as shown in the Work Breakdown Structure. The sum of the Milestones represents the completed project. There are fifteen total Milestones in the design phase of the project. Eleven of these Milestones will be completed and delivered to the client on the dates shown in the Work Breakdown Structure. The Work Breakdown Structure will be re-evaluated upon completion of the design phase to be revised for the construction phase. The team is expecting to deliver a functioning prototype by July of 2023.



## Meeting 1 Agenda

Sponsor: FSU PC

Maritime Drone Launcher

Team Members:

Brody Baker  
Team Leader

Connor Barrett  
Team Member

Richard Garcia  
Team Member

Alex Moeller  
Team Member

Advisor

Maurício Chagas, Ph.D.

Instructor

Yvonne Traynham, Ph.D.

### Maritime Drone Launcher

Tuesday, February 7, 2023

#### Past Work

- ❖ Work Breakdown Structure
- ❖ Project Scope of Work

#### Current Work

- ❖ Customer Needs Evaluation
- ❖ Functional Decomposition

#### Looking Ahead

- ❖ Concept Generation
- ❖ Concept Selection
- ❖ Cost Estimation

#### Needed Feedback

- ❖ Primary Focus of the Project (Software, Physical Structure, Electrical System, etc.)
- ❖ Discuss Time and Budget Constraints
- ❖ Feedback on Existing Concepts