

theRebelAlliance



AEV Project, ENGR 1182 Spring '17
Group I

Holly van der Lans, Rob McEwan,
Ryan Devine, Stephanie Smithson

Overview

- Design Process
 - Inspiration
 - Designs
 - Key Decisions
- Energy and Efficiency Decision Making
 - Coding Theory
 - Servo Brake
 - Plots (Energy vs. Distance)
- Final Design
 - Energy used
 - Design Aspects
- Recap
- Questions

Design Process: Inspiration

- Star wars theme in MCR
- Intended to replicate the X wing fighter
- Carries R2 unit on the front of the model which is parallel to what is seen in the films

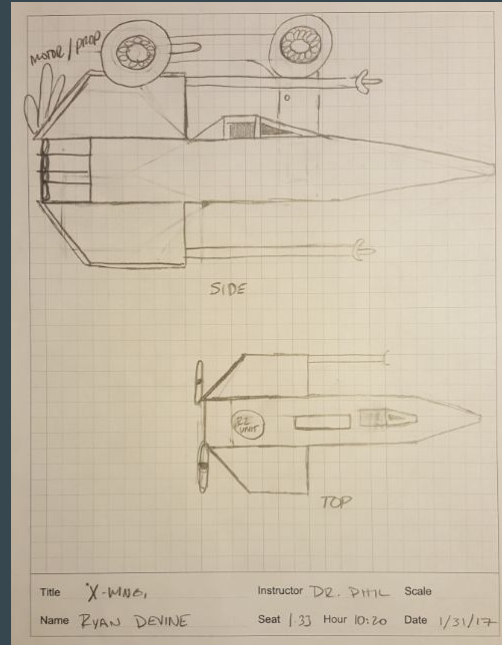


http://starwars.wikia.com/wiki/T-70_X-wing_fighter

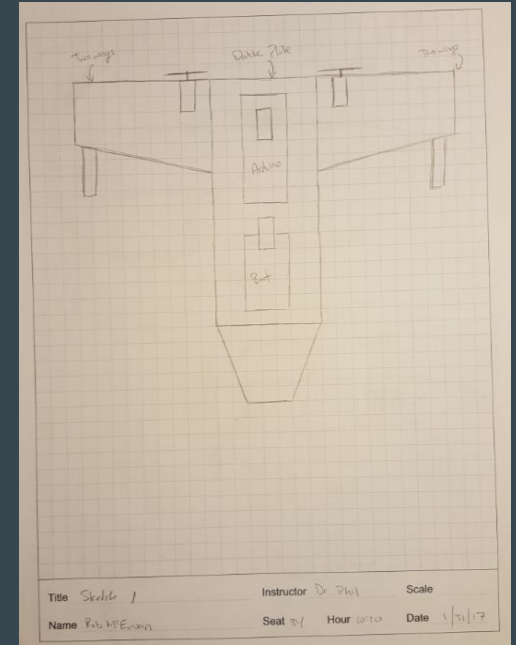
Design Process: Designs

- Team members made individual designs.
- Advantages from each were considered/implemented in a final design

1. Ryan's design
2. Rob's design



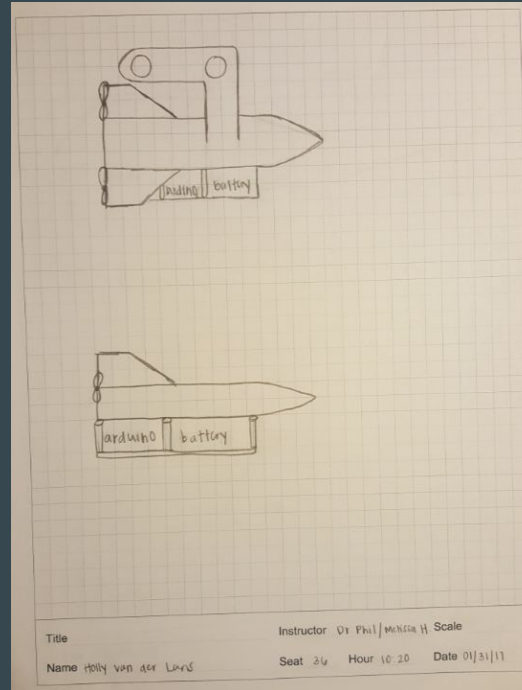
1



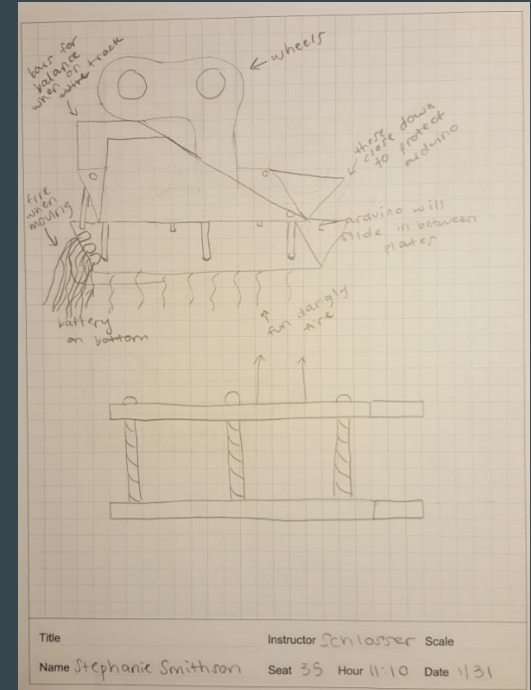
2

Design Process: Designs

3. Holly's design
4. Stephanie's design



3



4

Design Process: Decision Making #1

Screening Matrix

Success Criteria	Reference	Design X-Wing	Design Y-wing	Design Double Prop
Balanced	0	0	0	0
Minimal blockage	0	0	0	-
Center-of-gravity location	0	+	0	+
Maintenance	0	-	0	-
Durability	0	0	0	-
Cost	0	-	-	0
Environmental	0	+	+	-
Aesthetics	0	+	-	+
Sum +'s	0	3	1	2
Sum 0's	8	3	5	4
Sum -'s	0	2	2	2
Net Score	0	1	-1	0
Continue?	Combine	Yes	Combine	No

Scoring Matrix

		A Reference		Design X-wing		Design Y-wing		Design Double Prop	
Success Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Balanced	15%	3	0.45	3.5	0.525	3.5	0.525	3	0.45
Minimal blockage	5%	3	0.15	4	0.60	4	0.20	0.5	0.025
Center-of-gravity location	15%	2	0.30	3	0.45	3	0.45	4	0.60
Maintenance	5%	3	0.15	1	0.05	3	0.15	2	0.10
Durability	10%	2	0.20	2	0.20	3	0.30	1	0.10
Cost	15%	3	0.45	2	0.30	2.5	0.375	3	0.45
Environmental	15%	3	0.45	3	0.45	4	0.60	2	0.30
Aesthetics	20%	1	0.20	5	1	2.5	0.50	3	0.60
Total Score	100%		2.35		3.575		3.10		2.625
Continue?			No		Develop		Combine		No

Design Process: Decision Making #2

Screening Matrix

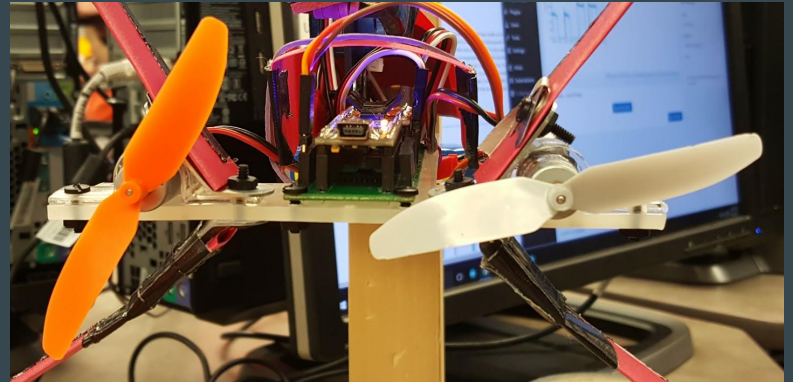
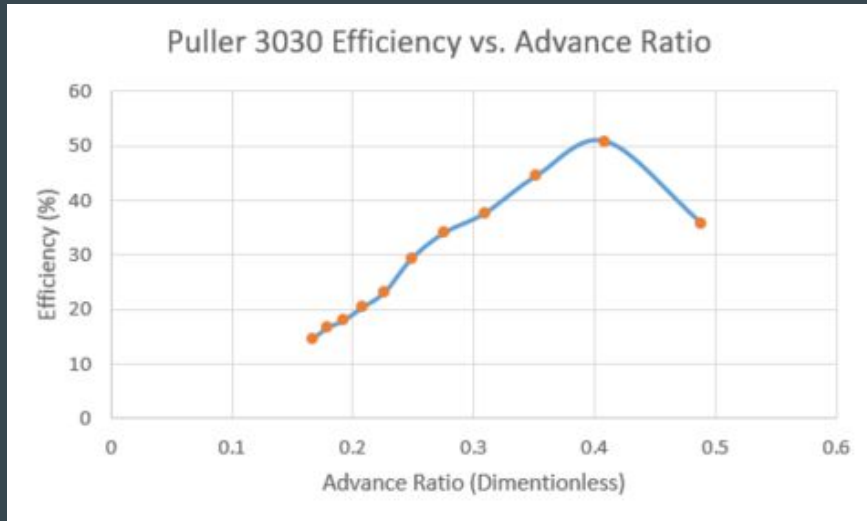
Success Criteria	Reference	Normal X-Wing	X-wing - No Wing	X-wing + servo brake
Balanced	0	0	0	-
Center-of-gravity location	0	0	+	0
Control	0	+	+	+
Durability	0	+	-	0
Cost	0	-	+	-
Environmental	0	+	+	+
Aesthetics	0	+	-	0
Sum +'s	0	4	4	2
Sum 0's	7	2	1	3
Sum -'s	0	1	2	2
Net Score	0	3	2	0
Continue?	Combine	Yes	Yes	Yes

Scoring Matrix

		Reference		Normal X-Wing		X-Wing - No Wings		X-Wing + servo brake	
Success Criteria	Weight	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score	Rating	Weighted Score
Balanced	10%	3	0.30	3.5	0.35	3	0.30	2	0.20
Center-of-gravity location	10%	2	0.20	3	0.30	2	0.20	3	0.30
Control	20%	2	0.40	3	0.60	2.5	0.50	5	1.00
Durability	10%	2	0.20	4	0.40	2	0.20	4	0.40
Cost	15%	3	0.45	3	0.45	3.5	0.525	2	0.30
Environmental	15%	3	0.45	3	0.45	4	0.60	4	0.60
Aesthetics	20%	1	0.20	5	1	2	0.40	3	0.60
Total Score	100%		2.20		3.55		2.725		3.40
Continue?			No		Develop		No		Develop

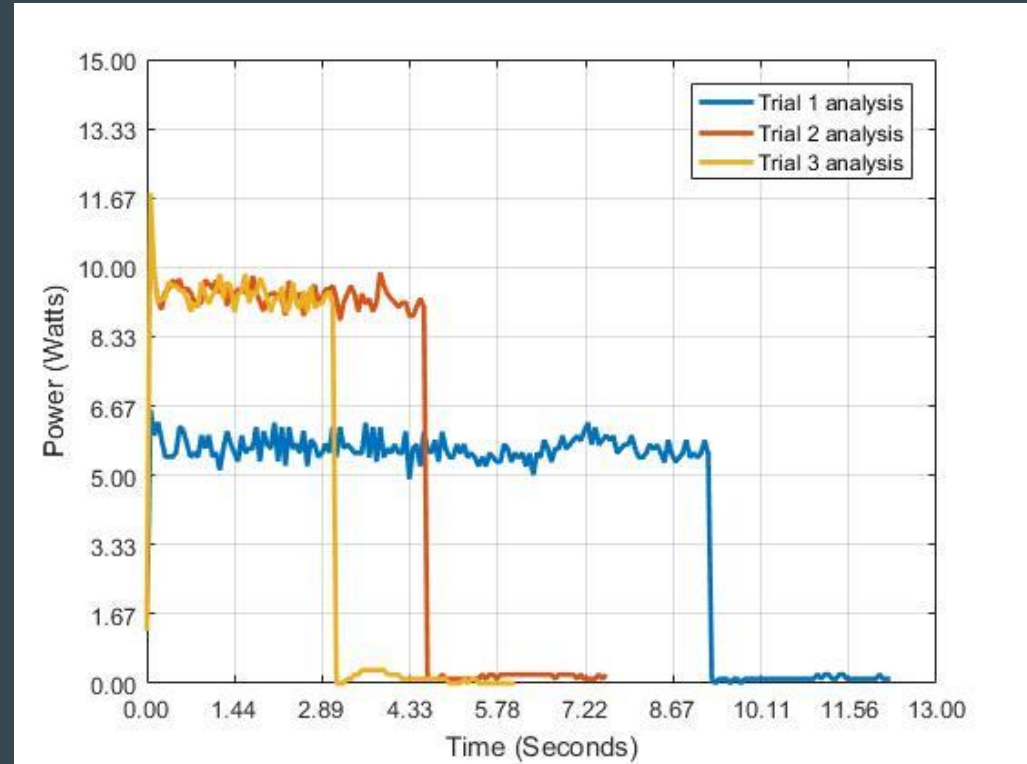
Energy and Efficiency: Propellers

Wind Tunnel Testing -- Puller 3030 won out over Puller 2510



Energy and Efficiency: Coding

- More Efficient when motors “blasted” at beginning, allows the AEV to coast using momentum
- Results in less power being used, which was proven through analysis data



Energy and Efficiency: Servo Brake

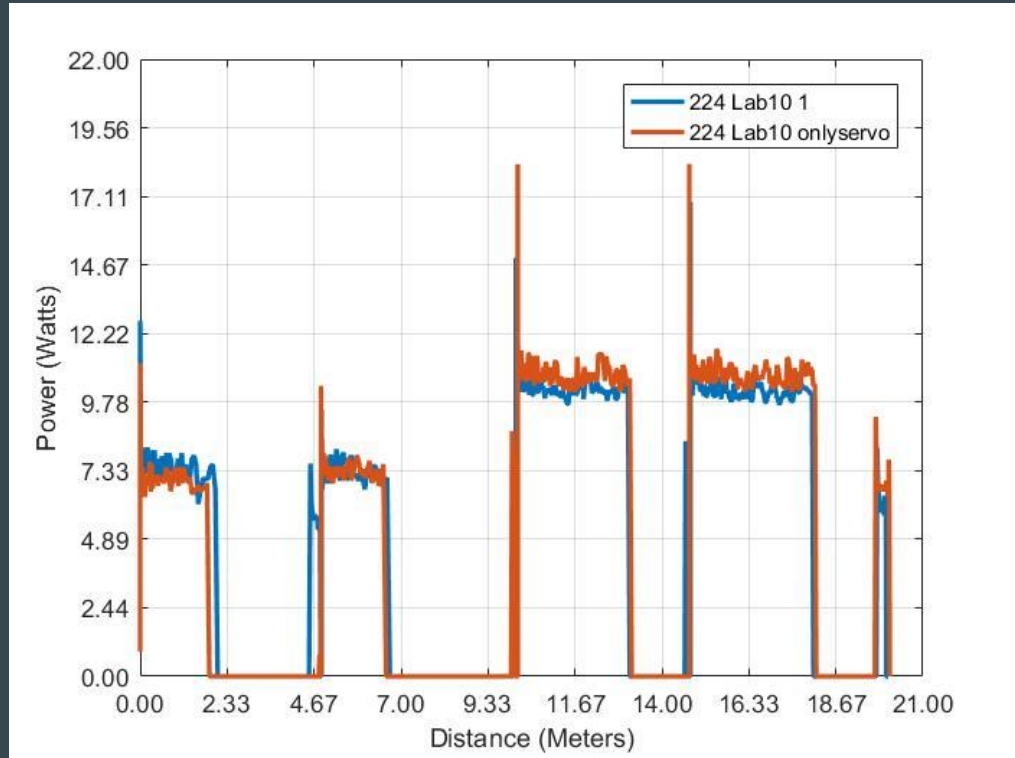
- How it was made
 - Servo motor was outfitted with an arm constructed of cardboard, duct tape, and paperclips
 - Rubber bands were implemented as a frictional surface for braking
- Advantages
 - Added control
 - Efficiency
 - Consistency



Energy and Efficiency: Plots for and against Reverse Thrust

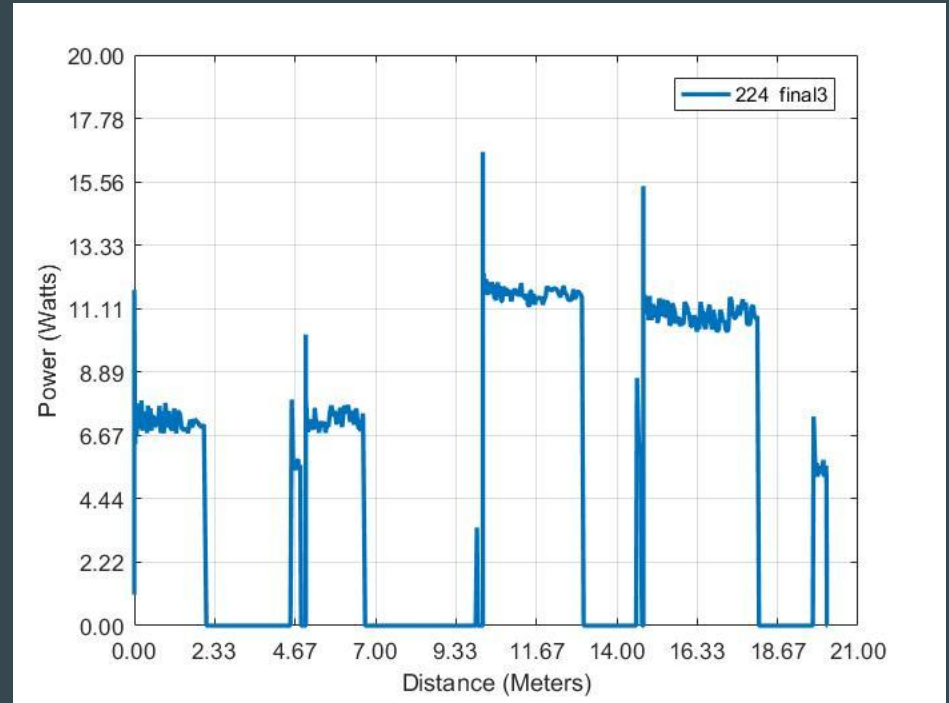
Energy 1 = 215 J

Energy only servo = 232 J



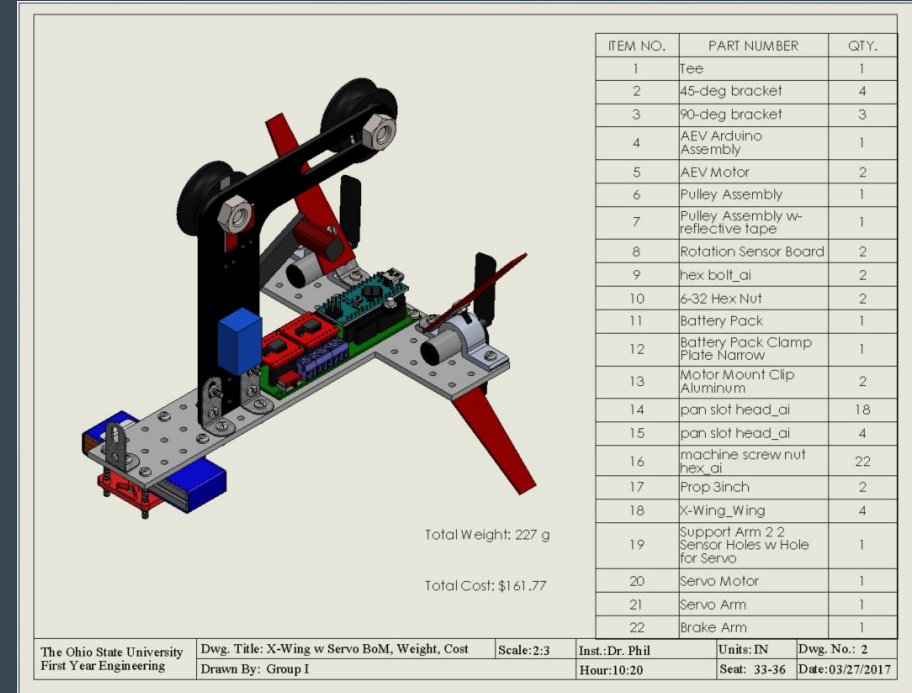
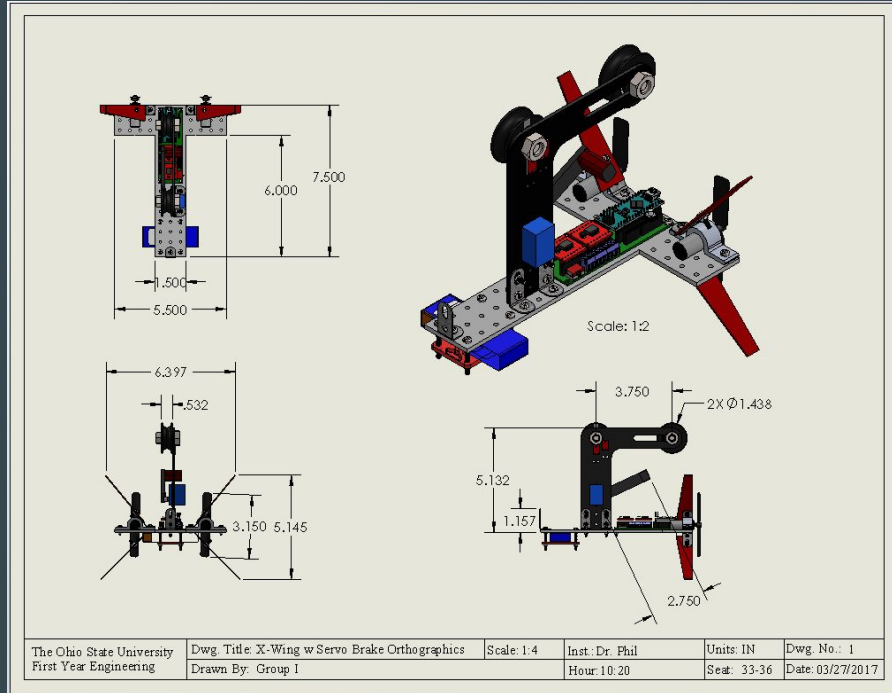
Final Design: Energy used in Final Run

- The final code proven highly efficient (220 J)
- Uses method of high burst of motor speed, using momentum as a means of travel
- Minimum braking propulsion
- Servo-brake used for precise stops

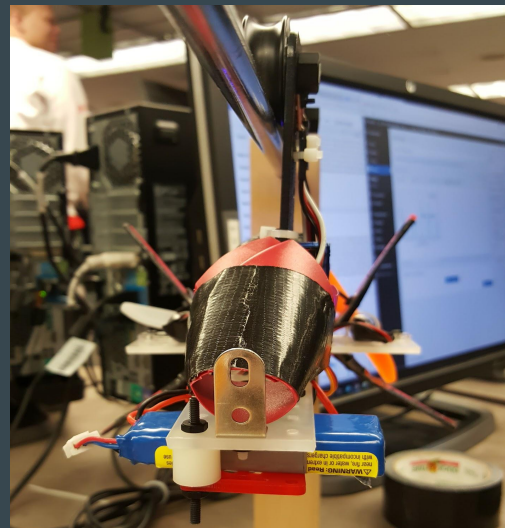
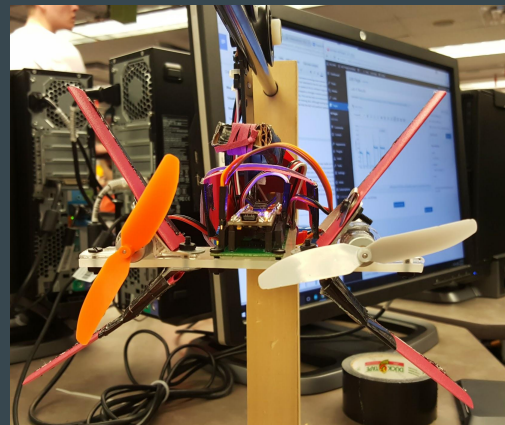
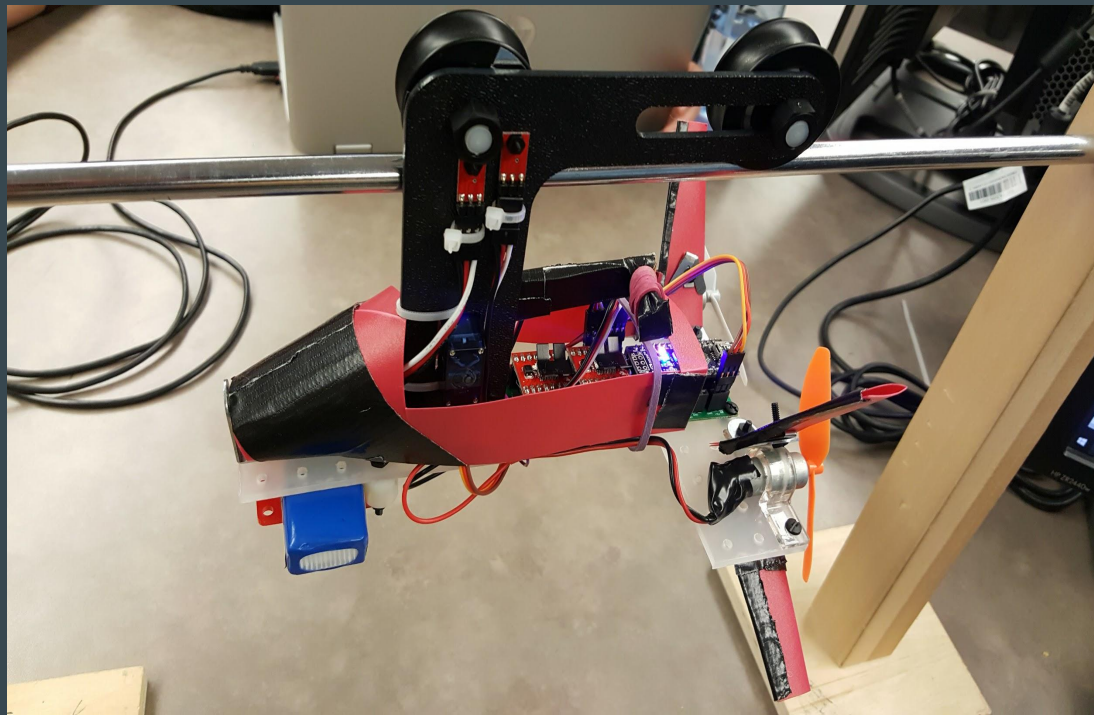


Final Design: SolidWorks

- Weight: 227 g
- Cost: \$161.77



Final Design: In Pictures



Conclusion

Key points in:

- Design Process
 - Inspiration for Design
 - Servo Brake
- Coding Theory for Efficiency
 - “Blasting” Method
 - Servo vs Non-servo codes

Questions

References

T-70 X-wing fighter. (n.d.). Retrieved April 11, 2017, from http://starwars.wikia.com/wiki/T-70_X-wing_fighter

Technical Communication Guide. (2014). Retrieved April 11, 2017

Whitfield, C., West, D., & Allenstein, J. (2016). AEV Lab Manual. Retrieved April 11, 2017.