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Professor Janiszewska
Executive Summary Lab 6
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Introduction

This lab was conducted because in order to produce the best AEV possible everyone needs to have an understanding of how it works. During lab 6, the team ran tests in order to learn about propulsion system efficiency. They also did the lab because they needed to understand how to use wind tunnel testing equipment, how to relate the AEV to the real world, and to learn how to apply wind tunnel results to the AEV.

Experimental Setup

Before the experiment was performed, the AEV was carefully inspected to make sure there were no loose parts. After inspection, the team verified the propeller configuration and made sure the power supply was correctly set up. After this, the team made sure the thrust stand was zeroed to give accurate data.

Results

After the experiment was done, the team took the data and put it into matlab to create graphs, which helped the students better understand that data. The team took this data and made strategic decisions that affected the future of the AEV, such as putting the propellers in the back and using the “push” method to raise the efficiency of the AEV.

Reference Thrust at Stop. (g)	160.4	
Voltage (volts)	**Current (ohms)**	**Thrust (g)**
0.37	0.13	161.9
0.74	0.20	162.0
1.11	0.29	164.6
1.48	0.39	169.8
1.85	0.48	173.5
2.22	0.59	177.2
2.59	0.70	182.9
2.96	0.81	188.1
3.33	0.90	194.5
3.70	1.01	200.4

Table .1 Propeller's Pulling Thrusts at increasing Voltage and Current in Wind Tunnel

Table 1. describes the voltage, thrust, and current of the electric motor puller in the wind tunnel. The voltage is the independent variable and as the voltage increases the current and thrust will increase as well.

Reference Thrust at Stop. (g)	181.7	
Voltage (volts)	**Current (ohms)**	**Thrust (g)**
0.37	0.12	181.9
0.74	0.19	180.9
1.11	0.28	183.7
1.48	0.37	187.9
1.85	0.46	191.9
2.22	0.57	196.3
2.59	0.67	201.6
2.96	0.78	207.1
3.33	0.90	213.2
3.70	1.00	219.3

Table 2. Propeller's Pushing Thrusts at increasing Voltage and Current in Wind Tunnel

Table 2. is another set of wind turbine data that describes the voltage, thrust, and current of the electric motor puller in the wind tunnel. The voltage is the independent variable and as the voltage increases the current and thrust will increase as well.

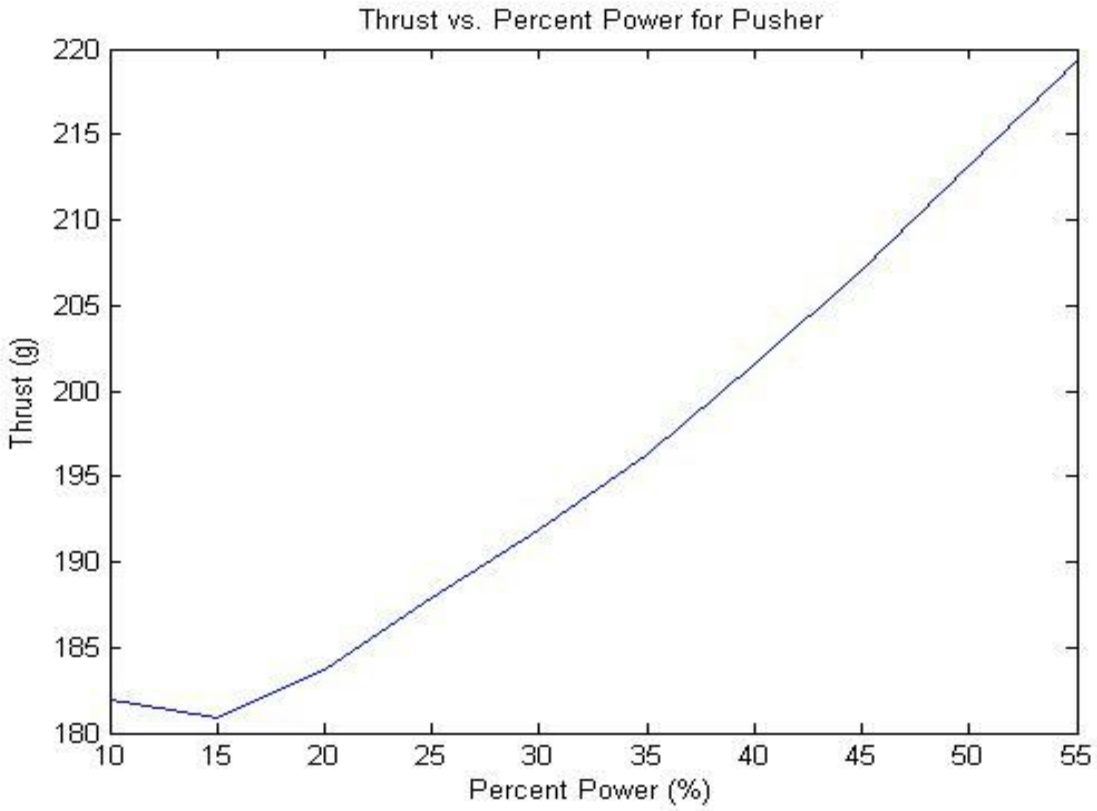

Figure 1. Propeller's Pushing Thrust in grams versus the Wind Tunnel's Percent Power

Figure 1. describes relationship between thrust and amount of power supplied from table 1. As the percent power increases there is a general trend that the thrust increases as well. This makes sense because the more energy that is in the wind tunnel system the more work that will be generated as thrust.

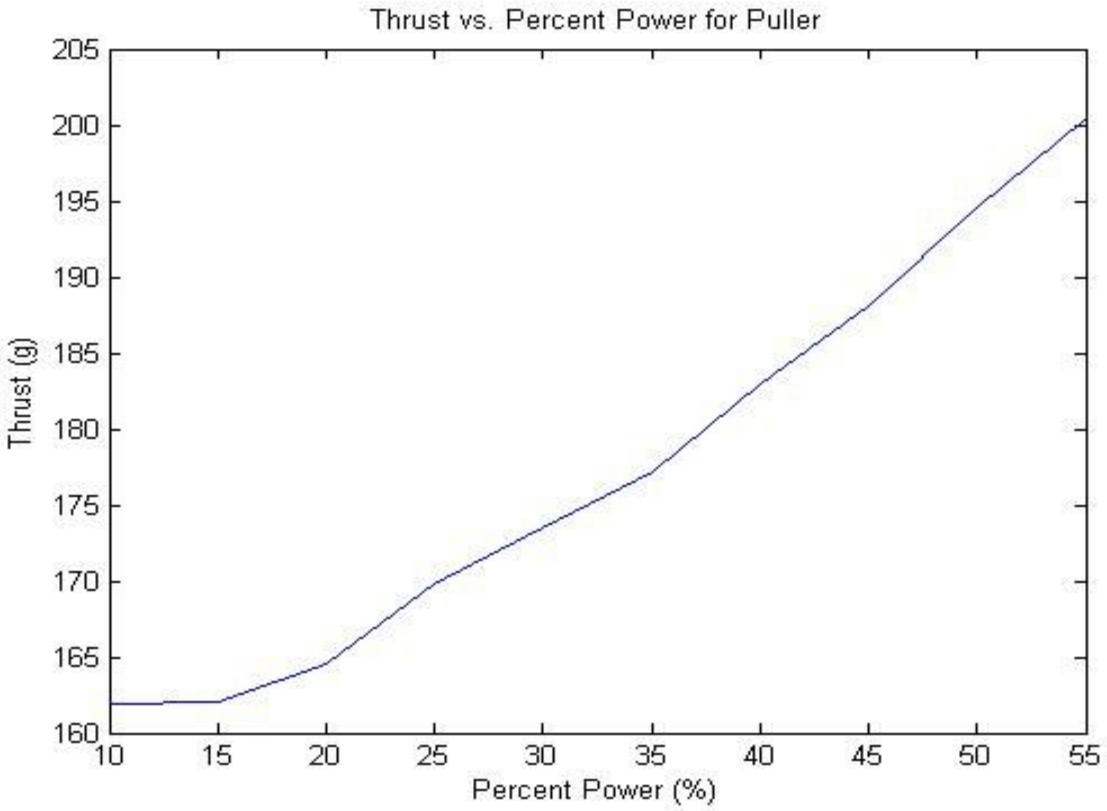

Figure 2. Propeller's Pulling Thrust in grams versus the Wind Tunnel's Percent Power

Figure 2. is another graph that describes relationship between thrust and amount of power supplied from table 2. As the percent power increases there is a general trend that the thrust increases as well. This makes sense because the more energy that is in the wind tunnel system the more work that will be generated as thrust.

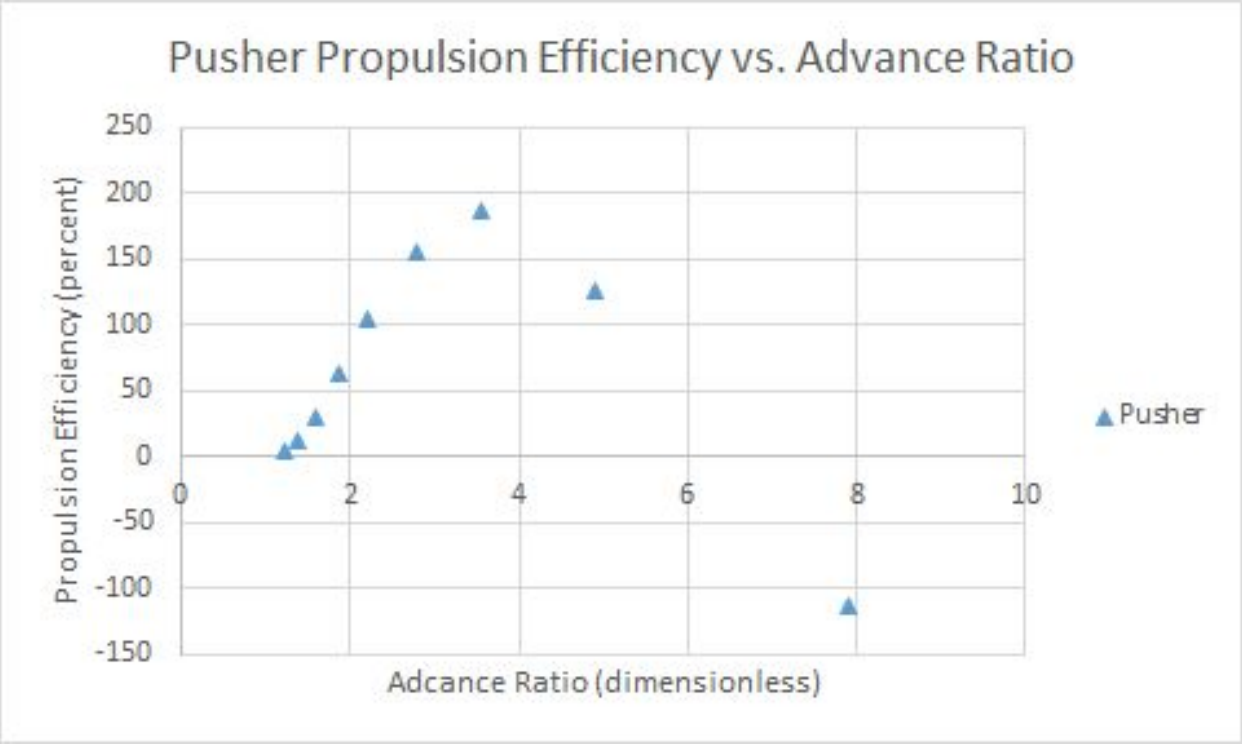

Figure 3. Propeller's Pushing Propulsion Efficiency versus Advance Ratio

Figure 3. is a graph that describes the relationship between propulsion efficiency and the advance ratio of the propeller. There is a maximum efficiency when the propeller achieves its highest efficiency possible because the advance ratio, the independent variable, approached a maximum value. The reason there is a maximum value is because the faster the propeller goes the more energy it will need to maintain that velocity and there is peak value in which the energy going into the AEV achieves a maximum efficiency.

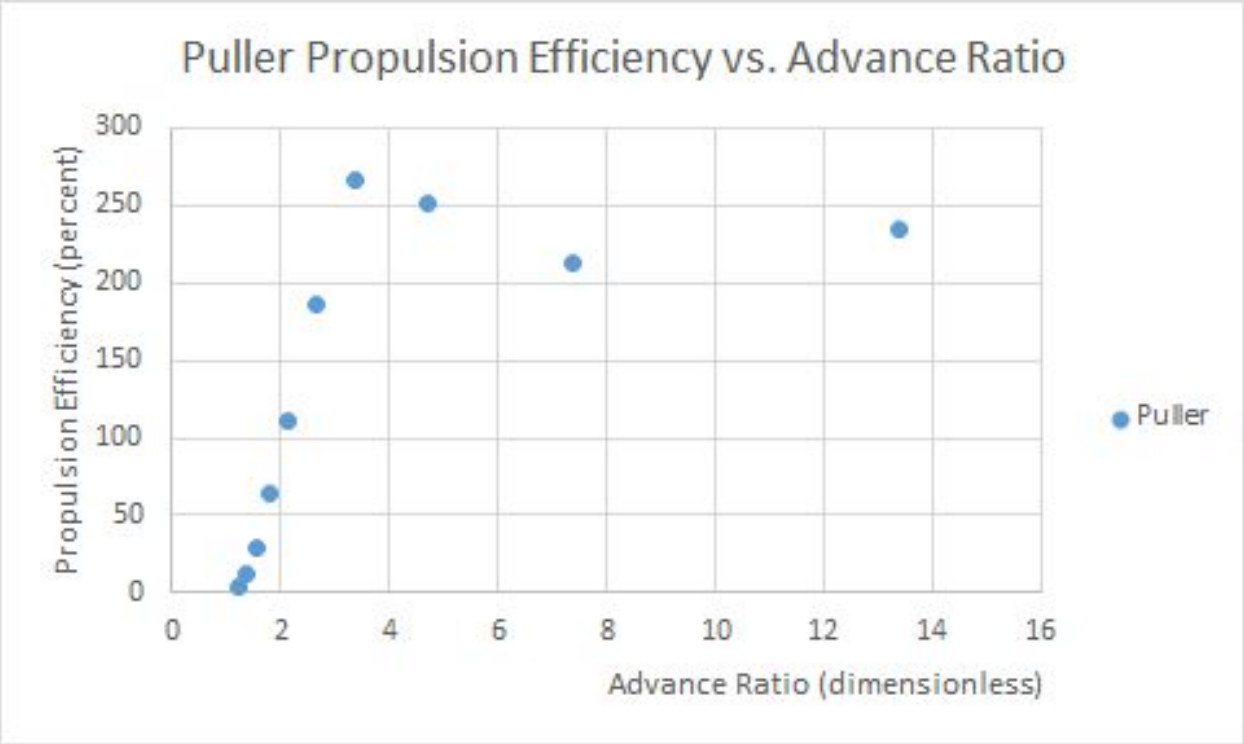

Figure 4. Propeller's Pulling Propulsion Efficiency versus Advance Ratio

Figure 4. is a graph that describes the relationship between propulsion efficiency and the advance ratio of the propeller with the second set of data. There is a maximum efficiency when the propeller achieves its highest efficiency possible because the advance ratio, the independent variable, approached a maximum value. The reason there is a maximum value is because the faster the propeller goes the more energy it will need to maintain that velocity and there is peak value in which the energy going into the AEV achieves a maximum efficiency. During the lab the team was having trouble collecting the data that was needed to complete the lab, so after trial and error, the team had to use Professor Janiszewska's data as a fall back. Another complication was when creating the graphs, the team had troubles getting accurate graphs, this was solved by using the help tool in matlab to remember what syntax to use.

In the future, to improve the AEV, the team will make sure to push the vehicle up the hill and pull it down the hill. This will be the most efficient way to do it while also keeping the safety of the passengers in mind. If the team pushes the AEV down the hill, it will be going too fast which would put the passenger's safety in jeopardy.

After testing the efficiency of all the different propeller setups, the team found out that the pushing method is most efficient. Shown by Figures 1 and 2, the pulling method is clearly less efficient. This will aid in the team's propeller decision because the team will have to set up the AEV to optimize the use of the power. The team will need to program the AEV to be pushed while going up the incline and pulled when going down, this will maximize the efficiency while successfully completing the objective of going around the track.

Conclusion

During this lab, the team concluded that the most efficient way to move the AEV was by having the propellers located in the back of the AEV when moving forward. The data also proved that having the propellers pulling the AEV was the least efficient, which reassured the team that the design was created to be the most efficient. In the future, this will aid the team when making the code for the AEV because the AEV will need to be pushed when going up the hill and pulled when going back down the hill. Since gravity will be helping it going down the hill this will be the most efficient way to program the AEV.

Acknowledgments

The team would like to thank the Ohio State University, their instructor, Professor Janiszewska, and the engineering department for giving the team the tools and resources necessary to complete this lab.