The purpose of Lab 07 was to allow groups to further understand the strengths and weaknesses of their AEV's through testing and results analysis. One of the objectives in lab 7 was to verify that the wheel counting sensor was operation accurately and that the sensor was operating in the correct way by running the AEV on the straight track and documenting the mark error in an excel spreadsheet. Another objective for lab 7 was to calculate the propellor force and the friction force of the AEV when it operated along the straight track length. These objective were important to the group because it allowed for the group be develop another tool that would allow for optimization of the AEV. This lab gave the group a better understanding of how things such as weight, friction, power, speed, etc. affect the efficiency of a vehicle and how to test for these things. Knowing how to interpret and collect this information is an important aspects of physics and therefore many fields of engineering and other STEM fields.

The lab was splitted into three tasks. In the first task, the group weighed the AEV using the digital scale and the weight of the AEV was 0.232 kilogram. The group then programmed the AEV with the test code. The code was aimed to run the AEV at 30% power for 4 seconds and then decrease the speed to 0% power for 10 seconds, which was expected to stop the AEV by friction force between AEV wheels and the track. The starting location of the AEV was 40 inches and the AEV stopped at 271 inches, which meant that the actual marks was (271-40)*0.0254/0.01224 = 479.4 marks. In the second task, the group was supposed to simulate the operation of AEV by using MATLAB and find out the marks errors to determine if the wheel counter system is working properly. The theoretical marks the group generated from the spreadsheet produced in MATLAB was 466 marks and the marks error was (479.4-466)=13 marks. In the third task, the group was expected to calculate the propeller force and the friction force by using the data collected. After analysis, time when the motors stopped was 4.08 seconds and the time when the AEV stopped was 13.32 seconds. According to the formulas, the friction force was 3.0 gmf and the propeller force was 9.9 gmf.

The data shows that the AEV traveled 479.4 marks. The theoretical marks the group got from the generated spreadsheet from MATLAB was 466 marks and the marks error was 13 marks. It indicates that the error is larger than 2 marks, which means that there are something wrong with wheel counter system or the design of the AEV design. In an attempt to correct the problem the team stripped off the extended wings to improve the center of gravity of the AEV to reduce the overall weight. The team also attempted to make the AEV more effective by spreading the the weight proportionally along the arms of the base.Figure 1 shows that the speed is proportional from 0 to 4.08 seconds, which means acceleration is a constant and the value is 2*2.411/4.08/4 = 0.2955 m/s^2. According to the formula F = ma, the net force is 0.2955*0.2328*100 gmf = 6.9 gmf. The constant speed deceleration happens when the time is 4.08 seconds and it turns to 0 when the time is 13.32 seconds. During this period, the constant deceleration is (0-1.182) / (13.32-4.08) m/s^2 = -0.128 m/s^2. The friction force is 0.128*0.2328*100 gmf =2.97 gmf. Therefore, according to the formula F_propeller = F_net + F_friction, the propeller force is (6.9 + 2.97) gmf = 9.9 gmf. The values obtained from the team's

calculations revealed that the AEV design created an abundant amount of frictional force, which would be the leading cause of the large mark error. The team also discovered that the design did not allow for a very powerful force to act upon the AEV, which could also lead to performance issues. The data also revealed that the AEV's propellor friction is o Compared to class average, the value of propeller force(9.9 gmf) is below the average value(10.3 gmf). The value of friction force(3.3 gmf) is close to the average(6.0 gmf) and the value of net force(6.6 gmf) is a little bit larger than the average(6.0 gmf). However, the value of mark errors(13 marks) is much larger than the class average(3.7 marks). Figure 2 shows the the the distance increases nonlinearly with respect to the time.

A potential error that could have occurred in the lab was that the tape that is attached the wheel was not working to its full potential. The mark error could be resolved by using another wheel and testing it on the AEV and observe any change in the mark error in the excel sheet. Another error that could have occurred in the lab is that the overall weight of the AEV was not fully centered, which would allow the AEV to sway as it traveled down the track causing the AEV to have a higher mark error. This error can be corrected by the team reconstructing the AEV and positioning the components of the AEV in the center of the T Shaped based. Another error that could have occurred in the lab is that one of the propellers was not fully on one of the motors, which caused the AEV to not have fully power coming from both sides of it. The error can be corrected by the team making sure that all of the components of the AEV are secure before each test run.

The group along with other groups around us seemed to be confused on what exactly to do during lab 07. A possible solution for this is to spend more time or give more detailed examples, at the beginning of lab, of what the groups will be doing in lab. Eventually most groups seemed to figure out what to do and how to test but wasted time in trying to fully understand what was to be done. Another possible improvement could possibly be to take a break from lab every 30 minutes or so to have a quick Q and A to allow everyone in the class to get familiarized and on the same page on what to do. There has also seemed to be some confusing in the class on what exact lab we are on. Switching the labs around and also starting the semester with lab 0 has caused confusion amongst our group on exactly what lab is next and what progress report we are currently working on.

The knowledge that was gained from this lab is the team now knows that AEV is not running the marks that it is suppose to. This correlates with the lab's objective of making sure the the wheel counting sensor was functioning properly. In addition, the group learned how to calculate net force, friction force and propeller force by using given formulas. It helps the group to analyze the operation of AEV statistically and objectively. What is more, the group learned to discuss about the error problem, made it possible for the group to think about the solutions to reducing the errors and optimizing the AEV.

Appendix

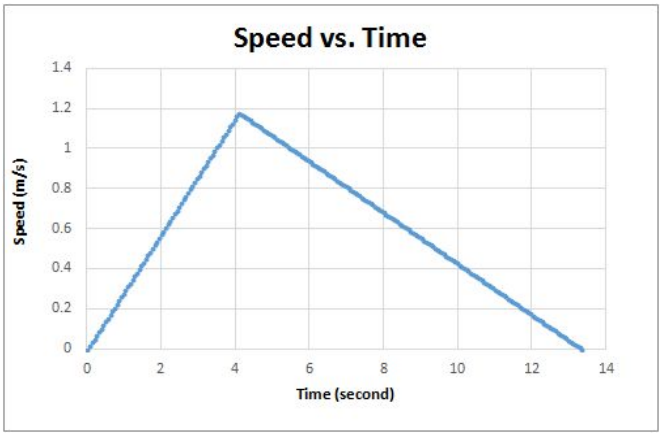

Figure 1: Speed vs. Time

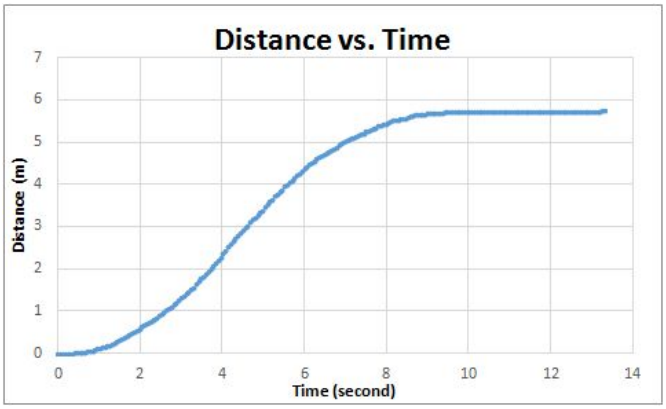

Figure 2: Distance vs. Time

References

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Technical Communication Guide.pdf
New Lab 07 Executive Summary.pdf
New Lab 07 Class Composite Datasheet 10413.xlsx