# Frontenac, Lennox & Addington Science Fair

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# Prefair Report

**4301** **Matthew Wilson**

**Div/Cat** **Computing and Engineering / Senior**

**Title:** **The Effect of Acetone on PLA 3D Print Smoothing**

**Summary:** My project is a study of the effect of concentrated acetone on 3D printed materials. In recent years there has been a stark rise in the popularity and availability of 3D printers and 3D printed parts. Despite the increased popularity and constantly innovating producers the main issue associated with 3D printing is the bumps that are formed during the printing process. One option for removing and smoothing these bumps is chemical baths. This lab utilized standard PLA printing material and the solvent acetone in order to test the effectiveness of chemical baths on smoothing the printed parts. The amount of time spent in the acid baths was varied in order to determine the optimal length of chemical bath time to smooth the print while not sacrificing structural integrity. The findings show that there is strong link between the length of acetone bath and the softness of the outer surfaces of the 3D printed parts which allows for easier sanding and minorly smoothed surfaces. Overall, acetone is clearly a possible choice of solvent that could be used for smoothing of 3D prints and due to its relatively safe nature in comparison to other solvent options it could definitely be an option for many casual 3D printers.

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# Prefair Report

**4302** **Liam Clarke, Cal Doyle**

**Div/Cat** **Computing and Engineering / Senior**

**Title:** **DEF Fluid Analysis**

**Summary:** Our project is in the experimental stage but we are looking at the environmental factors related to DEF fluid. We want to see if this fluid put into diesel vehciles today based on laws made in 2010. This fluid is said to remove dangerous NOx gasses from the exhaust system before being let out into the atmosphere. We believe this is true to an extent, based on our research we are going to test the DEF fluid systems in canada where this solution will freeze at -11 degrees celcius. We are going to test effectiveness of the DEF fluid and as well look at the solution itself. DEF fluid is made from a water and urea solution. A concentrated urea solution is a very dangerous chemical but when put into the DEF system it removes the NOx and produces ammonia which is another dangerous chemical. We want to test how much of these chemicals is produced from the exhaust system. We will test in different temperatures to see the effectiveness of the DEF fluid. We also want to test if DEF fluid is released from the exhaust system and drips onto the ground and if that could cause harsh road conditions in the winter in canada.

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# Prefair Report

**4303** **Daniel Fichtinger**

**Div/Cat** **Computing and Engineering / Senior**

**Title:** **Danny Fich's Reverse Jack in the Box**

**Summary:** In my project, I tried to answer the following question: How does the displacement of a spring with a mass loaded affect its Q factor? The Q factor is a unitless quantity which is a measure of the energy loss of an oscillating system, in this case, a mass attached to a spring. The value is equivalent to the number of times the system will oscillate before coming to a stop. The lower the number, the greater the energy loss per oscillation. In order to calculate the Q factor, I need to know the total energy in the system before it starts oscillating, and after the first oscillation. I hypothesized that the displacement of the spring will have no effect on the Q factor. I believe this to be correct because the Q factor depends upon the relative change in energy of the system after one oscillation. As the Q factor is a ratio, the difference in the magnitude of the energy stored (which depends on the extension of the spring) does not matter as long as the relative energy loss after one cycle is the same. Due to my physics knowledge, I knew that I would only need gravitational potential energy to make my calculations. I was able to collect the variables necessary for my calculation my setting up a high-speed video camera and recording footage of my system oscillating. After performing frame-by-frame analysis of the footage, I collected the data necessary to perform my calculations. Armed with the necessary data values, I derived the necessary equations and created the graphs necessary to draw my conclusion. I concluded that the initial displacement of the spring appears to have a linear relationship with the Q factor of the oscillation. As the initial displacement increases, the Q factor decreases.

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# Prefair Report

**4304** **Liam Andrew**

**Div/Cat** **Computing and Engineering / Senior**

**Title:** **Optimizing Wing Camber to Maximize Lift**

**Summary:** The main principal on which the science behind flight is founded is dependent on the difference in pressure between the upper surface of the wing and the lower surface. This pressure difference is created by lengthening the path that laminar airflow above the wing must follow by increasing the camber (the arch) of the wing. This manipulation induces a faster moving but lower pressure stream of air over the upper wing surface, forcing the wing upwards in a force known as lift. However at what point does this principal that states a longer air path equates to increased lift become no longer true. This was the question proposed in this experiment: How does the height of a wing's camber effect the lift created by the wing?

It was hypothesized that up until a certain point, if the camber of the airfoil increases then the lift experienced by the wing will increase simultaneously. After this point however it was hypothesized that lift will decrease due to excess drag and airflow separation leading to loss laminar flow around the wing and thus no pressure difference to create lift.

This hypothesis was tested on a scale model wind tunnel constructed using cardboard and a desk flan creating airflow around small wings of varying cambers. Lift force was measured by attaching the model wings to a scale to measure apparent change in weight due to the lift.

It was concluded that the model wings with cambers of 0.5,1,1.5 and 2 cm yielded increased lift in correspondence with the increased camber. These results were found to be due to the lengthening of the path difference between the top and bottom of the wing yielding a greater pressure differential between the two surfaces. However as the camber was increased to 3cm wildly varying lift values were seen suggesting airflow separation and thus loss of lift had occurred due to the inability for the airflow to follow the wing surface because of the extreme camber. The exact point for this loss of lift is dependant on many variables of wing shape, material and angle meaning that wing camber should be optimized for the designed purpose of the plane

Two noticeable sources of uncertainty in this experiment originated with the makeshift nature of the wind tunnel used for testing. The digital mass balance's lift readings were sporadic due to the relatively rough airflow coming from the desk fan which lead to random inaccuracy in determining how much lift was created. the angle of the wing was also difficult to maintain constant due to the attachment method which would have systematically increased lift if the angle was too large or decreased it if the angle was too small

Overall my hypothesis was confirmed though the exact point of loss of lift, 3 cm, is unique to each wing. This information has uses in exhibiting the effects of airflow separation and should be considered when designing airflow that may want to maximize stability and lift.

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