NORTHERN ARIZONA UNIVERSITY

Department of Mechanical Engineering

To: David Trevas

From: Alfred Serventi

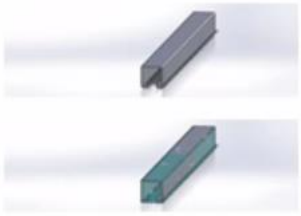
Date: July 5, 2020

Re: EGR-476C Self-Learning Assignment Memo

The purpose of the memorandum is to show the progress that was made through the self-learning assignment. This assignment consisted of challenging myself to learn an advanced skill in design with the hopes of the new skills provided towards the capstone project, which in this case is Vertical Farming. The assignment provided the resources necessary to learn a skill of our choosing. The skill chosen was advanced design and manufacturing.

The skill I chose to learn was advanced design for manufacturing. I chose this skill to give me further insight into the cost-effective methods behind a design. Up to this point I have learned how to create a design part, assembly, and drawing in Solidworks for a project. However, in every engineering course it is always emphasized that money is a driving factor in becoming a successful engineer and in being a valuable asset to any company. The reading included choosing the right materials for a design depending on what the requirements call for. Another tip was to choose the tolerances of a design within reason and to keep in mind the limitations of machining a part. The higher the tolerances, the more expensive each part will be. Further learning about cost could be beneficial for the Capstone project like learning how to use Solidworks to get a design estimate based on materials, machining type, and even quantity. Lastly, I viewed multiple videos on a company called Xometry (see references) and how their 3D printing works along with their limitations. Overall, I aim to use the knowledge I learned throughout this assignment towards the Capstone project and more importantly my future.

The skills mentioned above were put into practice through Solidworks. I created a part that will be needed for the physical build of the team's vertical farming design. I utilized Solidworks part estimate function to have an idea how much each part could cost if we decided to outsource a machined part of the frame for our design. The part is a simple beam that includes a slot for rollers that would be used to slide rows of plants in and out as necessary. By adjusting the material type I was able to decrease the cost compared to a tough steel which would be unnecessary for its function. I also kept in mind the amount of material needed to minimize raw material cost while having the proper dimensions that would be required to maintain the weight load expected. In the tutorial on how to create a cost-effective part, it was mentioned to identify how the part should be machined. After comparing the costs, it was cheaper to have the part machined using a block stock instead of a sheet or roll of material to manipulate or mill. I also compared costs of having a few parts machined to that of having the 20 shown in Figure 1. The cost was ultimately cut by 26% after adjusting specifications that were taught throughout this assignment.



Model Name:	Track Beam
Date and time of report:	7/5/2020 3:06:14 AM
Manufacturing Method:	Machining
Material:	Plain Carbon Steel
Stock weight:	22.86 lb
Stock Type	Block
Block Size:	24.00x1.84x1.84 in
Material cost/weight:	1.41 USD/lb
Shop Rate:	N/A

Quantity to Produce

Total number of parts:	20
Lot size:	20

Estimated cost per part: 53.37 USD

Costing template used:	[illegible]
Costing mode used:	Manufacturing Process Recognition
Comparison:	26% Current 53.37 USD Previous 72.41 USD

Cost Breakdown

Material:	32.23 USD	60%
Manufacturing:	21.13 USD	40%
Markup:	0.00 USD	0%
Mold:	0.00 USD	0%

Estimated time per part: 00:42:15

Setups:	00:16:00
Operations:	00:26:15

Figure 1: Cost Estimate Sheet

References

Hudak, A., 2020. *How To Cut CNC Machining Costs | Fictiv - Hardware Guide*. [online] Fictiv.com. Available at: <https://www.fictiv.com/hwg/fabricate/how-to-cut-cnc-machining-costs> [Accessed 5 July 2020].

Xometry, 2016. *Will It Leak? 3D Printing Watertightness Test*. [video] Available at: <https://www.youtube.com/watch?v=wGQxO0luIqU> [Accessed 24 June 2020].

Xometry, 2017. *Metal 3D Printing Support Structures: How Will It Grow? Part 1*. [video] Available at: <https://www.youtube.com/watch?v=O47rRcrcVi4> [Accessed 25 June 2020].

Xometry, 2017. *Metal 3D Printing Support Structures: How Will It Grow? Part 2*. [video] Available at: <https://www.youtube.com/watch?v=rmuvI6S9NOE> [Accessed 25 June 2020].

Xometry, 2017. *Top Ways To Save On CNC Machining*. [video] Available at: <https://www.youtube.com/watch?v=_jSxiGX2zys> [Accessed 25 June 2020].

Xometry, 2018. *Faster Quoting, Directly In SOLIDWORKS*. [video] Available at: <https://www.youtube.com/watch?v=lIP3b6aUuS8> [Accessed 24 June 2020].

Xometry. 2020. *Design Guide: Computer Numerical Controlled (CNC) Machining*. [online] Available at: <https://www.xometry.com/design-guide-cnc> [Accessed 5 July 2020].