

## Original Work Proposal

My original work which I am proposing involves the creation of identical parts using CNC machining and FDM printing and comparing the differences in cost, mechanical properties, appearance, and accessibility. In addition to comparing these factors, I also plan to evaluate and address the limitations of each manufacturing method as well as comparing the developments and what the future holds for each method. I plan to design parts in a 3D CAD software such as Autodesk Inventor or Solidworks, then manufacture these parts at either a local facility or online. Through creating this original work, I hope to answer questions about which manufacturing method is used for what type of part produced as well as understanding what practical applications CNC milled parts and FDM printed parts have. The parts I plan to design will also have some mechanical applications in a working machine such as gears or other various mechanisms involved in a machine.

In order to accomplish my original work, I will first have to acquire access to both a 3D printer or service as well as access to either a CNC machine or CNC milling service. I will try to find these services in the local DFW area, but I may still need to resort to online services. Throughout the search process, I will also have to take into account both the cost and possible shipping time for creating my parts. After acquiring access, I will then begin the task of designing the actual models for the parts themselves in a 3D computer-aided design, or CAD, software such as Inventor, Solidworks, or Fusion 360. During the design process I will need to make sure to make parts which will be able to have functional and practical mechanical applications while also creating parts which will be able to address the limitations of the manufacturing process. Such methods for designing these parts could include using complex

shapes, overhangs, hollow areas, or by using existing designs for gears or other parts. However, while my designs may be complex, they should also be able to be manufactured with the machines at ease or demonstrate how one type of manufacturing may not be able to manufacture the part at all. Following the design process, I will then have to import the designs into a CAM (computer-aided manufacturing) software in which the model itself will be sliced into several layers based on the designated settings as set in the software. During this stage I will have to apply my research of the CAM process as I had described in my past research assessments. This research will help guide this stage of my original work and possibly provide solutions to any obstacles I may face. During the CAM conversion process, I will also have to consider parameters such as resolution, or the level of detail of the model, which can apply to both manufacturing methods in order to maintain as many similarities as possible between manufactured parts.

After converting my CAD models into file types such as gcode which are usable by the machines themselves, I will begin the actual manufacturing process of the models. The gcode file type is essentially a set of instructions based on the various parameters set in the CAM software which can be interpreted by both CNC machines and 3D printers. When manufacturing the parts, certain parameters, such as support material may also need to be adjusted for one manufacturing process or the other. For instance, CNC machining uses subtractive manufacturing which means the parts themselves are created by cutting away from a solid block of metal or whatever material is used, typically allowing the machine to create features such as overhangs without support material, but with 3D printing a sort of truss-like structure must be created in order to support overhangs as they are printed using this additive manufacturing process. However, while it may

seem like the two manufacturing processes are quite different, they are in fact, quite similar. Both processes use the file type of g-code and create a part layer by layer. After the manufacturing of my parts, I will then need to evaluate how much each part costs, as well as evaluate the mechanical properties of the parts such as strength and durability by inputting them into a possible motorized setup in order to time the point until failure and by testing how much weight a part manufactured by each method can support. In addition to analyzing these factors, I will also have to analyze the time taken to create these parts, how much material was used or wasted throughout the process, and the accuracy of the parts when compared with the CAD model. To test accuracy and tolerances, I may also have to design these parts to be interlocking or to interact with each other.

Through the creation of my original work, I plan to gain a deeper understanding of both CNC machining and FDM 3D printing as well as a deeper understanding of mechanical engineering as a whole. The creation of this original work will incorporate the countless hours of research and interviews which I have done as well as a physical representation of my ideas and plans for the utilization of such manufacturing features. The research which I had done in the past on CAM-path generation and manufactured part accuracy will also help me in evaluating the properties of the parts created with these processes. I will most likely also be able to apply my research of other manufacturing processes to my original work and compare the differences and similarities of those processes as well. The creation of my original work will also demonstrate how I am able to combine multiple manufacturing processes together into one project rather than just focusing on either aspect, contributing to a broader horizon of the field. In addition to this, my original work will also showcase the growing field of 3D printing and CNC machining as

well as form the groundwork for future parts created with these processes such as inventions.

With this original work I hope to also show how “finished” or “unfinished” parts may look when manufactured by these processes and how that may improve with future developments in the field. The original work I plan to create will also show the rapid prototyping capabilities of CNC machining and 3D printers as well as the ease of making changes and updates to models created with CAD and just how quickly those changes can be interpreted in the physical model. For daunting task which lies ahead, I will have to spend most of my time both learning how to import CAD models into CAM software as well as how to effectively utilize the machines involved in the manufacturing processes to achieve high accuracy and reproducibility of my manufactured designs in order to create my original work Through my original work I plan to not only incorporate my research, but also learn new and more effective methods for using CAD and CAM software in conjunction with manufacturing processes.