Manufacturing Methods

GT Off-Road Racing | Data Acquisition

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# 1.0 Overview

## 1.1 Introduction

The purpose of this document is to serve as a guide of what manufacturing methods are available on campus and the pros and cons to each of those methods.

# 2.0 3D Printing (Plastic)

## 2.1 Invention Studio Ultimaker Fleet Printers

Pros:

* Usually the fastest way to get parts 3D printed (especially if doing multiple)
* GTOR members have option to get 24/7 Invention Studio access which can make the process very easy and prints can be started and retrieved after hours
* Requires the least amount of post processing, the parts are pretty much ready to go as soon as you get them off the printer after removing the small base which is pretty easy to do with a pair of snips

Cons:

* Prints in PLA which is the weakest 3D printing plastic (although it is still pretty strong and works for most things)
* The build platforms aren’t super big, they have only one big Ultimaker printer (the S5, all the others are Ultimaker 3)
* Can be slow towards the end of the semester since this is the manufacturing method of choice for ME 2110 students
* Is generally the least reliable of the methods, some of the fleet printers work pretty much all the time, others have issues with filament that stops coming out or parts lifting off the print bed

## 2.2 Invention Studio Formlabs Resin Printers

Pros:

* The strongest 3D prints
* Extremely high resolution prints
* Options for different materials including flexible, elastic, tough, low friction, high temp, etc.
* They are almost never all busy at once since so few people actually know how to use them

Cons:

* Requires scheduling specific training from the 3D print master to be able to use them
* Build volume is pretty small compared to other methods
* Very slow prints, even super small prints usually take a couple of hours
* Lots of post processing, resin needs to be washed for 10 minutes, then cured for usually about an hour, then all the support material needs to be cut off

## 2.3 Stratasys F170 Printers at the Hive and at the SCC

Pros:

* Prints with ABS which is quite a bit stronger than PLA
* Quite a big build volume
* The fastest print time of all the options
* The hive has 3 of them and there is one at the SCC too that can be used

Cons:

* Ones at hive usually have a multiple day queue although their queuing system works well, if part isn’t high priority, then basically you give them the file, the slice it, print it, and remove the supports and then you come back a few days to a week later and pick up the finished part
* Support material usually needs to be removed in a chemical wash, this takes like half a day; note that there is no chemical wash at the SCC (that I’m aware of), so you might have to get creative with removing the support material or just take the part to the Hive and put it in their wash
* There is no queue for SCC printer and during the busy season for Robojackets (all of Spring), it is almost always in use

# 3.0 Machining, Welding, Etc. (Metal)

## 3.1 Waterjet

The waterjet is great for machining 2D parts very quickly. Sheet metal and steel are great candidates for being manufactured with the waterjet. We generally have at least a few people within our team that are trained on the waterjet which makes this a generally preferred manufacturing method.

## 3.2 CNC Router

There are 2 CNC routers at the Invention Studio, a small one and a big one. The small one is great for doing 2D profiles in polycarb or wood and is easy to learn and use. The big one is good for cutting large profiles in MDF wood.

## 3.3 CNC Machining

CNC Machining is a good manufacturing method for complex 3D aluminum parts. There is usually quite a bit of experience within our team on CNC machining since a lot of our car has custom CNC machined components. However, there is almost always a backlog on the CNC for the same reason and so can have slow turnaround times. If there is a part that needs CNC machined, it would be best to ask the mechanical team to make it at the very beginning of the Fall semester.

## 3.4 Manual Mill / Lathe

The manual mill and lathe are great alternatives to the CNC machine and if parts can be simple enough to be machined using one of these options, then it should be designed that way.

## 3.5 Welding

# 4.0 Revision History

06/18/2021 (Andrew Hellrigel) – Created first revision of document.