Machining Portfolio

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General Info

Tools and Equipment Used:

- Bridgeport Manual Mill
- Sharp and Kent Manual Lathes
- Cold Saw
- Pedestal Grinder, Angle Grinder, Dremel
- Pedestal Drill/Drill Press
- Tap and Die (Manual and Powered)
- Band Saw, Vertical and Horizontal
- Calipers (Digital and Analog), Micrometer (Vernier), Gear tooth Micrometer, Bore/Telescoping Gauge, 1-2-3 Block, Gauge Blocks, Pin Gauges
- Welding (MIG and Stick), Oxy Acetylene Torch
- Dial Indicator for Bore Centre and Parallel measurements
- Deburring Tools
- End Mills, drills, fly cutters, face mill, etc.
- Turning/Face Tool, Cut-off tool, knurling, groove tool, 3-jaw and collet chuck
- Sand Blaster
- General Hand Tools

Processes and Projects:

In order to access the machine shop at Oregon State Uni I completed several qualifications, which included a teaching session, supervision and quiz as well as an inspection of all parts created.

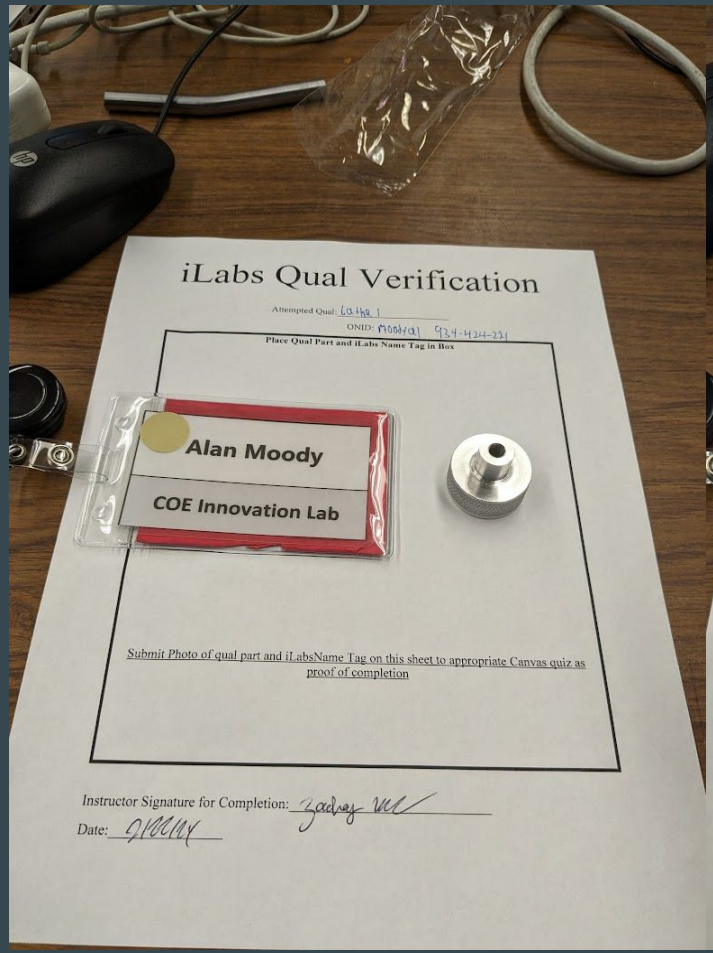
- Manual Lathe:
  - Drill and Power Tap Pushrods on lathe
  - Stock Prep for CNC Lathe
  - Turning gearbox inner spindle, didn't fit within wheel hub. Dial indicated to check concentricity. (Season critical part)
  - Turned bushings, pins and other misc. components.
  - Custom Tooling (Turned down socket). This was due to a design mistake and not checking bolt head clearances
- Manual Mill
  - Stock Prep for CNC Mill
  - Post processing components after CNC Milling or Lathe
  - Drill and Reaming wishbones
  - Autonomous Stepper Motor Mount (Made a dimensioning mistake, ended up as an expensive paper weight. Learned about Datums and GD&T after the mistake)
  - Dial Indicating to tram vice. Student machine shop meant this had to be done often, especially if you wanted tight tolerances.
- Other:
  - Bandsaw to cut stock
  - Proper Machine clean up,
  - Set tool height for CNC Mill, parts came out with proper dimensions.

Shop Qualification (Power Tools)

Power Tools Qual.
This included using the band saw, cold saw, tap, die and pedestal drill.

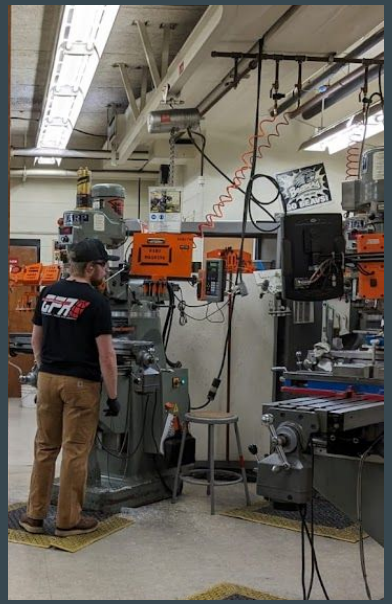
Shop Qualification (Manual Lathe)

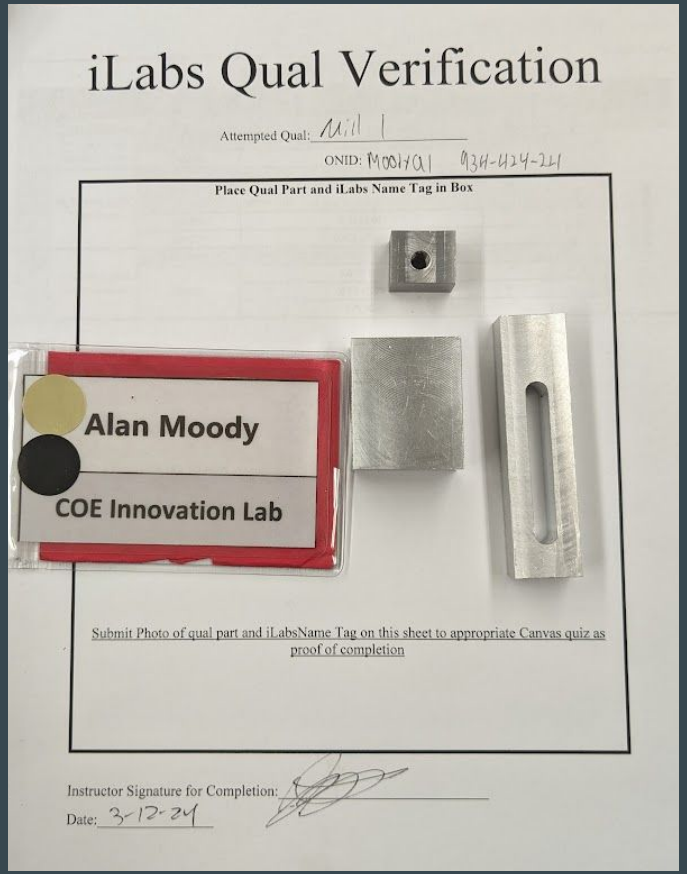
Lathe part with a blind hole and knurling. Parted from a larger round of aluminium.



Shop Qualification (Mill)

All three parts had to be square and all sides parallel. The top cube is steel and I used a carbide endmill to get a good surface finish and reduce the wear on the shop's tools. The right part was a full depth slotting operation. It was purposefully not centred vertically to add challenge. The block on the left had to be square and an acceptable surface finish.





Suspension Clevis Post Processing

Description: Post Processed clevises on a manual mill after CNC machining

Tools: Bridgeport Manual Mill, Technical drawings, Calipers, edge finder, Centre Drill, Toe clamps, Face Mill.

Outcomes: Located and drilled holes into Clevises, this was done post machining because we hadn't finalized out bushing sizes and certain clevises required different fixturing. Milled excess material off from the CNC machining process. This can be seen in Image 3. This was due to the fixturing process on the CNC machine.

Image 2.

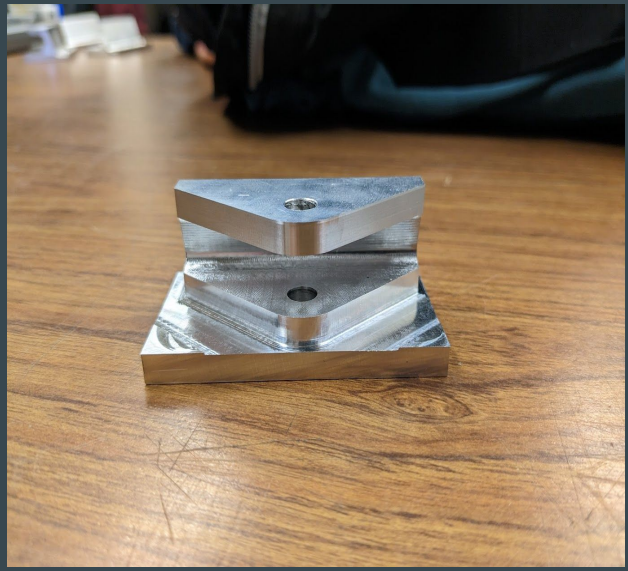


Image 3.

Stock Prep

Description: Prepped stock for CNC machining, often sent to sponsors.

Tools: All previous listed lathe, mill, cutting tools and metrology tools used

Outcome: Several successfully CNC machined components, including clevises, pushrods, bushings, steering components. All met concentricity, flatness and parallel requirements, often meeting or exceeding tolerance requirements.

Drilling Bolts for Locking Wire

Description: Drilled Holes in bolts for safety wire.

Tools: Bridgeport Manual Mill, Technical Drawings, Calipers, Edge finder, parallels (Image 4) and end mill or drill bit. Later processes used a collet to hold the bolt.

Outcomes: Located and drilled holes into bolt heads, this was because there weren't bolts in the size and strength that we required with the holes pre-drilled. Had to be highly repeatable and special care was required to not break the end mill or clamp the threads down. These were critical components in the gearbox, and any damaged bolts had to be discarded.

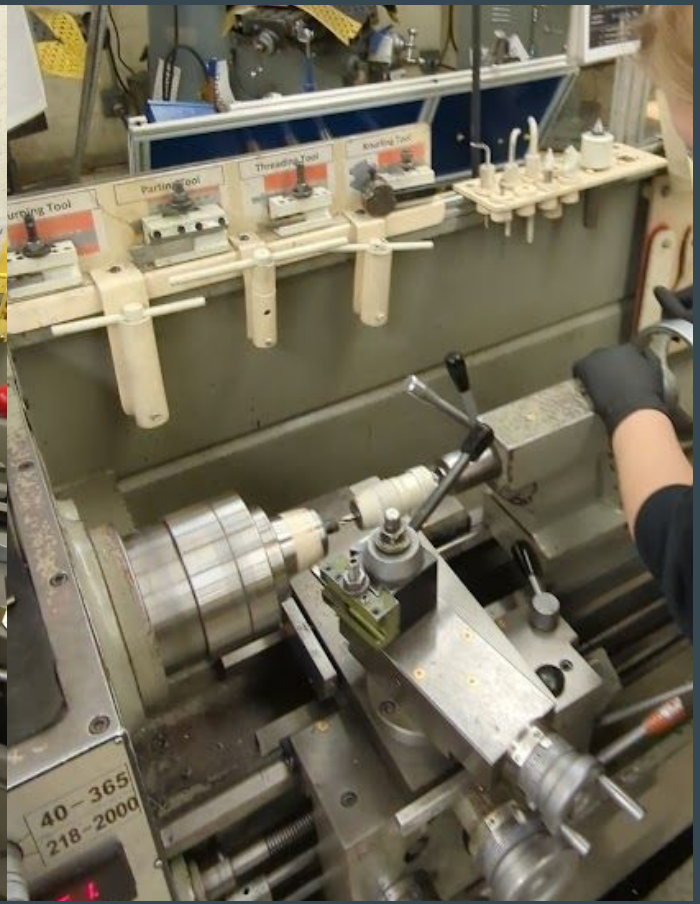
Image 4.

Pushrod/Trackrod Drill and Tap

Description: Used a lathe to drill and tap threads into pushrods and track rods to attach rose joint/rod end bearing.

Tools: Lathe, centre drill, drill, tap.

Outcomes: For the tap operation we set the lathe to low gear and set a slow rpm, set the tailstock to the unlocked position so it could slide. Then the tap would be free to thread in, using the spindle controls to change the direction of the tap and break up the swarf, just like manually tapping threads. Utmost care had to be used to not bind up the tap or crash the tailstock into the part. Virtually all rods created worked with rod ends and were used on the car. This process sped up manufacturing and enabled us to make enough spares.



Welding

Description: Fabricate structural joints for personal and academic projects

Tools: SMAW (6010, 7018), GMAW, drill press, grinder, Oxy Acetylene Torch.

Outcomes:

Completed structural welding class at Portland Community College with high marks. Fabricated components for fixtures and test assemblies. Developed strong attention to detail, weld quality and joint prep skills. This was my first exposure to reading technical drawings.

Autonomous Stepper Motor Mount

Description: Milled a mount for the steering motor for the autonomous conversion of our Formula Student Car

Tools: Bridgeport Manual Mill, Technical Drawings, Calipers, Edge finder, parallels, face mill and end mills.

Outcomes: Learned about locating features, feeds and speeds. Made a dimensioning mistake, ended up as an expensive paper weight. Learned about Datums and GD&T after the mistake. Ultimately this part taught me about thinking about the whole machining process beforehand and planning out exactly how to locate and machine features that are dependant on one another.