Unit 1 - (Continued Safety and Training)   (Length of Unit - 3 Days/Ongoing)

Students will review their training on the lathe, mill, cnc plasma and cnc mill. Students will be required to retake several safety test prior to using the machines on a daily basis. Students will be required to read blueprints and use precision measuring equipment to design and create various projects on the lathe, mill and cnc equipment. Students will be required to enforce all safety rules and machine clean up on a daily basis.

In this unit, students will …
Recognize and demonstrate shop safety during lab activities.

Students will wear safety glasses at all times when using any piece of equipment.

Students will make all the adjustments when the equipment is off and to the appropriate speeds.

Students will complete all required safety with a 100%.

Standards for (Metals 2)

MNF1.a.7.h: Identify safety and health protections and procedures that are critical to worker well-being.

MNF1.c.6.h: Learn how to cooperate with others in ways to exhibit respect for individual and cultural differences and for the attitudes and feelings of others.

MNF1.c.7.h: Recognize characteristics and benefits of teamwork, leadership and citizenship in school, community and manufacturing settings.

MNF1.h.7.h: Demonstrate the proper safety and use with plasma cutting equipment.

ENG5.b.7.h: Operate systems so that they function in the way they were designed.

PE1.b.11.h: Demonstrate and follow proper safety procedures for tools and machines used in power and energy systems.

Unit 2 - (Project Design)   (Length of Unit - 3 weeks/ongoing)

Students are given parameters and have the freedom to design their own projects using the lathe, mill and cnc equipment. This forces the students to think like an engineer, create like an operator and value the importance of blueprint reading and precision measuring. This unit is ongoing and enhances their skills and talents both as

an operator and engineer. The students are engaged throughout the course given the endless possibilities.

In this unit, students will …
Analyze and create project designs.

Students will be able to clarify and explain the function of a design product, life expectancy, material selection, cost, etc.

Students will be able to construct their project design to the specified dimensions within +/- .010".

Standards for (Metals 2)

BB1.a.5.h: Describe how systems can fail because of design flaws, defect parts, poorly matched parts or they were used beyond their design capabilities.

BB1.b.5.h: Select appropriate resources and explain how trade-offs between competing values, such as availability, cost, desirability and waste influenced their decision.

ENG1.a.9.h: Examine how the design needs to continually be evaluated and the ideas of the design must be redefined and improved.

ENG2.a.8.h: Analyze the process of engineering design accounts for a number of factors to make decisions.

ENG4.b.5.h: Develop and produce a product or system using a design process.

MNF1.e.8.h: Use a manufacturing system to produce a product.

Unit 3 - (Blueprints and Improvements)   (Length of Unit - 1 week/ongoing)

Students will be required to enhance their blueprint reading skills to find mistakes on various prints and consider revisions on certain parts. Students are required to have a blueprint and read a blueprint to make any project on any of the equipment. Students will work in small groups and independently on multiple assessments to enhance their understanding on blueprint reading.

In this unit, students will …
Assess blueprints and investigate other possible solutions.

Students will be able to question and revise poor blueprints.

Students will be able to redesign blueprints using Inventor/Fusion 360 Software.

Standards for (Metals 2)

ENG4.a.5.h: Identify the design problem to solve and determine how to address it.

ENG4.b.4.h: Refine a design by using prototypes and modeling to ensure quality, efficiency and productivity of the final

product.

ENG5.a.7.h: Document processes and procedures and communicate them to different audiences using appropriate oral and written techniques.

ENG5.b.9.h: Troubleshoot, analyze and maintain systems to ensure proper function, accuracy and precision.

MNF1.a.9.h: Select and apply the appropriate units and scales for situations involving measurement.

MNF1.c.9.h: Identifying various strategies to conflict resolution and their importance for a variety of situations.

Unit 4 - (Continued Precision Measuring)   (Length of Unit - 2 days/ongoing)

Students will continue training and enhancing their knowledge on multiple measuring devices - micrometer (inched and millimeter), depth gauges, calipers (vernier, dial and digital), steel rule (1/64th), gauge blocks, etc. Students are expected to be faster and more efficient with measuring and finding parts out of tolerance.
They will continue using required precision measuring tools throughout the course on various projects. Students will work in small groups on multiple assessments to increase their knowledge and hands-on experiences with all precision measuring devices.

In this unit, students will …
Be able t read and demonstrate how to properly use precision measuring tools.

Students will calculate and illustrate how to use inch-based micrometers, metric-based micrometers, dial calipers, dial indicators, 1/64th steel rule and depth gauge, etc.

Standards for ((Metals 2)

MNF1.a.8.h: Use appropriate tools, materials and machines to repair a malfunctioning system.

MNF1.a.9.h: Select and apply the appropriate units and scales for situations involving measurement.

ENG4.b.5.h: Develop and produce a product or system using a design process.

ENG5.b.7.h: Operate systems so that they function in the way they were designed.

ENG5.b.9.h: Troubleshoot, analyze and maintain systems to ensure proper function, accuracy and precision.

Unit 5 - (Advance CNC Machining)   (Length of Unit - 4 weeks)

Students will continue their knowledge of cnc operating, g-code and machine set-up. Students will be given more responsibilities setting the machine up and getting things organized to machine prior to instructor inspection. Students will have opportunities to change the tooling, measure for tool offsets/work offsets and place those measurements into the controller. Students will be using Fusion 360 to help generate code and designing more complex parts. In addition, the students will manually write several codes to help understand

the coordinates (x,y, z) and absolute zeroing vs. incremental zeroing.

In this unit, students will … Demonstrate machine setup, G-Code and machine operation. Students will be able to design, construct and evaluate individual project given specific criteria. Students will be able to generate g-code from fusion 360 and upload to the CNC simulator to proof read the code for machine clearances. Students will be able to change tooling and reset the tool offsets to .005" Students will be able to determine the safest way for clamping stock for project completion. Students will be able to run various canned code to quickly complete common cnc cutting.

Standards for (Metals 2)
BB1.b.6.h: Choose and perform the material processing operations of forming (bending, pressing, forming, rolling bonding, gluing, brazing, welding, fastening, bolts, rivets, clips and finishing surface preparation, cleaning and treatment). **MNF1.a.9.h:** Select and apply the appropriate units and scales for situations involving measurement. **MNF1.e.8.h:** Use a manufacturing system to produce a product. **MNF1.h.8.h:** Demonstrate how to use oxy-acetylene and plasma cutting. **ENG4.b.5.h:** Develop and produce a product or system using a design process. **ENG5.b.8.h:** Use computers and calculators to access, retrieve, organize, process, maintain, interpret and evaluate data and information in order to communicate.