Stirling Engine

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Aim of Project

The aim of this project was to Design, manufacture and test a working Stirling Engine in a group environment

Background

The main objective of this team-based project is to design, manufacture and test a Stirling engine. A Stirling engine is an external heat engine which means it produces power from heat, but the heat source is external to the engine. In our groups we were assigned to carefully choose between a Gamma, Beta or an Alpha sterling engine. Our group then must design their chosen engine, model it on SolidWorks, manufacture each individual piece using Solid Cam and CNC machines and finally assemble and test their final design. This is all done in groups of three or four and is to be completed in seven months from the start of October to the first week in April.

Design Procedure

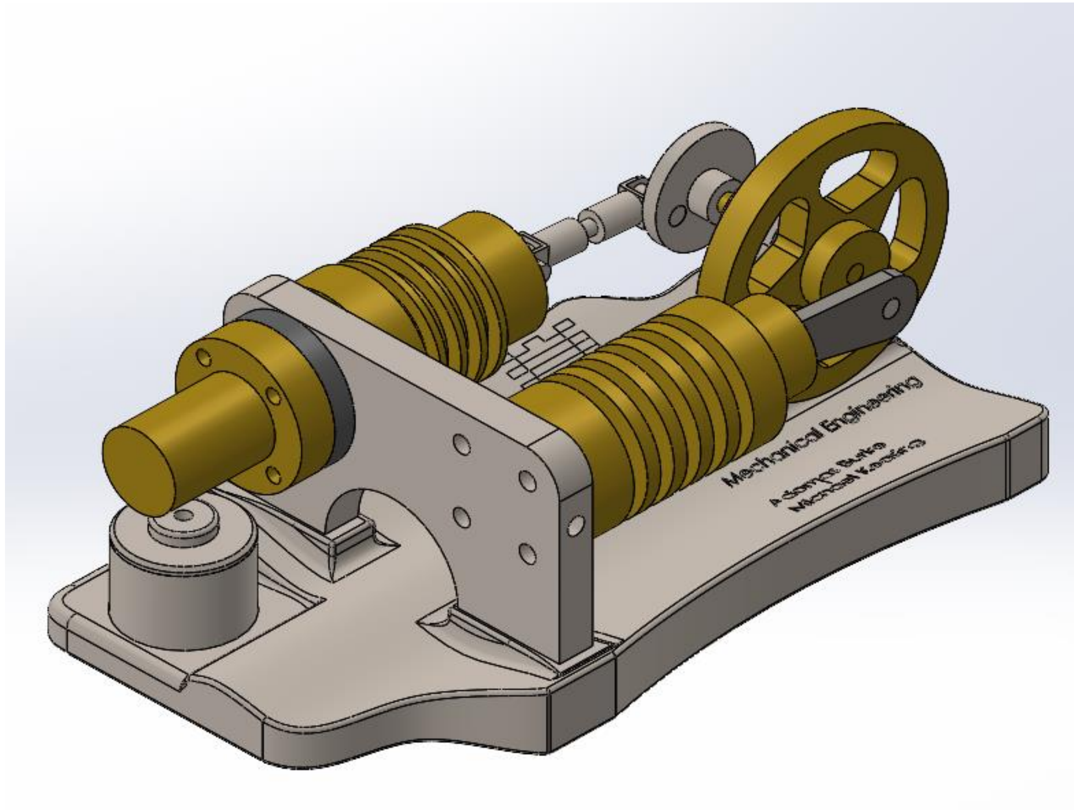
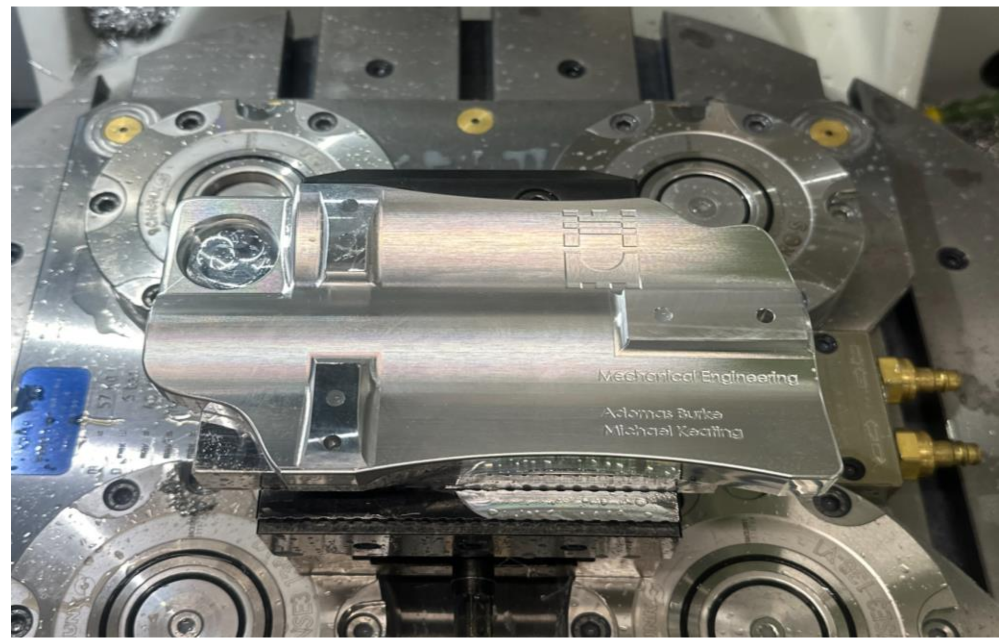


Figure 1: SolidWorks Model

Seen above is the final SolidWorks design of our Stirling Engine. SolidWorks was a big part of our design procedure as we knew once every park on SolidWorks was working with each other we could start to manufacture. We had several constraints that we could not exceed that we had to be conscious of which altered our design procedure also.

Manufacture

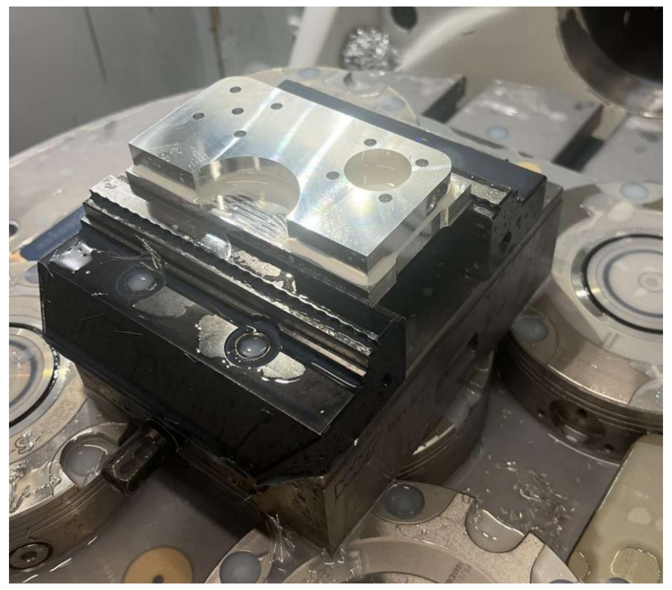
There were several various manufacturing processes utilized in the manufacturing process of this project.



CNC Machining: The components chosen to be manufactured in the CNC machine were the Flywheel, Flywheel Axel Holder, Cylinder Holder, Burner and the Base. Solid Cam software was utilized to generate G-Code which instructed the CNC machine what operations to carry out.

Lathe Machining: The components selected to be manufactured in the lathe were circular as . features on the lathe such as the automatic feed ensured a good quality surface finish on each part.

Milling Machining: This was very useful for drilling and tapping holes in precise locations and for completing the manufacture of the nylon piston.



Materials

The materials used for this project consists of Brass, Aluminum, nylon and steel.

Aluminum	Brass	Steel	Nylon
• Base • Burner • Cylinder Holder • Flywheels • Shafts • Hollow Piston (Displacer)	• Both Cylinders • Hot End (Heated Point) • Flywheel Axel • Flywheel	• Power Output Shaft	• Thermal Break • Power Piston

Simulation

Simulations was used to create a preview of how the engine will run and how will the temperature of the burner will behave when the heating component of the engine will react or will the nylon thermal break fail its purpose of preventing the heat to conduct further towards the engine.

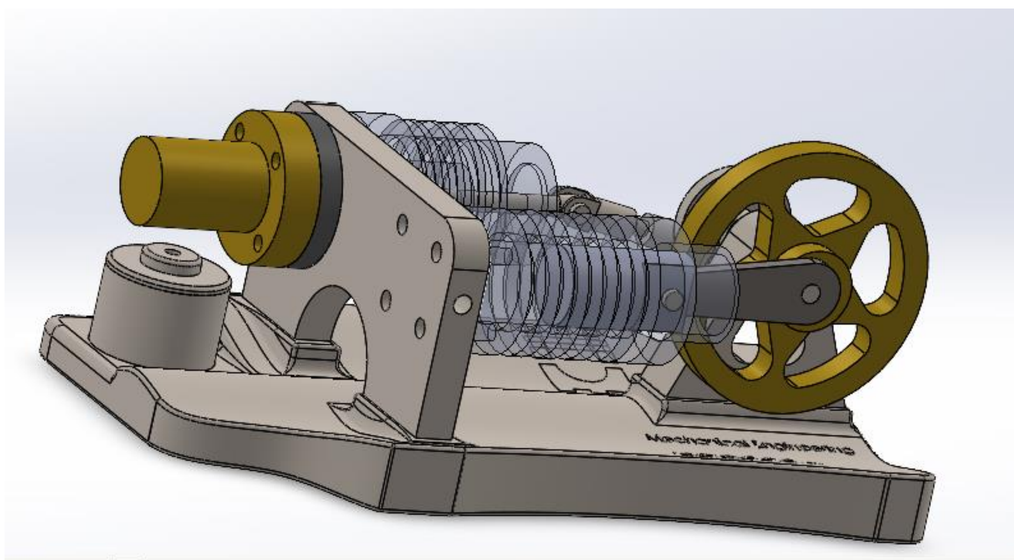


Figure 2: FEA Simulation

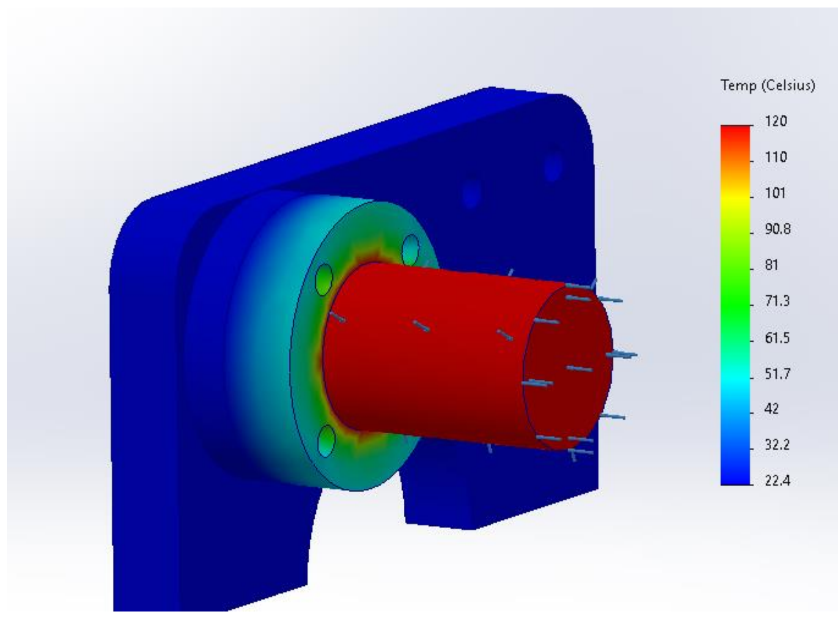


Figure 3: Thermal Break Simulation

Conclusion

After researching and design revisions in manufacturing the Stirling engine. There were a few challenges during the project but with good coordination, time and teamwork we overcame them. Our design was aimed to be efficient unique and durable while concentrating on precise and light weight components. We made the best possible use of multiple materials and machining. Overall, the project has helped us understand the huge scale that design and manufacturing goes into from start to finish on creating these projects. Time was the biggest factor in this project, countless hours went into reviewing and redesigning in solid works especially and to ensure that components are safe to machine in a CNC machine.

References

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