

Radial Engine – Inner Workings Group P2

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Aim of the Project

Review Current Design / Create functioning assembly
 Research Machining Strategies
 Use CAD/CAM to create programs

Background

This project aims to finish off a previously incomplete project on the design and manufacture of a radial engine. This group has been tasked with the inner workings of the Radial Engine. The project will require cataloguing of the existing parts that have been manufactured and completing the design to a point where all parts are ready to be machined and then to assemble into a working engine. The parts needing completion are the crankshaft, engine housing end covers, radial engine gear train valves and other parts that are external to the engine housing. It will be the aim to utilise the available work holding but fixtures will need to be designed and manufactured to machine certain parts. Engineering drawings will need to be created for all parts.

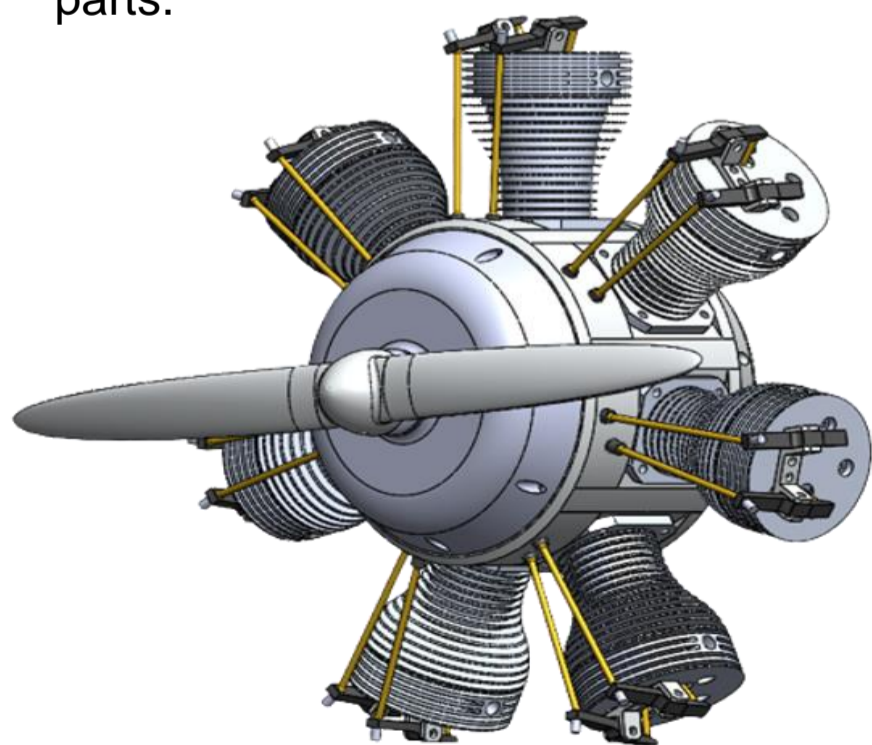


Figure: Completed SolidWorks Assembly

Project Review

Building upon a project initiated by a prior student group, significant modifications were applied to establish a more structured work-environment and facilitate an easy and clear communication between the team participants. Additionally, the 3d CAD inner parts design were reviewed, and modified as per as needed to achieve the internal mechanical motion necessary for full function ability of assembly.

Design Review

The design review also had the objective to use the technology present in the TUS work-shop, where the use of advanced machines, allow the easier fabrication of a complex part such a crankshaft. Follow below a quick explanation of what such capability can represent:

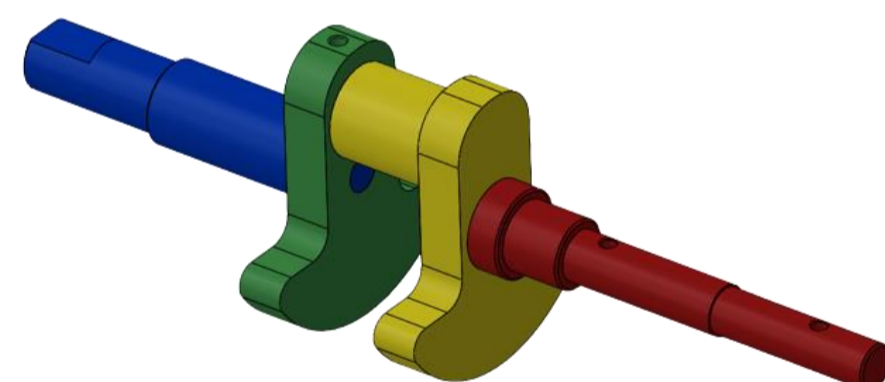


Figure : Initial Crankshaft Design

As shown above, the crankshaft was divided in four parts. However, considering the availability of a Mill-turn machine, the component was re-design into two parts and machined with a much shorter time and more Precise.

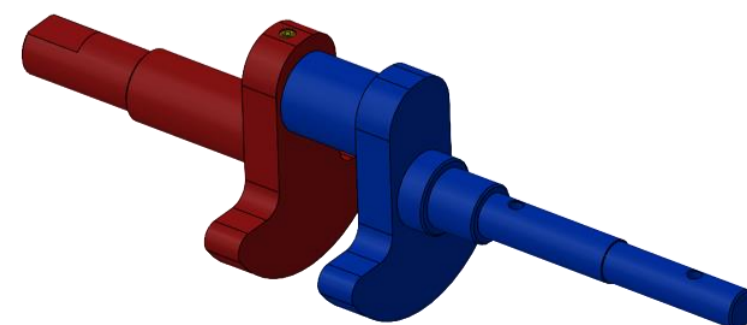


Figure: Final Crankshaft Design

Manufacturing

The Aim of the manufacturing of each part was to reflect the industry standard of efficient Machining practises such as Optimal Speeds and Feeds to minimise cycle time while maintaining high standards of surface finish and tolerances. These practises were utilised in the part shown below which resulted in a nearly Transparent Surface Finish, Hitting all tight tolerances required for the fitting of bearings and a respectable cycle time of 9 Minutes.



Figure: Acrylic Front Cover after first Operation

Fixturing

Fixtures were utilised for the Accurate Machining of parts with irregular geometries that could not be held easily in a Vice, as shown below.

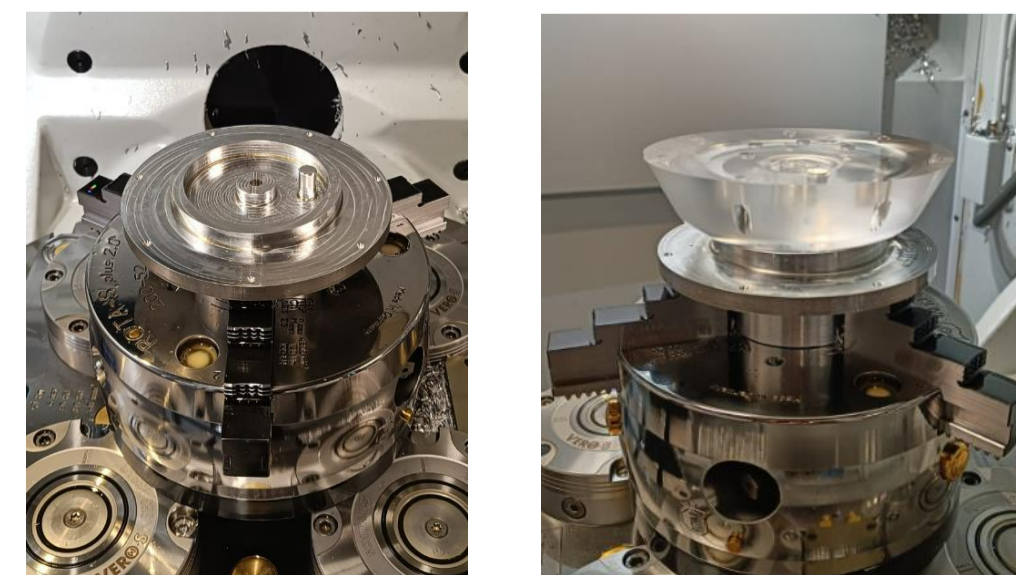


Figure: Left-Fixture Plate after Manufacture, Right with Cover positioned.

Gear Train

The changes applied to the gears were necessary for the new model as the previously designed gears were not of the same specifications as the physical gears that had been provided.

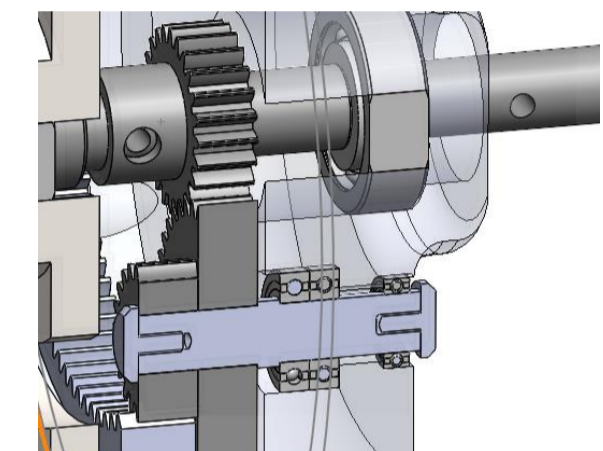


Figure: Updated Gear-Train in SolidWorks Assembly

Conclusion

The aim of this project was to review and complete the Design of the Radial Engine Inner Workings handed over to us from the previous semester. Our team was successful in carrying this out with a full re-structure of documentation making all documents easily accessible and understandable, all problems with the design rectified, Gear Train function completed, and all parts programmed in SolidCAM with as many parts physically machined as was possible given the barricades along the way that prevented us from using machines such as the breaking down of the compressor during our machining time.

Acknowledgements

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