Impeller Pump Project 2023-2024

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Aim of the Project

The aim of this project was to design and manufacture an impeller pump. The design should be able to empty a large vat of water as quickly as possible while also staying within the design constraints.

Background

Each group was given a dimension for the impeller. Our group's impeller had to be a final diameter of **66mm**. Our entire project was designed around this dimension.

We broke the project into a series of phases:

1. Research Phase
2. Design Phase
3. Feedback Phase
4. Redesign Phase
5. Manufacture Phase
6. Assembly / Operation Phase

Managing our project using this phase-based structure allowed us to use our limited time as effectively as possible. It also allowed us to organise our tasks by importance.

Research

Not wishing to go into the project blind, we first decided to do some research into existing designs. One of the most important parts to the function of the pump is the impeller itself, of which there are three main designs:

Figure 1: Three types of impeller fan designs

One of our main philosophies was to keep our design simple; some projects from previous years were too complex to finish in the time given and sometimes rendered them ineffective.

Our group also drew on nature to influence our design, this is mainly seen in the design of our involute.

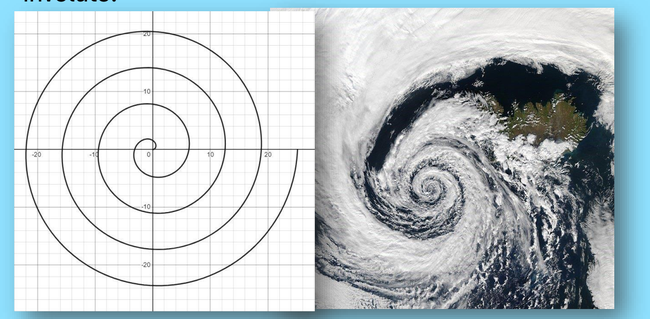
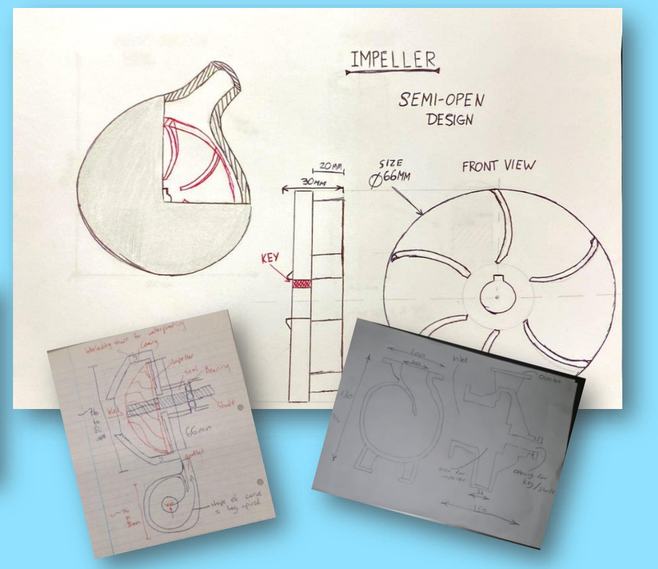


Figure 2: A graph of a Log Spiral used in our designs, and its occurrence in nature

Design and Feedback

Our first designs had many issues such as potential for leaks, complexity and lacking required design features for function to name a few. By continually modifying each feature using manual drawings and SolidWorks, along with receiving guidance from our professors, we created a final design that fits all the required criteria and should work effectively.



Photos of various work-in-progress design documents

Manufacture

The Manufacture phase was the longest and most important phase of the project. It was imperative that we effectively assigned and completed necessary tasks and maximized our productivity.

Our first order of business was to produce working drawings for use in the workshop. These include all the required measurements for the parts to be made.

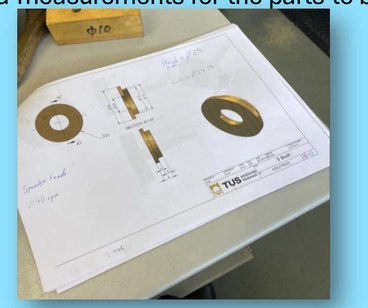
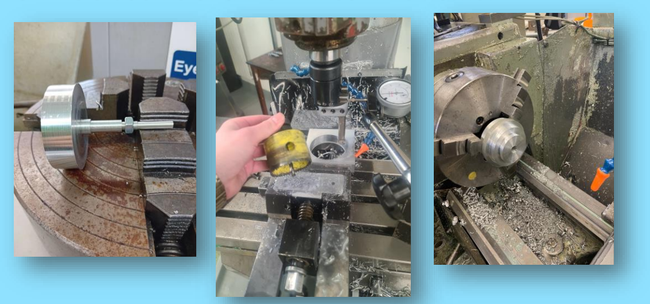


Photo of an example of a finished drawing sheet

Most parts had to be partially or wholly completed in our workshop, owing to the number of parts between all the students and the limited time frame.



Photos of various work-in-progress parts

Some parts, such as the base and impeller, had to be made with CNC solutions due to their complexity.

Photo of the impeller having been completed in the CNC Spinner

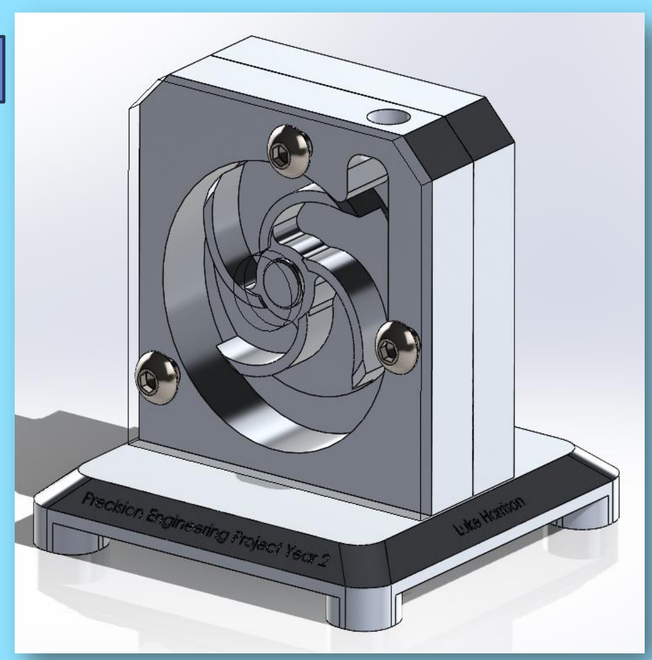


Figure 3: SolidWorks model of final pump

Conclusion

This project taught us a lot about the difficulties and effort that goes into creating a product. Throughout the entire ordeal we learned best practices for:

- Managing our time effectively
- Managing material costs and budget
- Organising and categorising tasks and processes
- Ensuring parts were produced accurately
- Designing and redesigning to ensure the best final product
- Working within design constraints
- Working effectively with team members and ensuring everyone is pulling their weight