Impeller Pump Project

Group P3

Adam Grimes, Reece Mulqueen, Brendan O' Brien

TUS

Aim of the Project

The aim of this project is to design, assemble, and test an impellor water pump. Our goal is to create one capable of emptying a 5-litre tank of water.

Objectives:

- Research Impeller pumps and their applications, components used, and general operation.
- Create three concept designs by means of rough sketches and carry out a design study to select the most suitable/efficient design for our use case.
- Create an assembly of our final design in SolidWorks and provide a full set of working drawings for all modelled components.
- All unique parts are to be machined using either manual machining, CNC, or 3D Printing.
- Assemble and test the pump's capabilities using the motor provided. Test how quickly it can empty a 5-litre tank of water. The goal is to empty the tank as quickly as possible.

Background

An Impeller pump is a type of axial flow pump designed to move a liquid by means of rotational energy.

The project we have been assigned involves researching, designing, and manufacturing an impeller pump.

We have been given almost complete freedom over the design with only a few design constraints which must be adhered to…

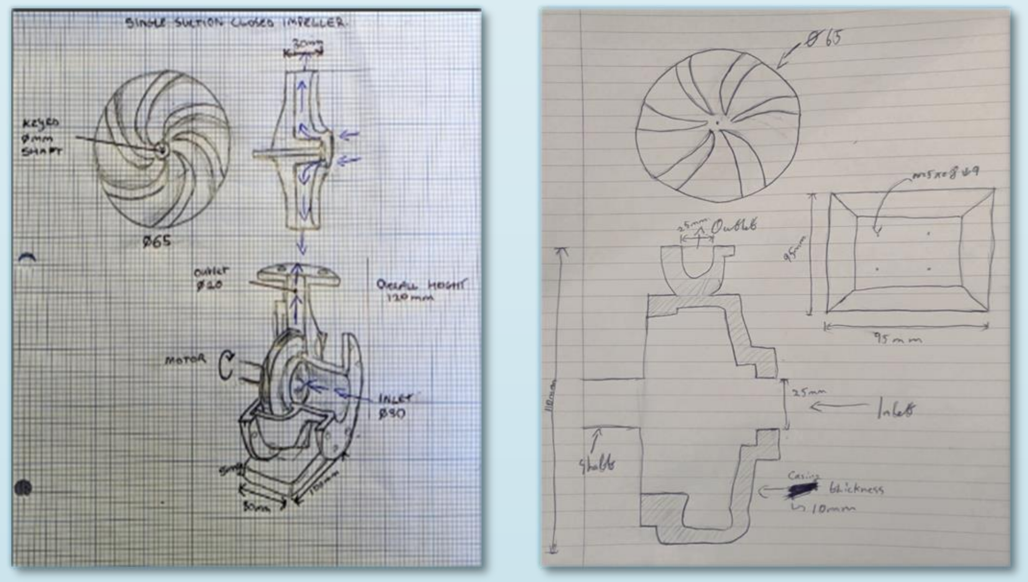
Specification	Details
Maximum Base Stock Size:	150mm x 100mm or 150mm Diameter
Machining Base & Impeller:	CNC Machined, OP1, or OP2 may be done in the manual workshop if needed
Impeller Type:	Each Team can select either Open, Semi-open, or closed
Maximum Impeller thickness:	30mm
Impeller Material:	Steel or Aluminium
Pump Type:	Non-submersible
Critical Design Components:	The final design must include seals, bearings, etc.

Design:

The images below (*Images 1&2*) show the concept ideas we considered when deciding on our final design and the type of impeller we were going to choose.

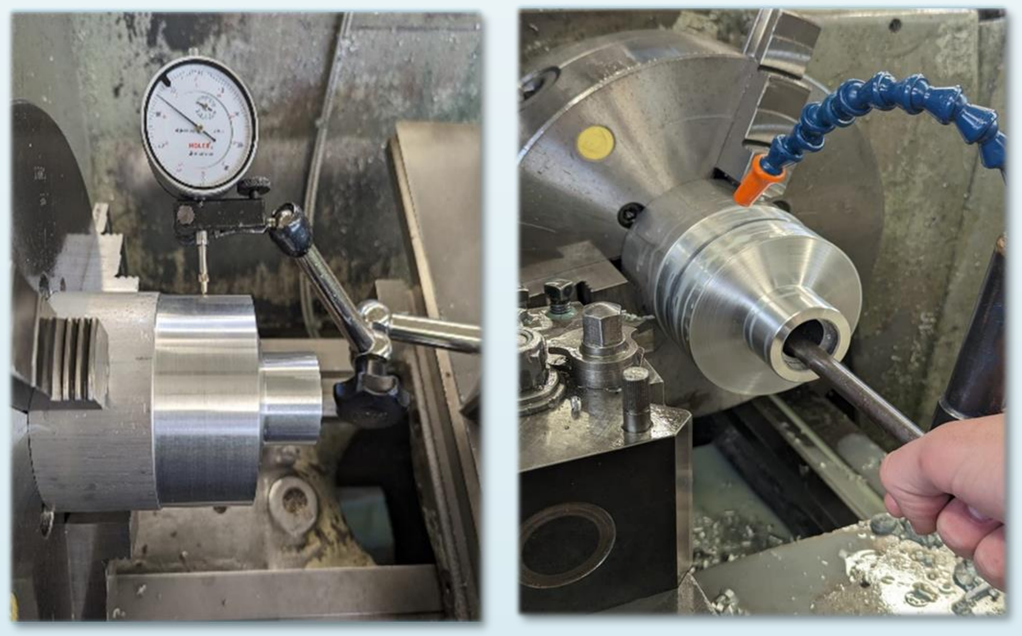
We initially considered an open impeller due to its ease of machining, followed by a closed impeller due to its superior efficiency.

We finally concluded that given the complexity of the closed impeller design and our time constraints, a semi-open impeller would be our most suitable option.



Images 1&2 - Early Concept Design Sketches

Manufacturing:



Images 3&4 – Machining of Rear Casing

Our first step was to manufacture as many components as we could using the workshop's manual machines. We had three lathes being operated at once machining the casing, impeller shaft, and bushing.

We then programmed the machining of our base and impeller for the CNC machine as these parts were too complex to be manually machined.

We opted to 3D print our outlet due to its complexity, which made manual machining impractical and to avoid the time-consuming process of programming the CNC machine.

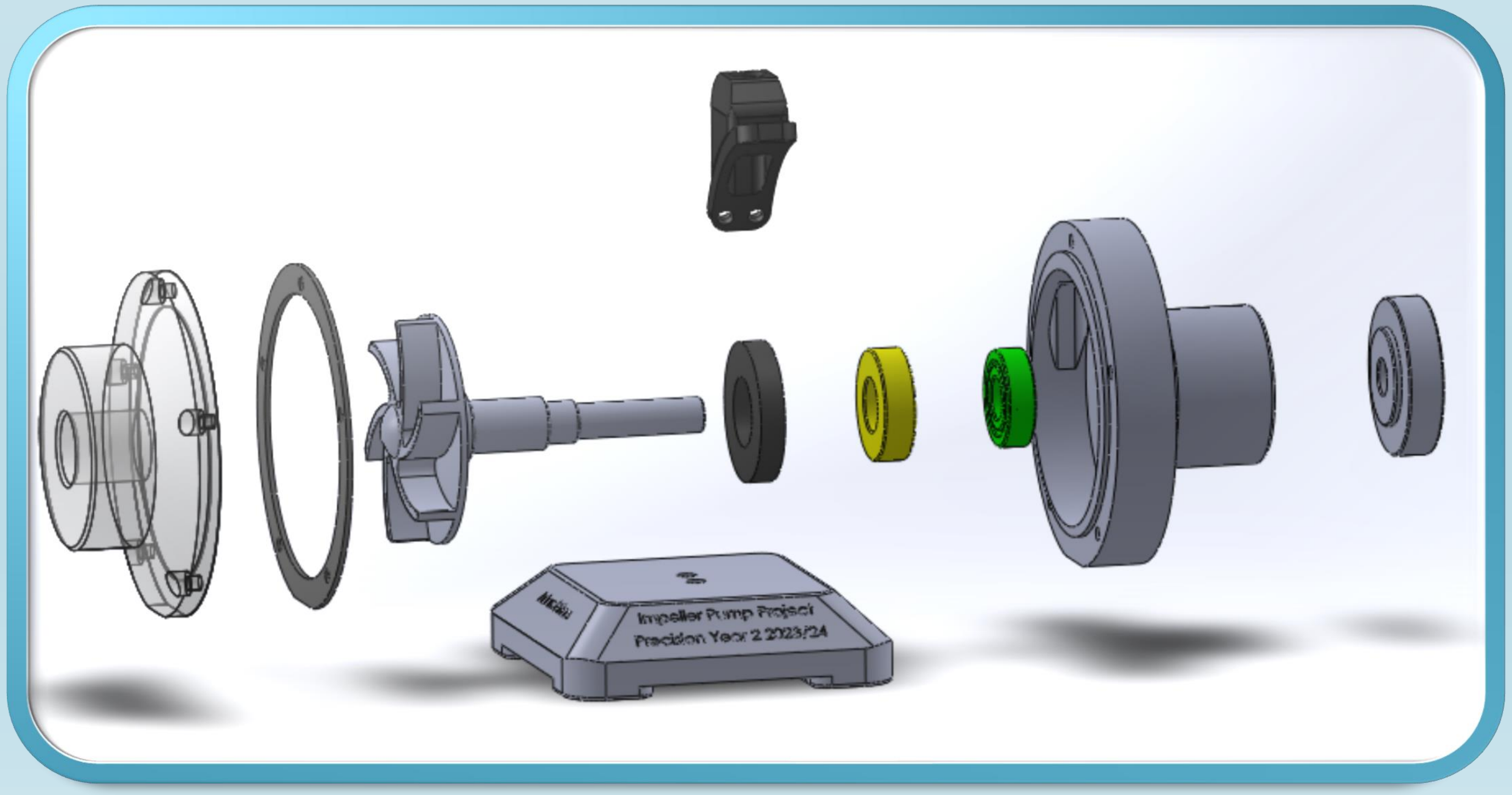


Image 5 – Exploded View of the SolidWorks Assembly

Final Solution:

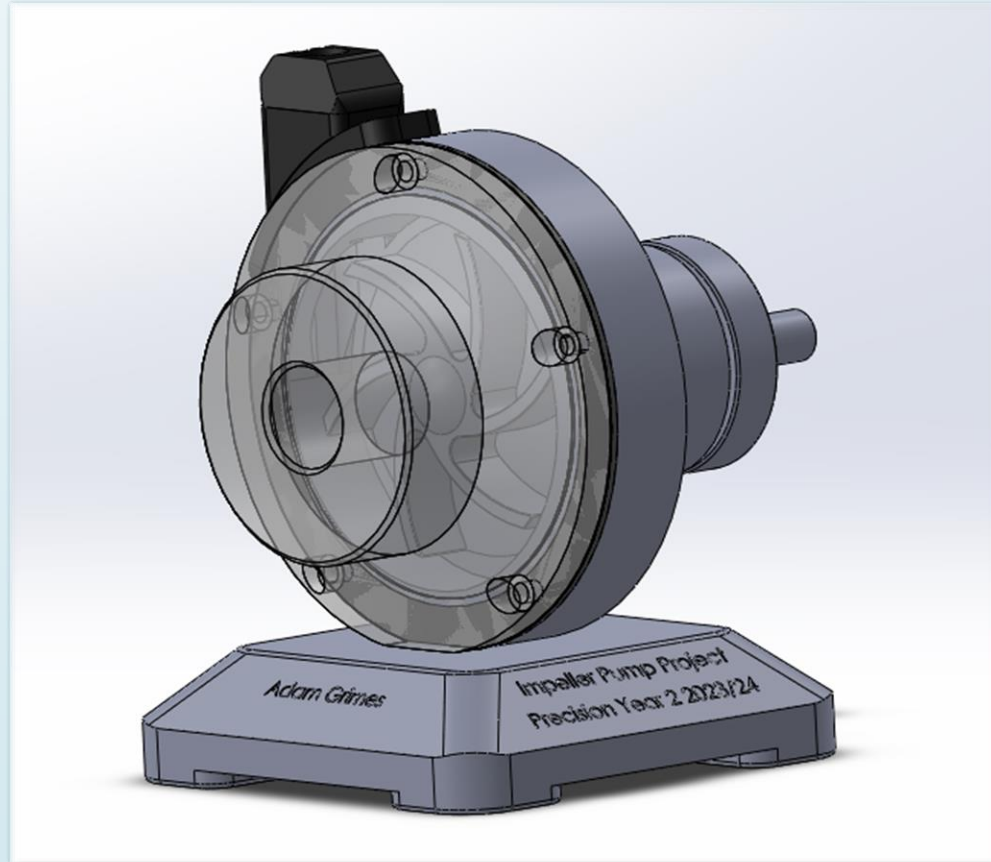


Image 6- Full view of SolidWorks model

The design of this impeller pump includes an inlet with a ¾" female thread and an outlet with a ½" female thread, along with a bushing, a casing that houses two bearings, a lip seal, a gasket, and a semi-open impeller/shaft (*Image 5*).

This design was primarily focused on having parts that could be machined on a manual lathe.

Conclusion:

The team worked together to produce a fully functional pump through both CNC machining and by applying our practical skills in the workshop.

Despite encountering some minor issues during manual manufacturing, we successfully adjusted our machined parts to conform to the project's specified part tolerances.

Contact Details:

Adam Grimes K00281992@student.tus.ie
Brendan O' Brien K00300527@student.tus.ie
Reece Mulqueen K00285462@student.tus.ie