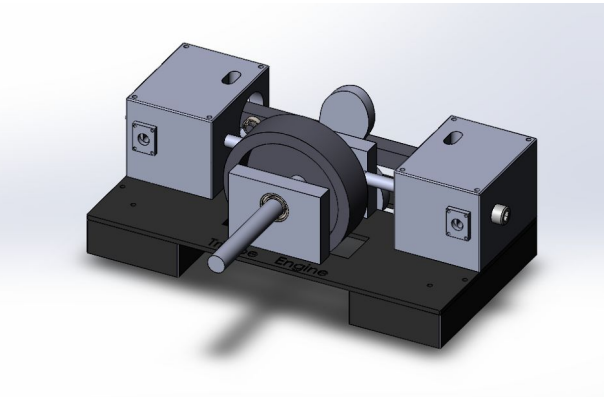
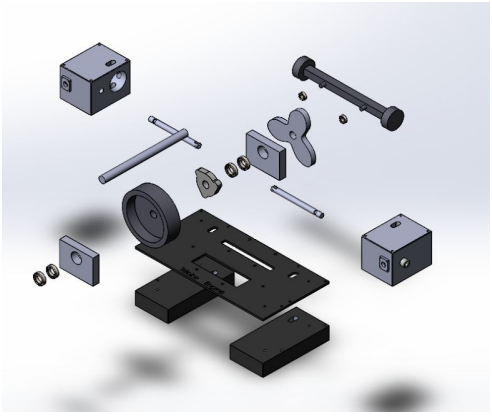
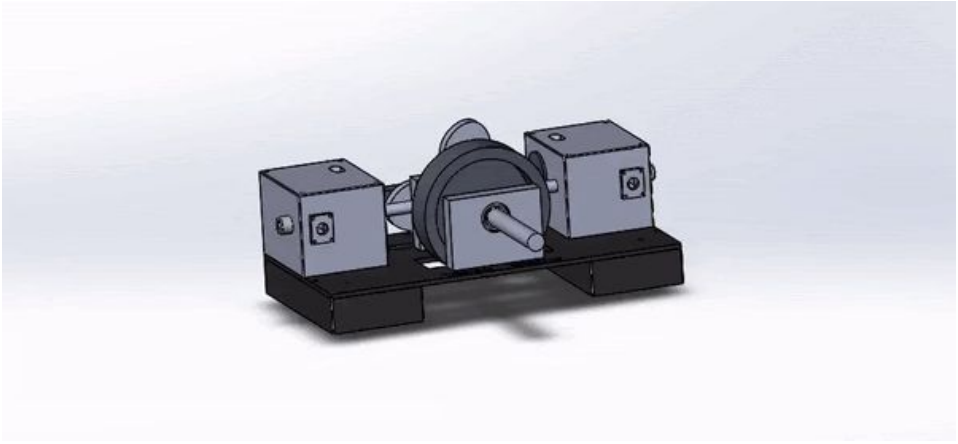
Greensteam Design Report

Trilobe Boxer Engine - Phase II
Lee McEligot
Fall 2020
Design Development and Renders







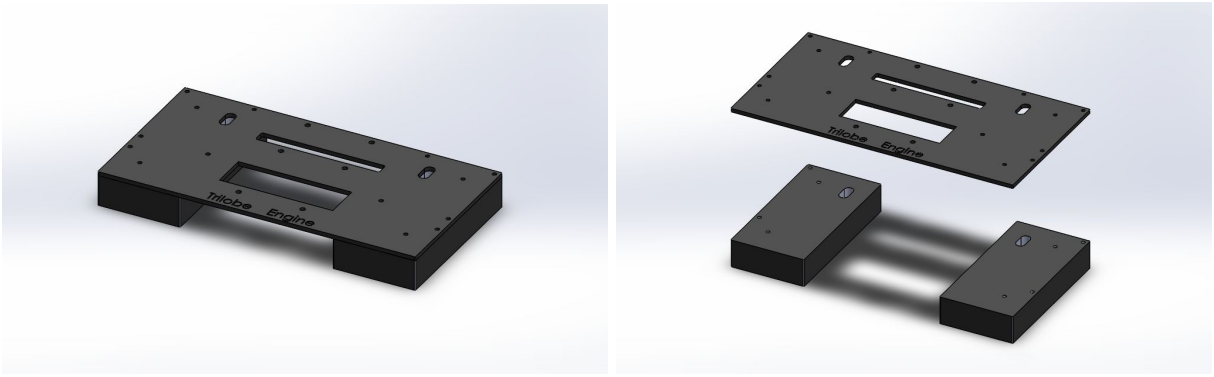
For the Fall 2020 Quarter, the design and development of the Trilobe Boxer engine was continued to its second phase and construction drawings were produced. The process began with research and looking into Trilobe engine mechanics as a whole, though specifically looking into the trilobe as it is the most unique component in the design. Then different parts of the engine were remodeled to optimize and simplify the engine. Finally, construction drawings were created for the parts for manufacturing purposes.

Within the design and modeling process, redundancies were removed and certain parts were simplified that were previously overcomplicated. This includes the removal of the exhaust cylinder within the exhaust block assembly and simplifying the design of the shaft mount. Also within the modeling process, parts were refined, making them more accurate. A spring system was added to the exhaust block for the inlet valve system and added a bolt for easy access.

Throughout the designing process, there were a few problems. The first was the optimization and understanding of the cam responsible for power generation. In order for the trilobe engine to properly work, it must rotate the cam without having it reverse direction. This required an understanding of the mechanics of the different cams. The cam had to be steep enough at its peaks and shallow at its troughs. The previous design was questioned for not being steep enough, yet with the inclusion of the flywheel, providing extra inertia, the problem was solved. Another problem was the inclusion of the spring system in the exhaust cylinder. The modeling and understanding of the system provided difficulties to the design process of the system. It is still in its trial phases and is not ready for construction.

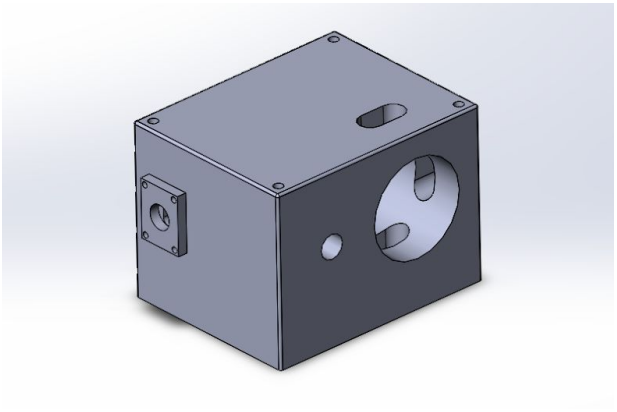
Part Breakdown

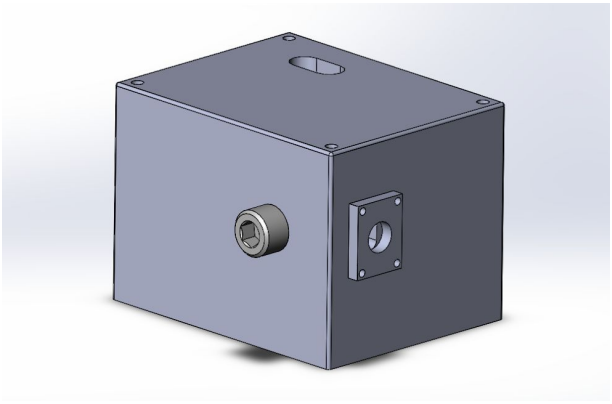
Base

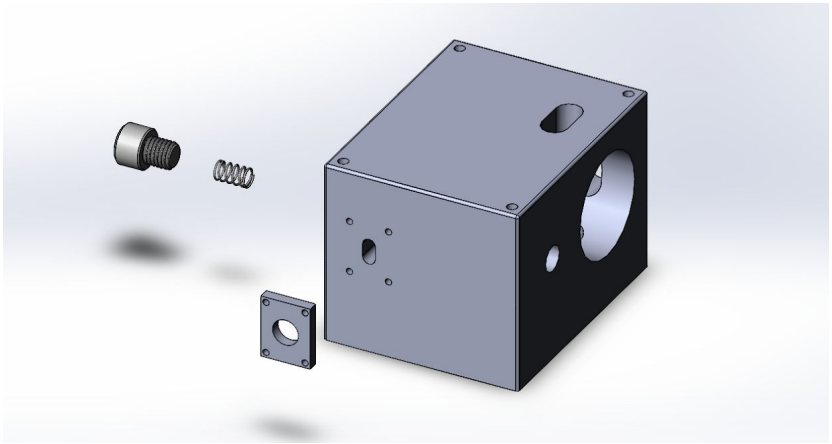


The Base assembly consists of a base plate and two legs. The base plate has two larger rectangular holes, the larger one for the flywheel and the smaller for the trilobe. The ovular shapes are exhaust ports for steam leaving the bottom of the cylinder block. The base was only slightly changed from the original design with the addition of holes for fasteners for the shaft mounts and the exhaust ports in both the legs and the plate. The targets for this design was adjusting for other subassembly's design changes, hence the addition of the fastener holes and the exhaust holes.

Cylinder Block

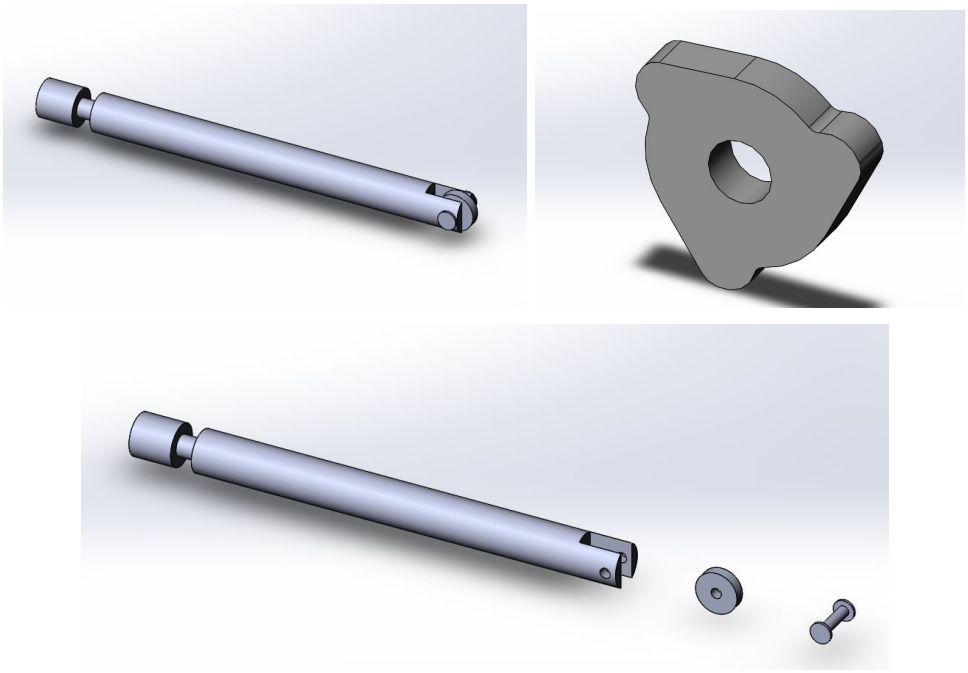






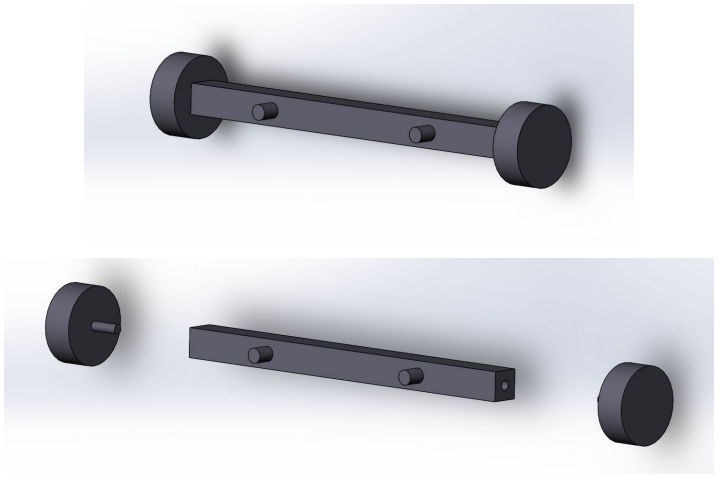
The Cylinder Block assembly consists of the cylinder block, an inlet valve attachment, a socket head cap screw, and a spring. There were changes from the last design including changes to part designs and additions and removals of parts. The changes to part design came on the cylinder block, where the inlet valve port hole was changed to a through hole in order for easy access to the spring mechanism and threads were added for a fastener. Then, the exhaust cylinder inside the block was removed as it was redundant and unnecessary to the design. Finally, a spring and fastener (head cap screw) was added. The new components are not finalized and may be changed based upon material and size.

Inlet Valve



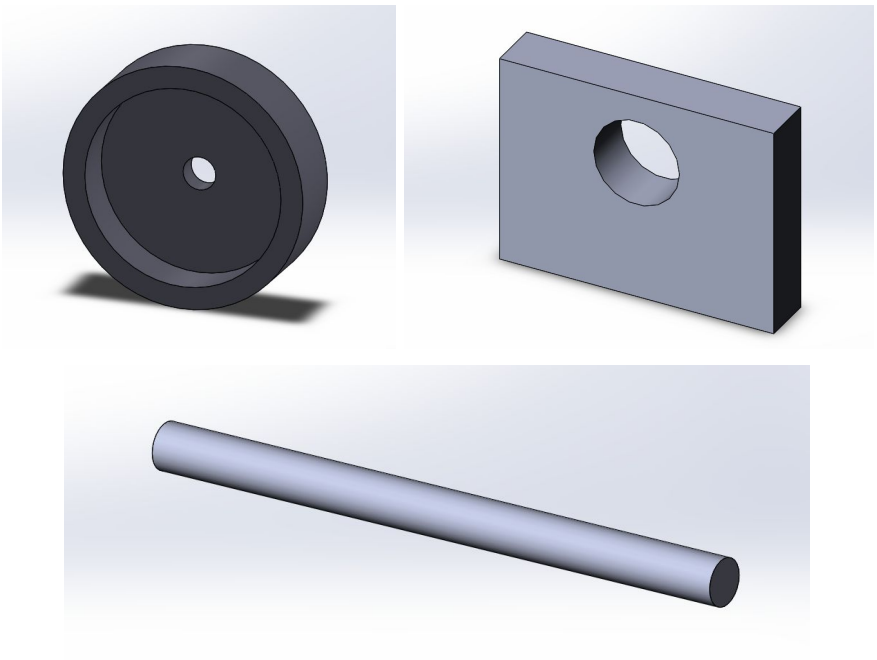
The Inlet Valve assembly consists of a cylinder with a pin and roller assembled together. The entire inlet valve system is run with the usage of an inlet cam. The inlet valve assembly was not changed other than the pin which was decreased in size to compensate for the increase in area of the shaft mount. Because of the small size, the pin may need further modification to avoid risk of friction upon contact with the shaft mount. For the inlet mechanism as a whole, different mechanisms were implored such as using the spring system within the exhaust port to allow steam to flow in when the spring is stretched. This would involve changing the inlet cam to have troughs instead of peaks.

Piston



The Piston assembly consists of a piston rod and two piston pins. The piston rod has two pins sticking out for bearings that would move the trilobe cam. No changes were made to the design from the first versions. Some future additions could be the addition of a system where the bearing pins could be spring loaded to add some tolerance to the piston-trilobe mechanism.

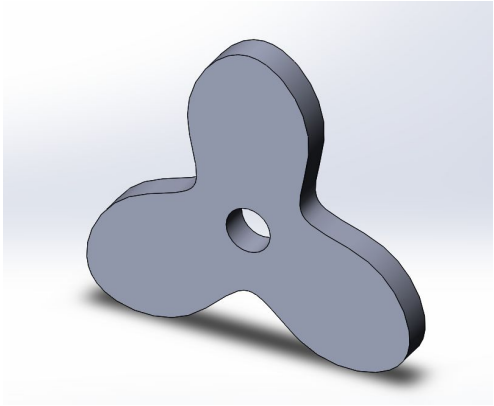
Shaft



The Shaft assembly consists of a shaft cylinder, shaft mounts, bearings and a flywheel. There were two shaft mounts placed on the base plate, one in front of the flywheel and the other in front of the trilobe cam and behind the inlet cam. The shaft cylinder was placed through both mounts, flywheel, and through the cams, up to the trilobe cam. The adjustments were made to the

shaft mounts. The shaft mount's shape was simplified to a rectangular shape, and in addition to that, holes with threads were added to the bottom for fastening to the base plate. Shape changes could be considered for the shaft mount if the inlet pin continues to be a problem.

Trilobe Cam



The Trilobe cam is where the linear motion from the pistons is converted into rotational motion for power generation. No changes were made to the Trilobe cam. There have been considerations in previous designs for different shapes such as an asymmetrical trilobe cam or a tristar cam, yet the Trilobe Cam was considered to be better.

Files

- Master CAD
- Renders
- Drawings