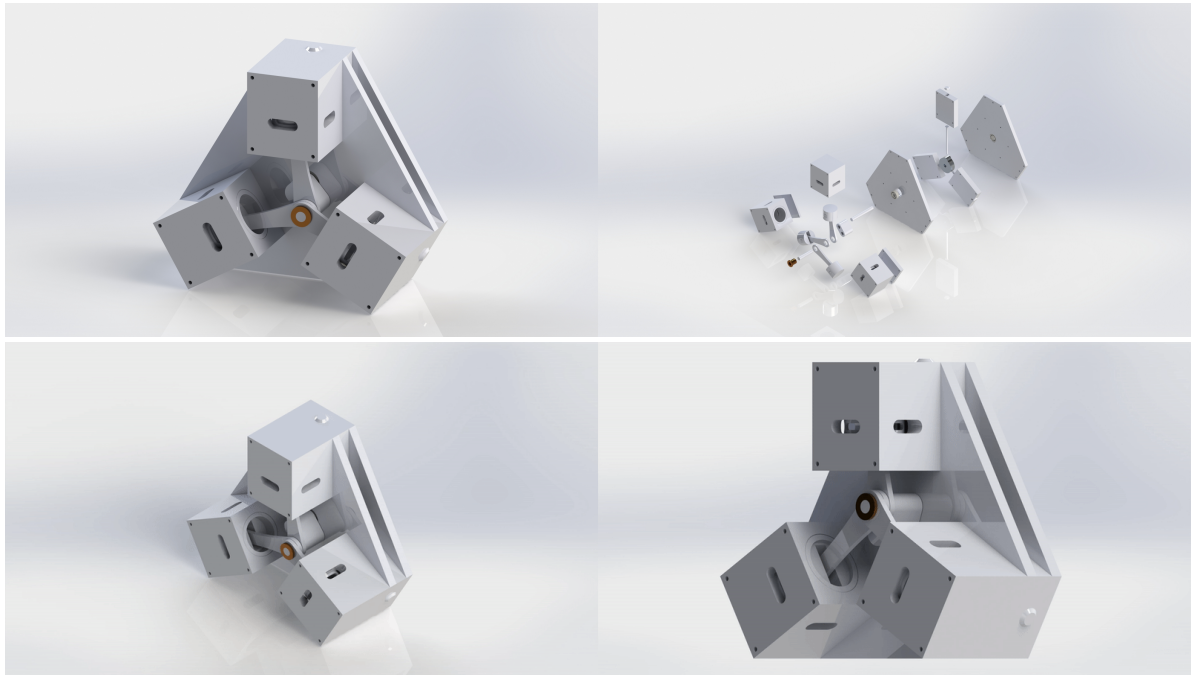# Greensteam Design Report: Uniflow Triradial Engine
Tae Rugh, Summer 2020

   This engine has a triradial layout meaning the 3 cylinders are spaced equally 120° around the shaft. The advantage of this triradial cylinder layout is that the engine is able to run smoothly without requiring a flywheel. Each cylinder is offset slightly from the others so the piston rods may all attach to the same overhung crank. Behind the cylinder array is the first bearing plate, followed by the valve array, and finally the second bearing plate. 3 cam rods, one for each cylinder, track on a single cam and actuate poppet valves for inlet steam. Exhaust is accomplished through the uniflow ports at bottom dead center. The uniflow, poppet, and cam systems are reliable and effective, though there are some limitations to the control of valve timing.

Part Breakdown

The crankshaft has a large overhung crank that is responsible for turning all 3 pistons. Since the crank drives all 3 pistons, it is subject to significant forces and must be relatively thick to compensate. A bushing sleeve is fit over the crank pin so the piston rods can rotate smoothly. The cam is attached to the shaft between the 2 bearing plates with angled cotter pins.

The cylinder blocks are separate for each piston and have holes at the head which connect to the valve blocks for inlet. Spacers are added between 2 of the cylinder blocks and the first bearing plate so that each cylinder is slightly offset and all 3 piston rods can attach to the same crank without interfering with each other. The slots on 3 of the sides are the ports for uniflow exhaust to escape to the atmosphere.

The piston consists of the piston head, piston pin, and piston rod. The pin is press-fit to the rod, but given clearance through the head. The pin stays in place by slight contact with the cylinder wall on each side. In this way, the rod is free to rotate along the axis of the pin, but held in place otherwise.

The bearing plates hold the cylinder blocks and valve blocks in place and support the crankshaft on bearings. Additionally, they have holes that allow inlet steam to pass into the valve block and then from the valve block into the cylinders.

The valve block houses a poppet valve which follows the cam. The housing for the poppet valve is bored from the top of the block and then sealed with a steam-tight cap.

Files
- Master CAD
- Renders