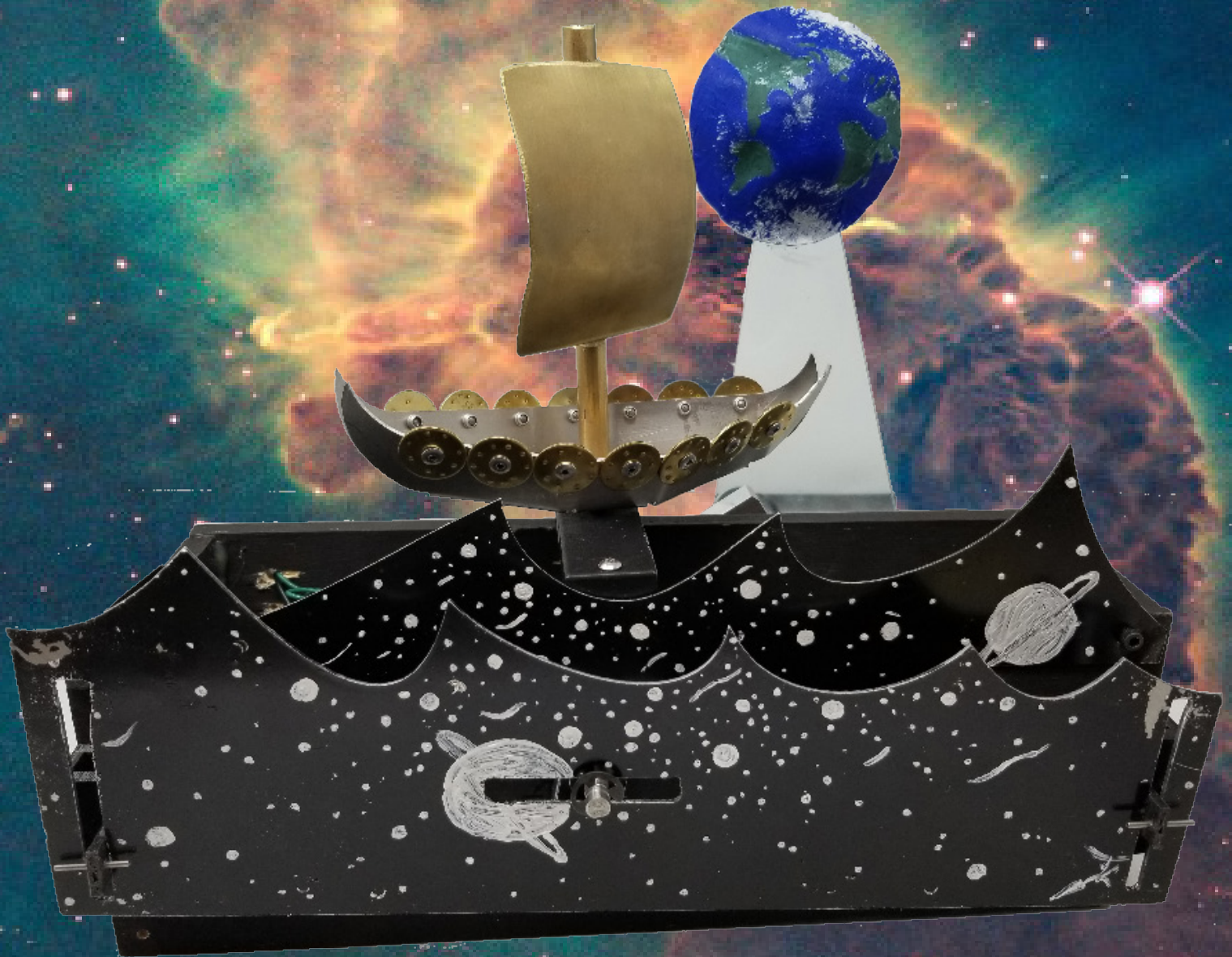


Adrift Among Stars

ENGR 2330: Mechanical Prototyping



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Executive Summary

Inspired by the vikngs, who used the stars to guide their travels, we created a moving sculpture that pays homage to our ancestors. Our sculpture symbolizes human's exploration of space; now that we have discoverd much of what Earth has to offer, we choose to search elsewhere, among the stars.

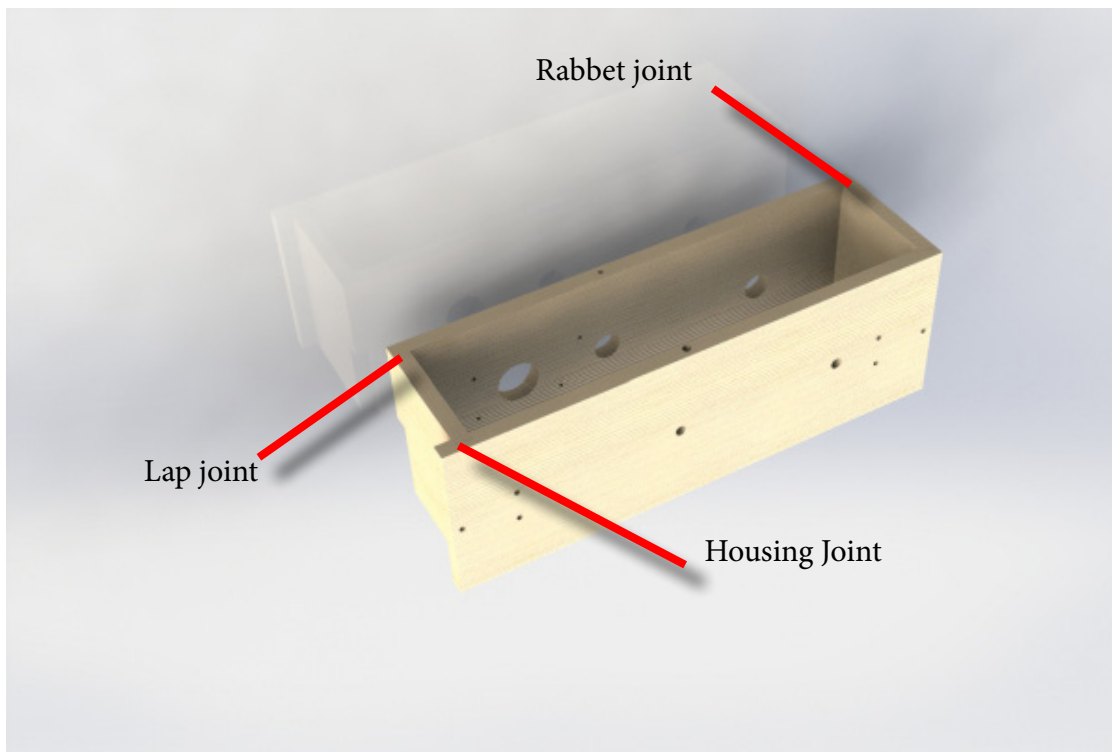
We created a boat out of folded sheet metal, which rises and lowers on a CAM. The boat floats on a sea of stars, the piece resembling waves on the ocean. The waves shift up and down using a scotch yoke mechanism. Earth drifts in the background using a four-bar linkage. Overall, the piece works fairly well. The planet moves much faster than intended, and the boat and water tend to wobble or stay stationary for short periods of time.

Detailed Design Review

We began our sculpture by creating the most important part, the frame and the drive system. We used a gear transmission and chain drive to ensure all of our parts would move. But before we could put all these transmissions in, we had to make something to hold these.

The Box

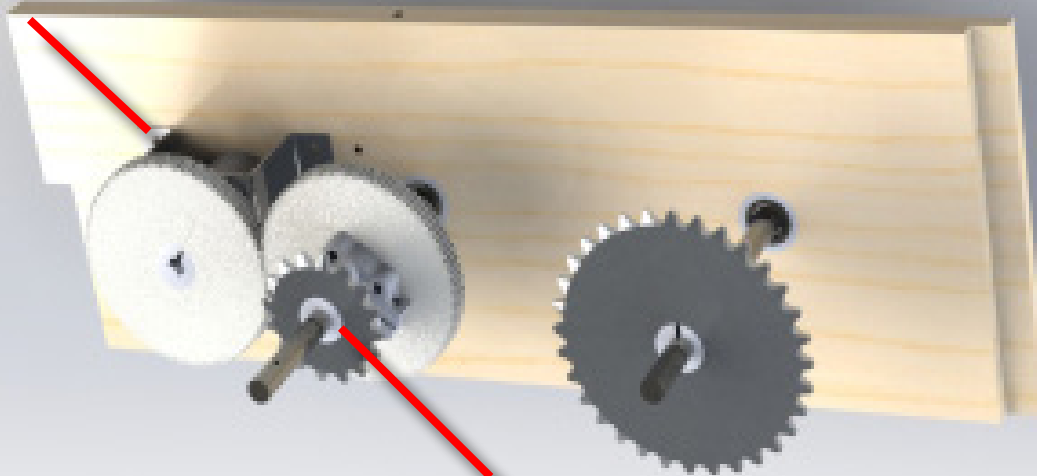
We begin our sculpture with the box. It consists of four pieces of plywood that are woodglued together. We use a rabbet, lap, and housing joint to hold this box together.



The Transmissions

Moving on from the box, we have our gear and chain transmissions. Our main system runs on two shafts and the output shaft from the motor. The motor has a gear mounted on it, which connects to a gear on the adjacent shaft. Next, a sprocket is on the shaft which runs to a smaller sprocket on the third shaft (2:1 gear ratio). All gears and sprockets were mounted using spring pins. The motor was mounted using a folded sheet metal piece, and the bearings on each shaft were mounted into the box using 3D printed bearing mounts that press fit into the wood.

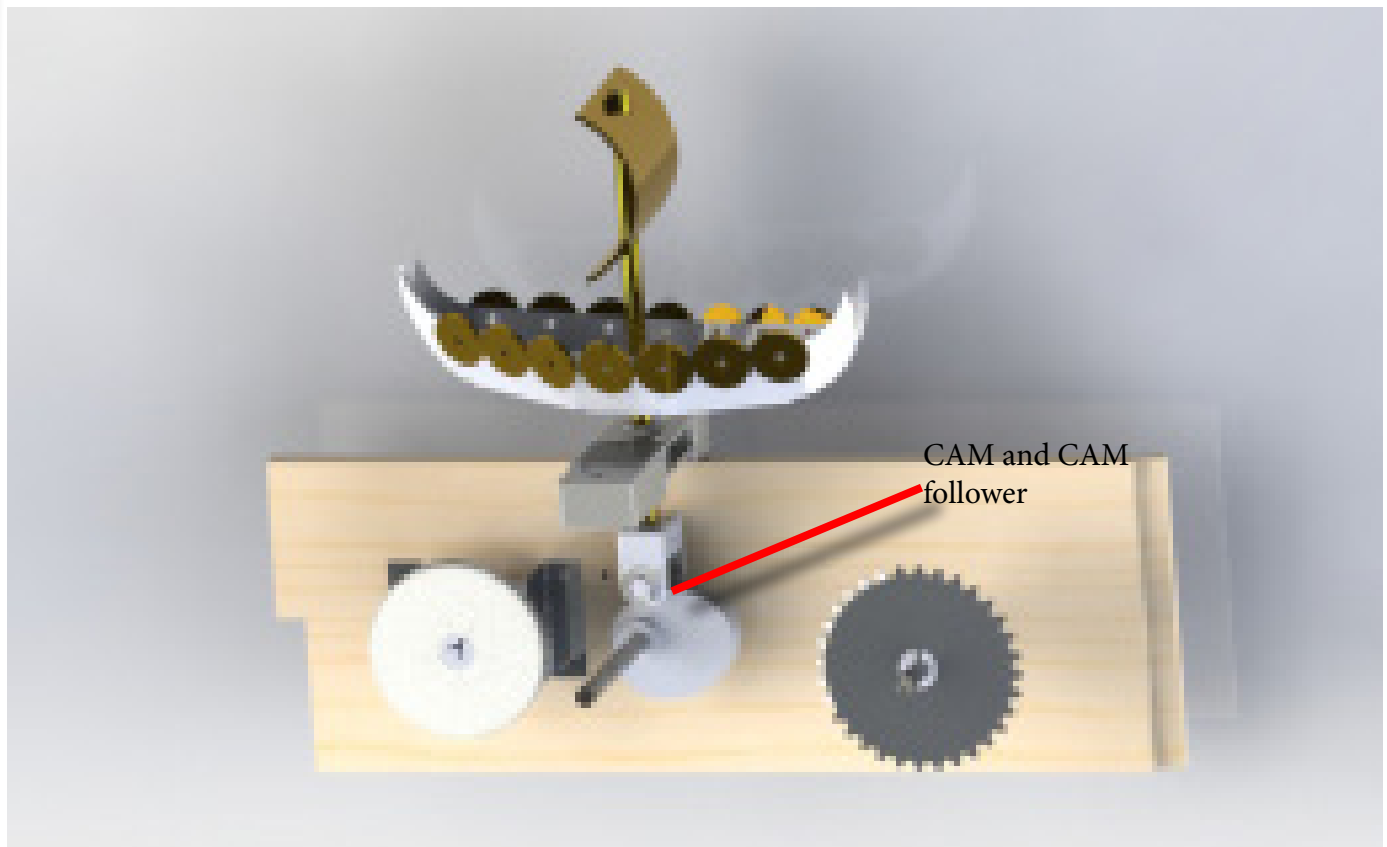
The motor mount bolts into the motor and screws into the wood



All hubs the gears are mounted on are spring pinned

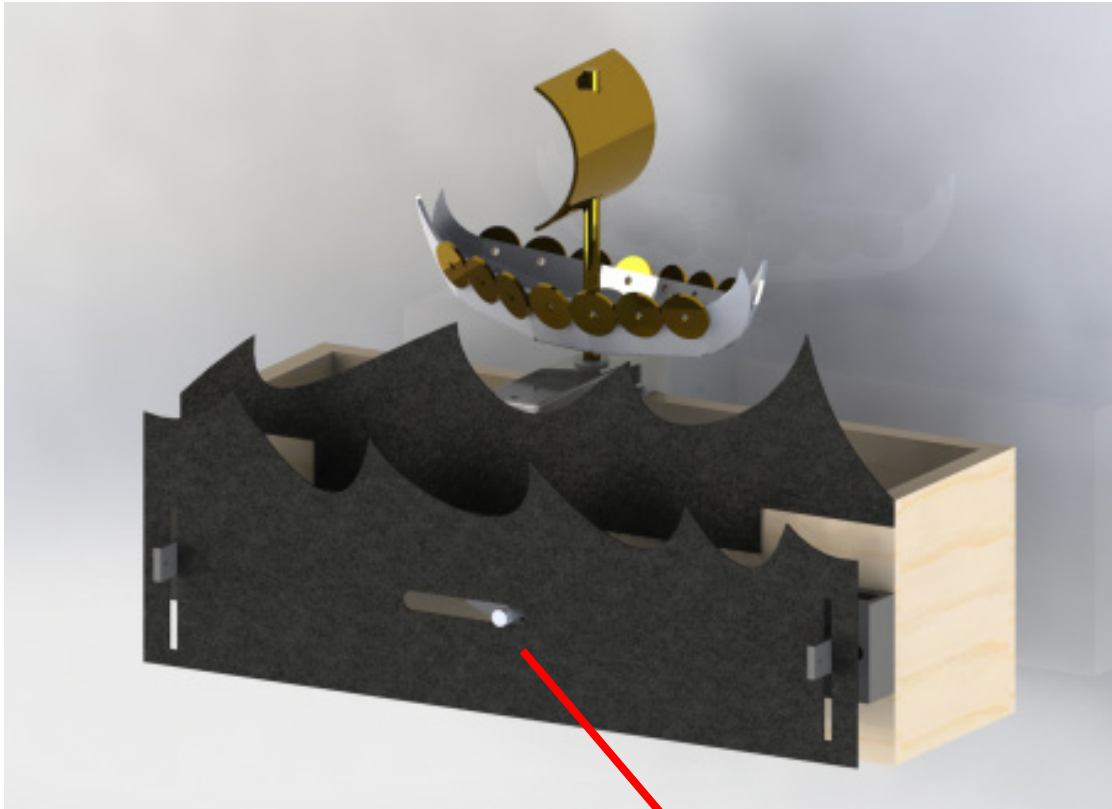
The CAM and Boat

The middle shaft consists of two main components for the sculpture (the boat and the water). The boat rides up and down on a CAM, which is spring pinned into the shaft. The boat is attached to a shaft/CAM follower, which was made with 3D printed materials and a freely spinning spacer. We pinned the shaft into the 3D printed piece to create the follower arm. The boat was then secured to the shaft using c-clips. The shaft runs through two bushing mounted into a 3D printed part, which is screwed into the box in multiple locations. These bushing lock the horizontal motion of the boat-CAM system, so the boat can only rise up and down. We made the shields for the boat out of brass, and used a punch to add the raised details. We then riveted them to the boat, so that the boat would better resemble a viking ship. Lastly, we used the spacer material to mount the flag on. We rolled the brass into a curved shape, then industrial hot glued it onto the spacer. We then placed the spacer over the shaft the boat was mounted on.



The Water

The water is moved linearly up and down using a scotch yoke mechanism. The water was created using a plasma cutter to cut the general shape, and then a mill to smooth out the slots in it. The water has 3 slots in it, on horizontal on is the middle, and two vertical ones on the sides. We mounted an acrylic arm onto the middle shaft on the outside of the box, and then mounted a small shaft on the other side of the arm. Next we mounted the center slot of the water onto the small shaft, which now allows the water to move up and down. We needed to then constrain the rotational motion of this, so we used the slots on the sides of the water and two 3D printed pegs mounted on the box to constrain this motion.



The 4-Bar

The last main component of our sculpture was the 4-bar linkage, which moved out planet in the background. It had two aluminum arms which were milled and then belt sanded to size, and an acrylic joint which was laser cut. We then industrial hot glued a carbon fiber Earth to the top of the acrylic, and our 4-bar was done. We decided carbon fiber would work well because it is light-weight and easily moldable.



Made by creating a mold out of clay and then forming carbon fiber onto the mold.