

Autonomous Lunar Landing Site Preparation – Testbed Gantry Components

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Background

- Mines has been contracted by NASA as part of the Lunar Surface Technology Research – Autonomous Site Preparation: Excavation, Compaction, and Testing (LuSTR-ASPECT) Project.
- Ultimate Project Goal: Design and prototype an autonomous robot that can prepare a spacecraft landing location on the Moon.
- The prototype requires a testing environment.
- The robot must be powered via a power cord during the testing period.
- An XY gantry system made from stage truss will carry the power cord during testing.

Objectives

- Design a “cart” that can move along the gantry’s crossbeam and carry the robot’s power cord and other electronic hardware.
- Design a “truss mover” that can support the weight of the gantry’s crossbeam and enable translation in the X-axis.
- Successfully integrate and interface with various electronic and mechanical hardware.

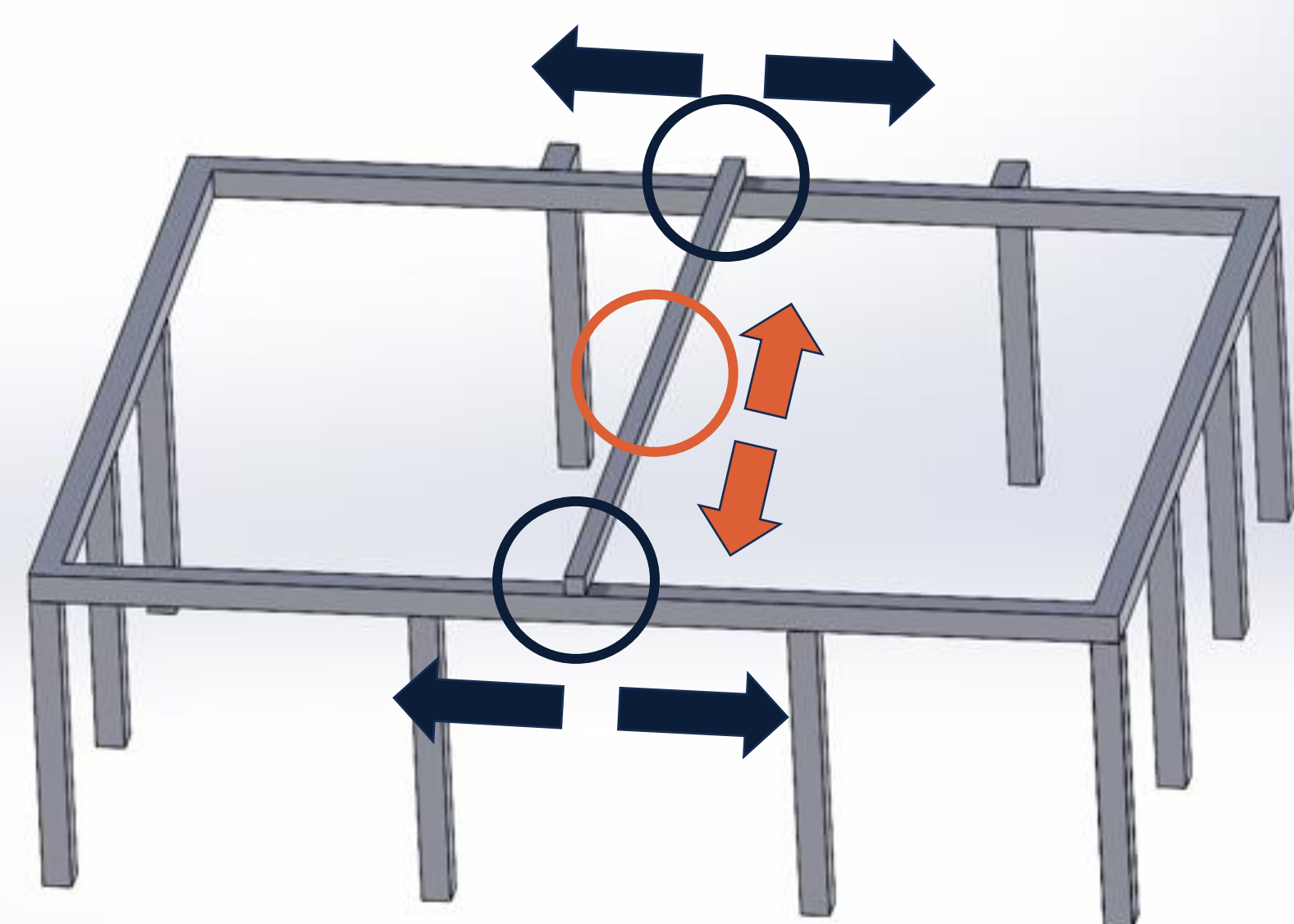


Figure 1. Gantry structure with marked locations and movement directions for gantry cart (orange) and truss movers (dark blue).

Gantry Cart

Overview:

- A wooden baseplate is mounted to the top of the crossbeam truss with U-bolts.
- Aluminum V-tracks are mounted to the wooden baseplate.
- A steel “skate” with V-groove wheels rolls along the V-tracks.
- The skate has brushes in front of the wheels to push debris off the tracks.
- A bottom roller is attached to the skate to mount cameras for robot tracking.

Mounted Hardware:

- Motor Assembly
- Motor Drivers (3X)
- Electrical Filter
- Logitech C920x Webcam (2X)
- L515 LIDAR Camera
- Cable Chains (2X)
- LattePanda

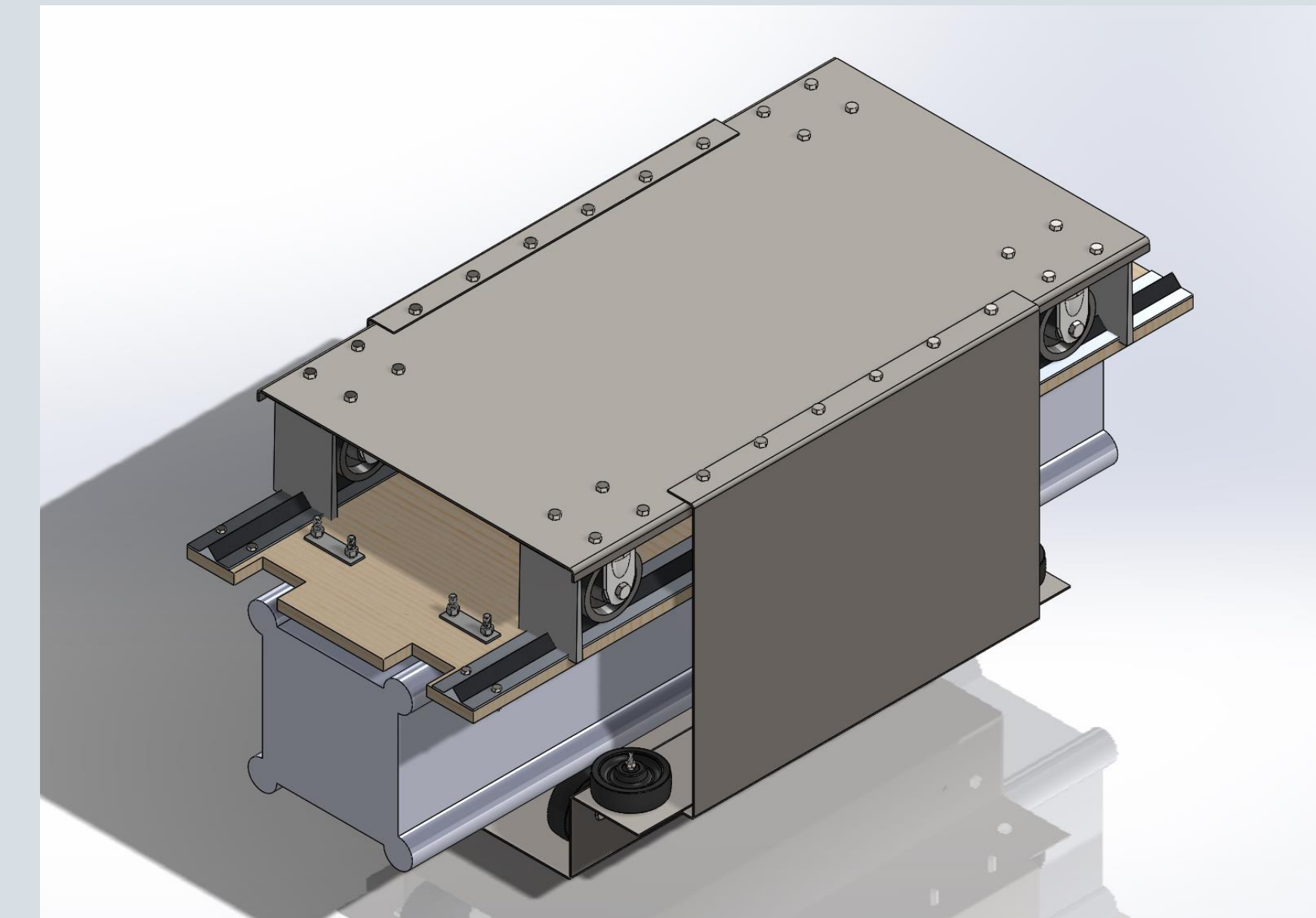


Figure 2. Gantry Cart (Isometric View)

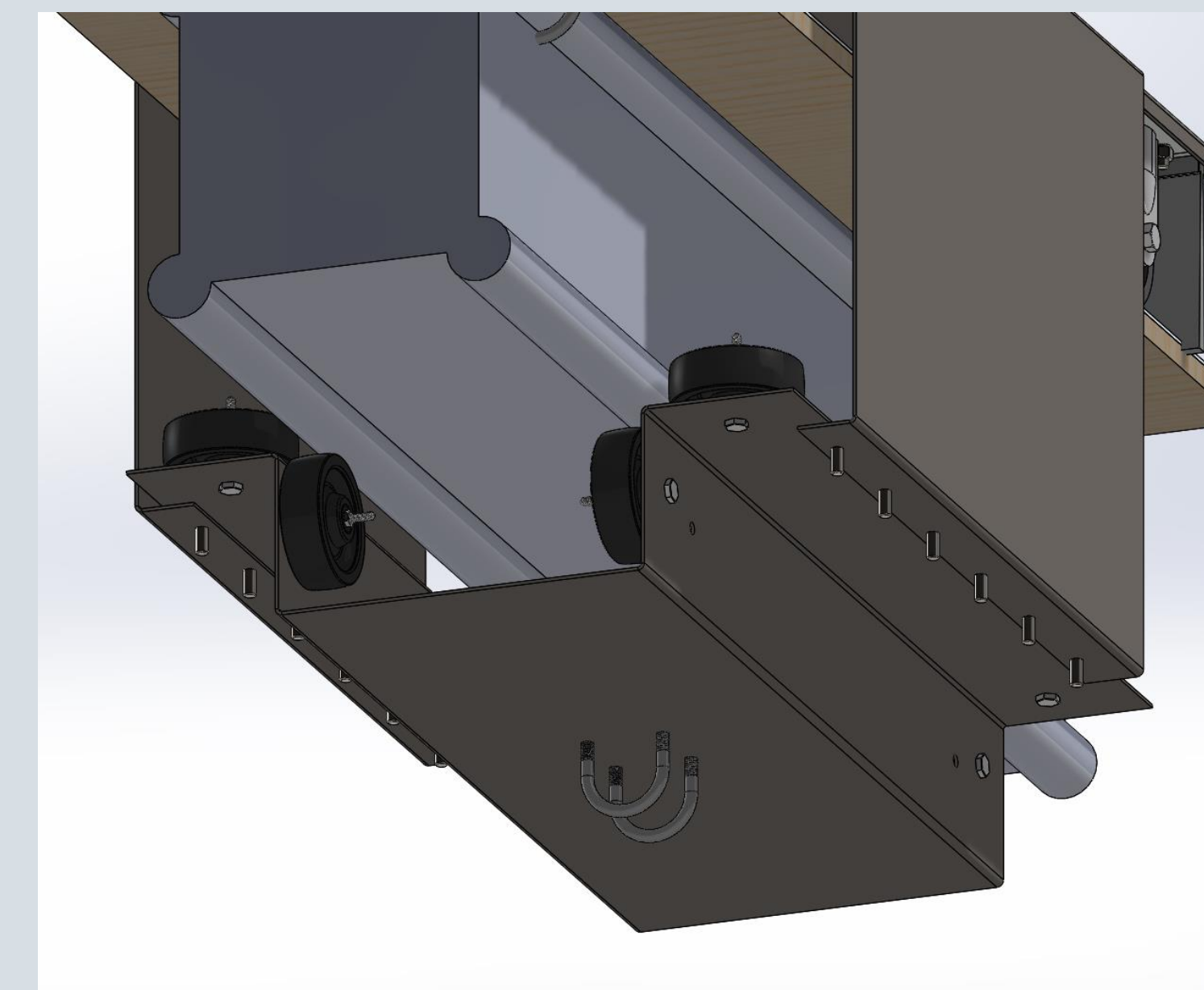


Figure 3. Gantry Cart (Bottom View)

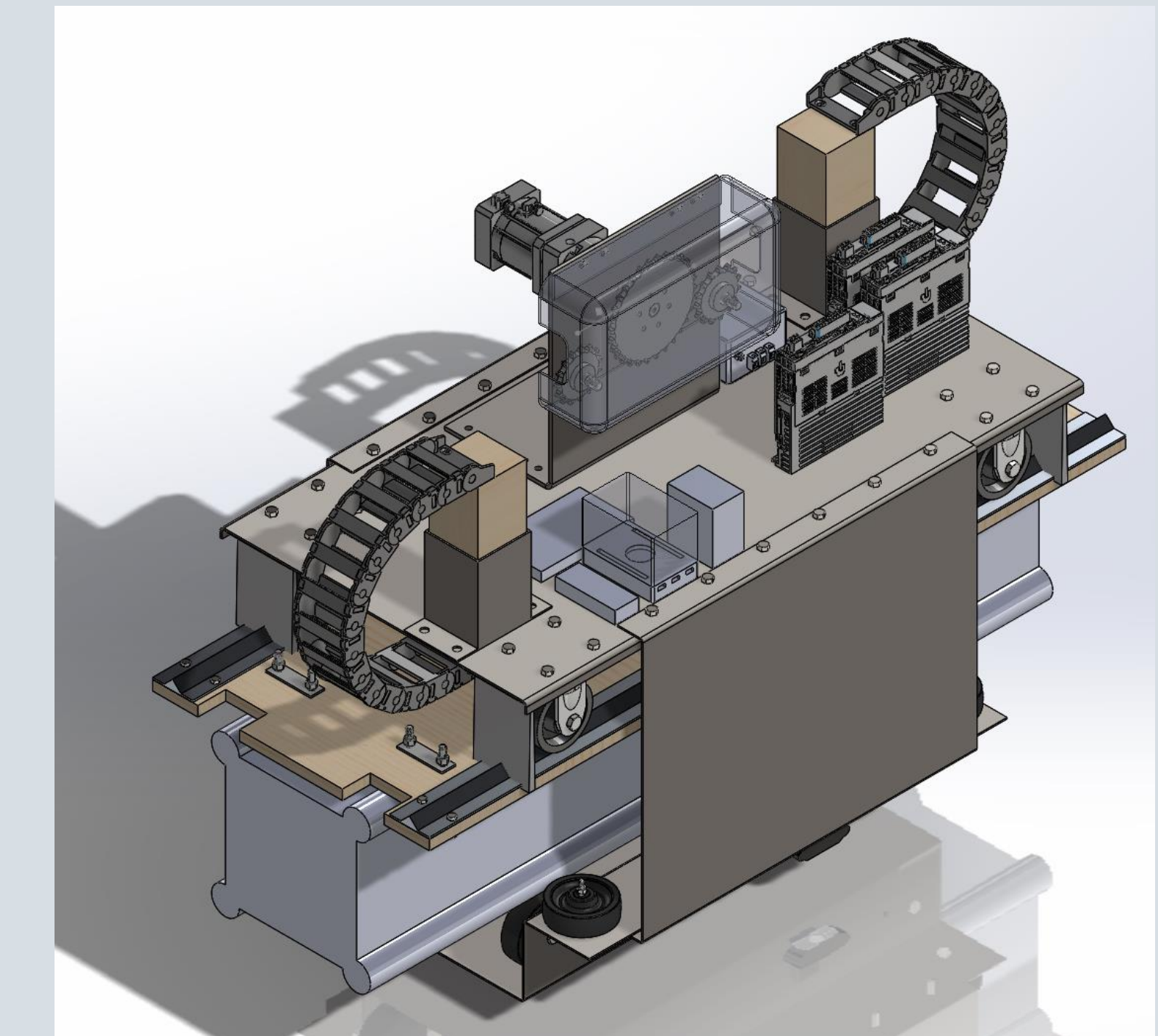


Figure 4. Gantry Cart with Hardware (Isometric View)

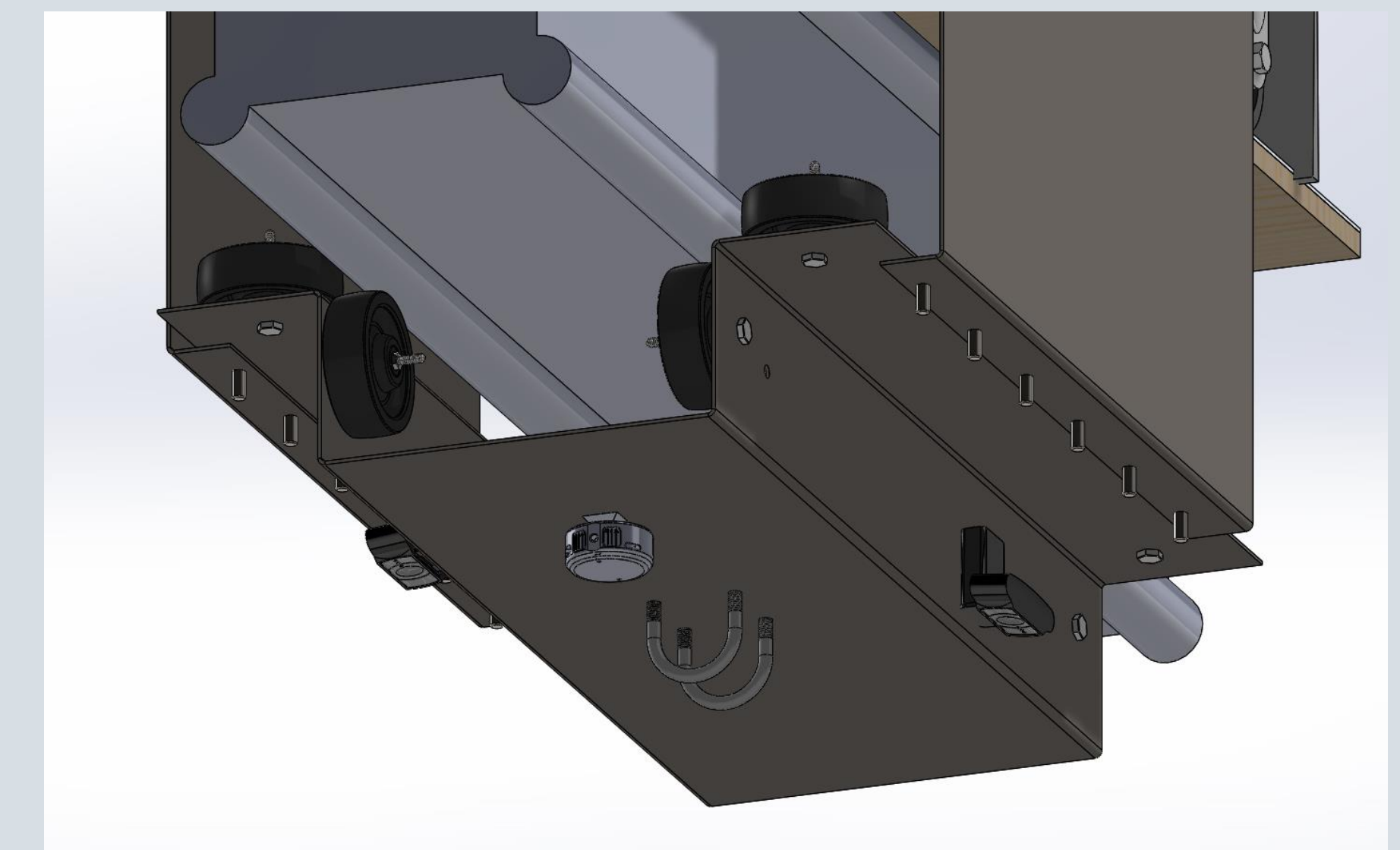


Figure 5. Gantry Cart with Hardware (Bottom View)

Truss Movers

Overview:

- Construction is similar to gantry cart – a steel skate rolls along V-tracks that are mounted to a wooden baseplate.
- A steel L-bracket attaches the crossbeam truss to the top of the skate using U-bolts

Mounted Hardware

- Cable Chain
- Motor Assembly

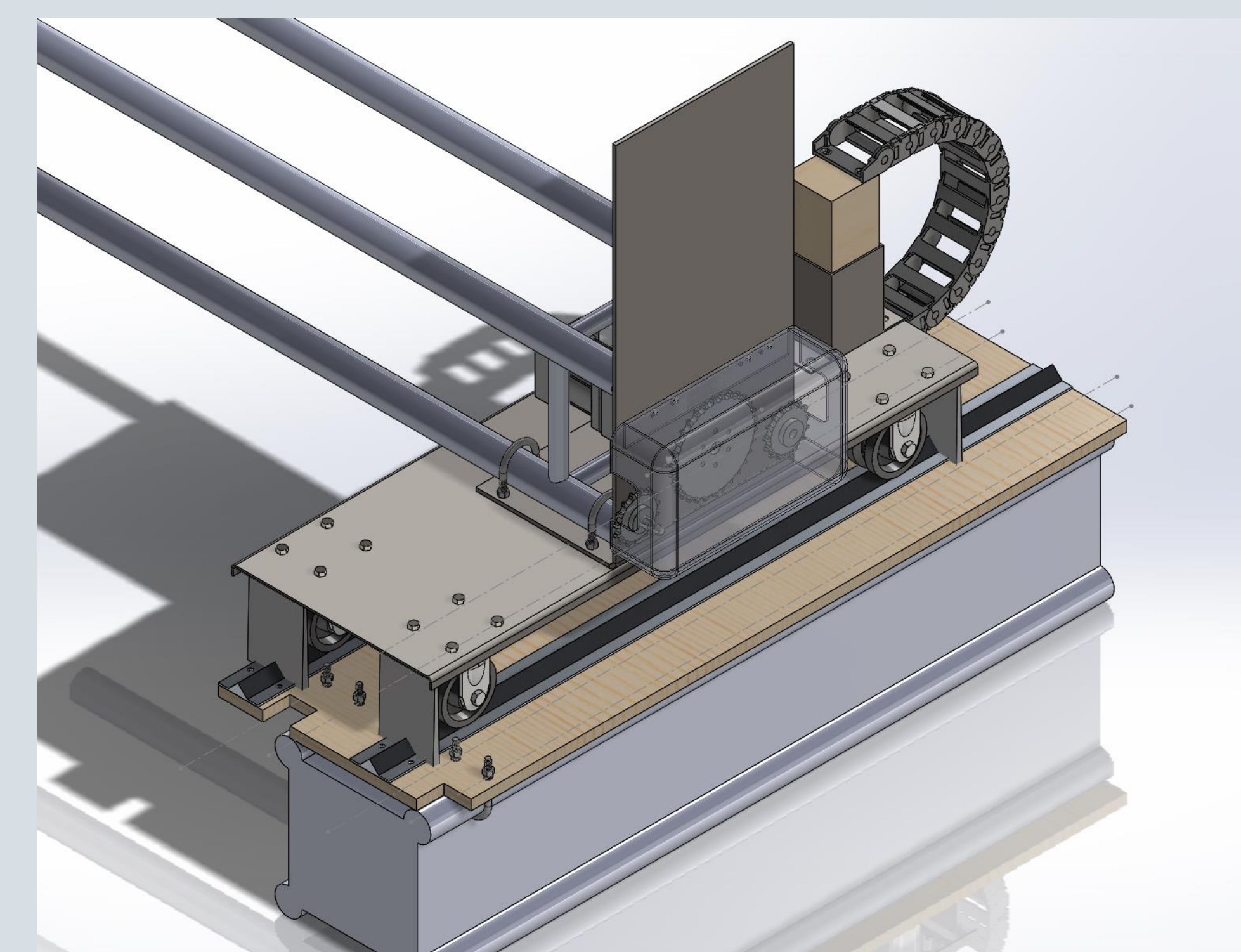


Figure 6. Truss Mover with Hardware

Additional Details and Future Work

Additional Details:

- The gantry cart and the truss movers will be moved using the mounted motor assemblies.
- A sprocket will be attached to the motor which will interlock with a chain running alongside the tracks.

Future Work:

- Physical prototypes will be constructed for design validation.
- Construction of the testing environment will soon begin in the Earth Mechanics Institute.