EMC Antenna Mast

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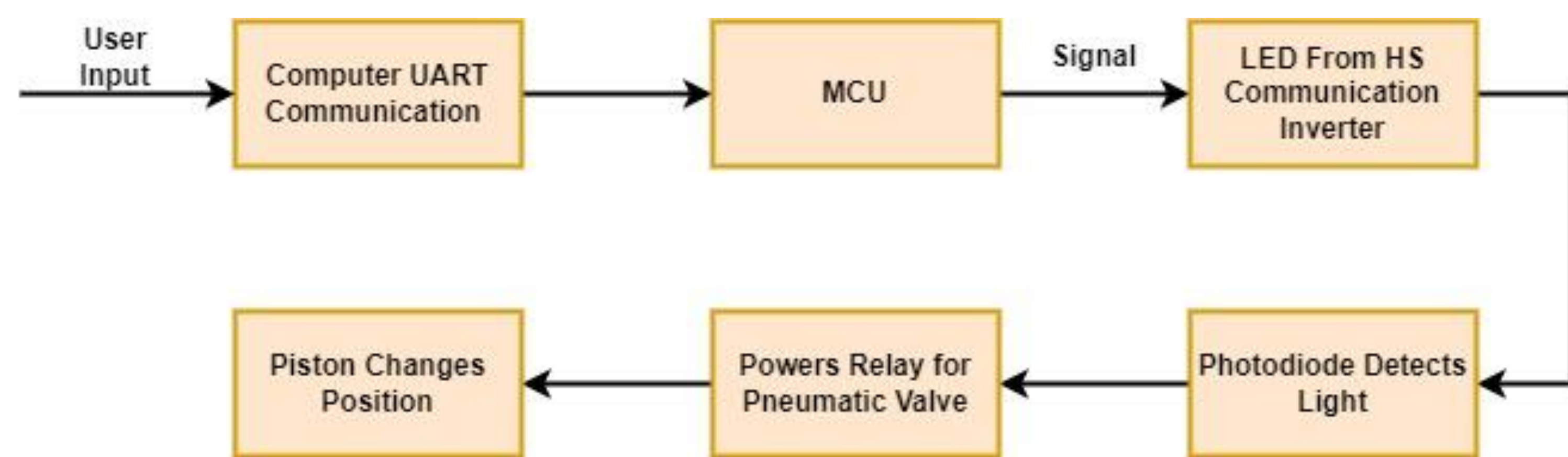Sponsors: Mathew French, Nicklas Koeller, Scott Mee

The requirements for this project are to produce an automated antenna mast that is compatible with four different types of Electromagnetic Compatibility (EMC) antennas, and meet the following specifications:

- Must accommodate the attachment of four antennas
- Antenna height and boresight angle must be able to be manually adjusted
- Antenna horizontal and vertical orientations must be automated using Nexio BAT-EMC software
- Must be in accordance with CISPR14 radiated emissions testing standards
- Must hold the antennas at heights from 1 meter to 2 meters above the EMC chamber floor
- Must maintain alignment and stability during rotation so as not to disturb the antenna's position from its intended placement
- May not contribute noise emissions greater than approximately 2 dB over the noise of the system in the EMC Chamber

Mechanical Design

Electrical Design

The microcontroller receives input from the test technician regarding whether the arm should be in the vertical or horizontal polarization, and this electronic signal with that information is converted to a light signal with the transmitter PCB. The signal then travels through a fiber optic cable to the receiver PCB inside the chamber, which actuates a pneumatic device that pushes air into the double-acting hydraulic cylinder from either the top or bottom, causing the arm to move either vertically or horizontally. The PCBs for the transmitter and receiver are shown in the images below.
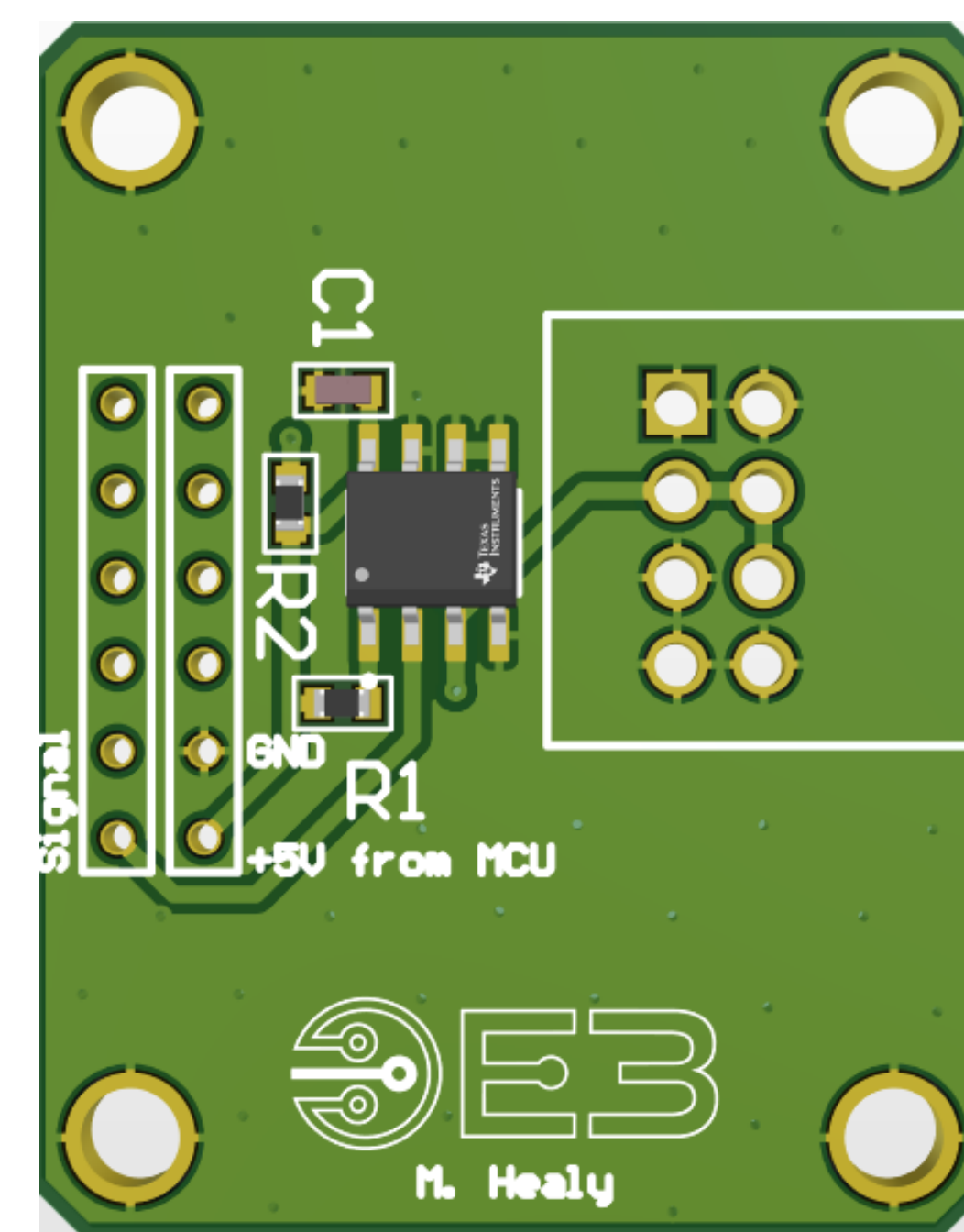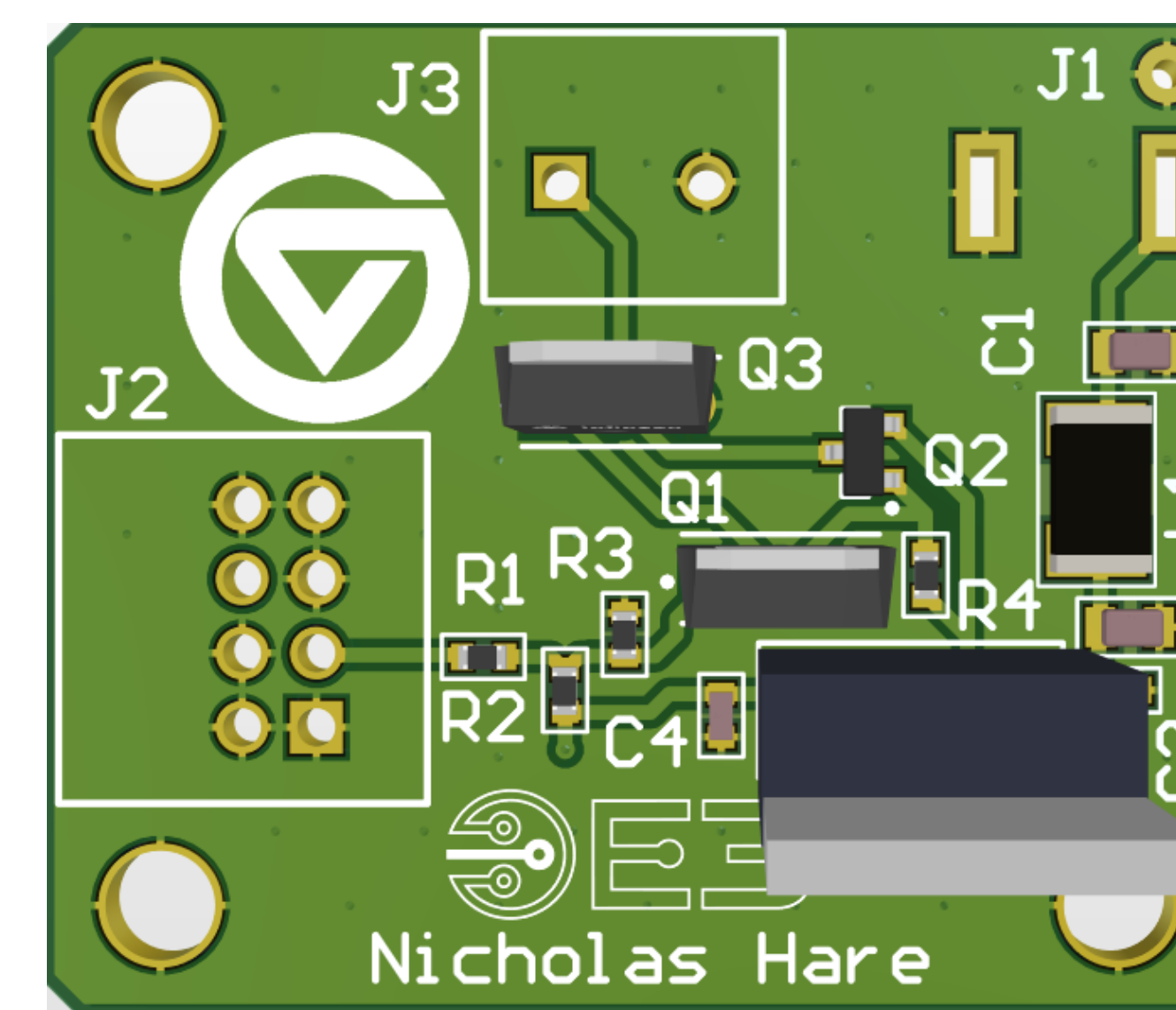
Software

The microcontroller is connected to the computer via USB to use serial communication protocols to receive instructions from the user. The instructions received from the serial communication protocols are the horizontal and vertical executables. Once the microcontroller receives these, it will send signals to the fiber optic circuitry shown to the right.
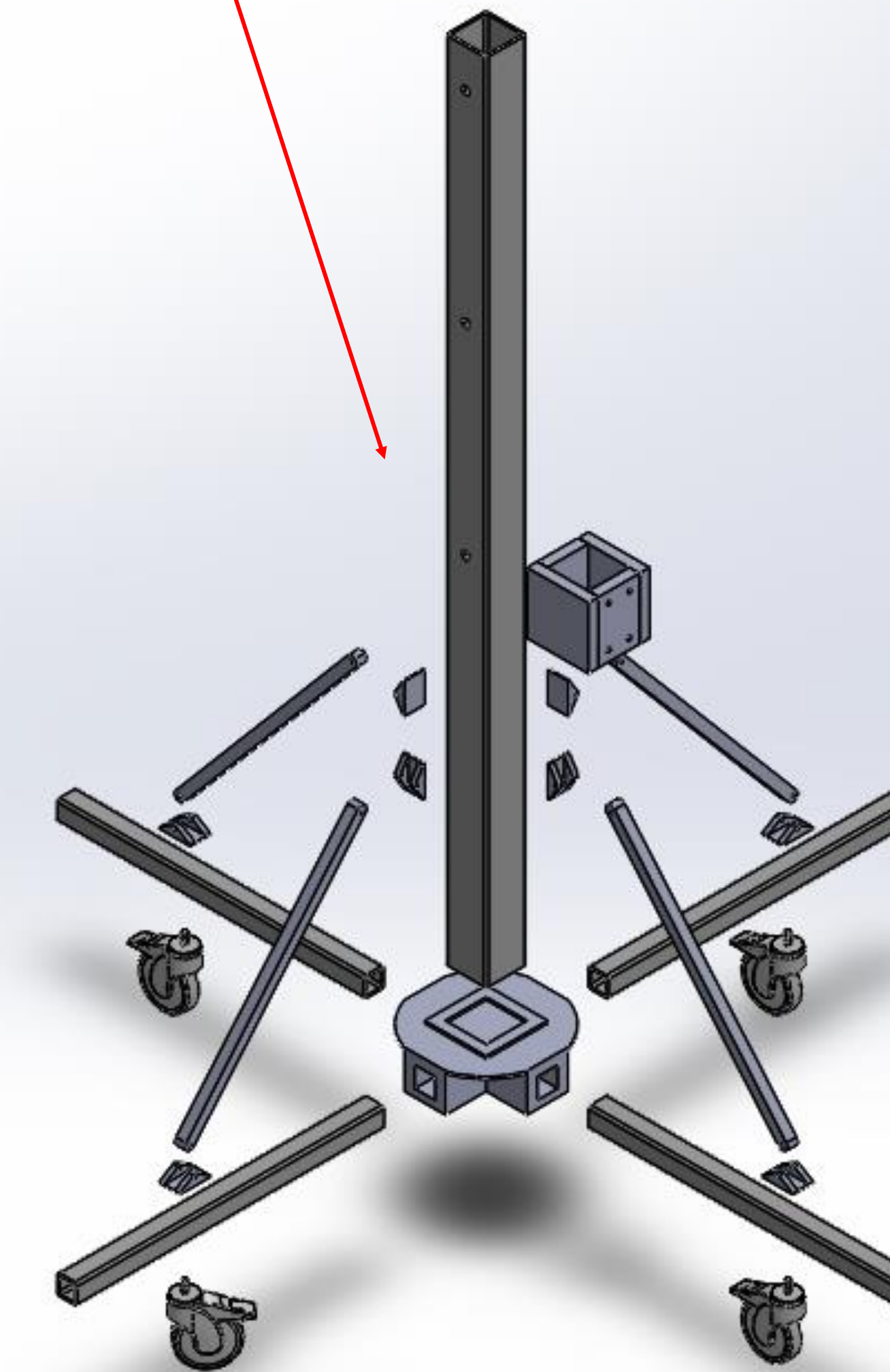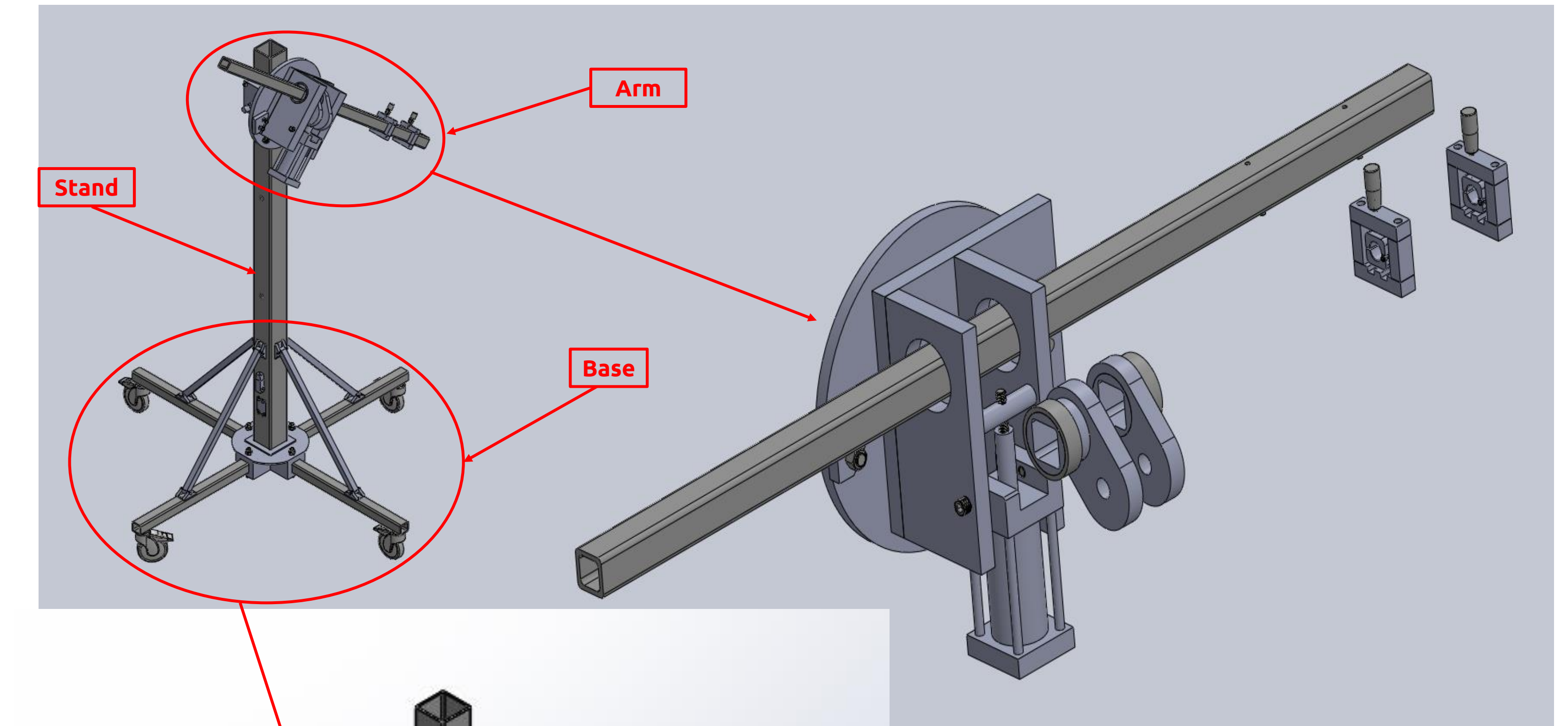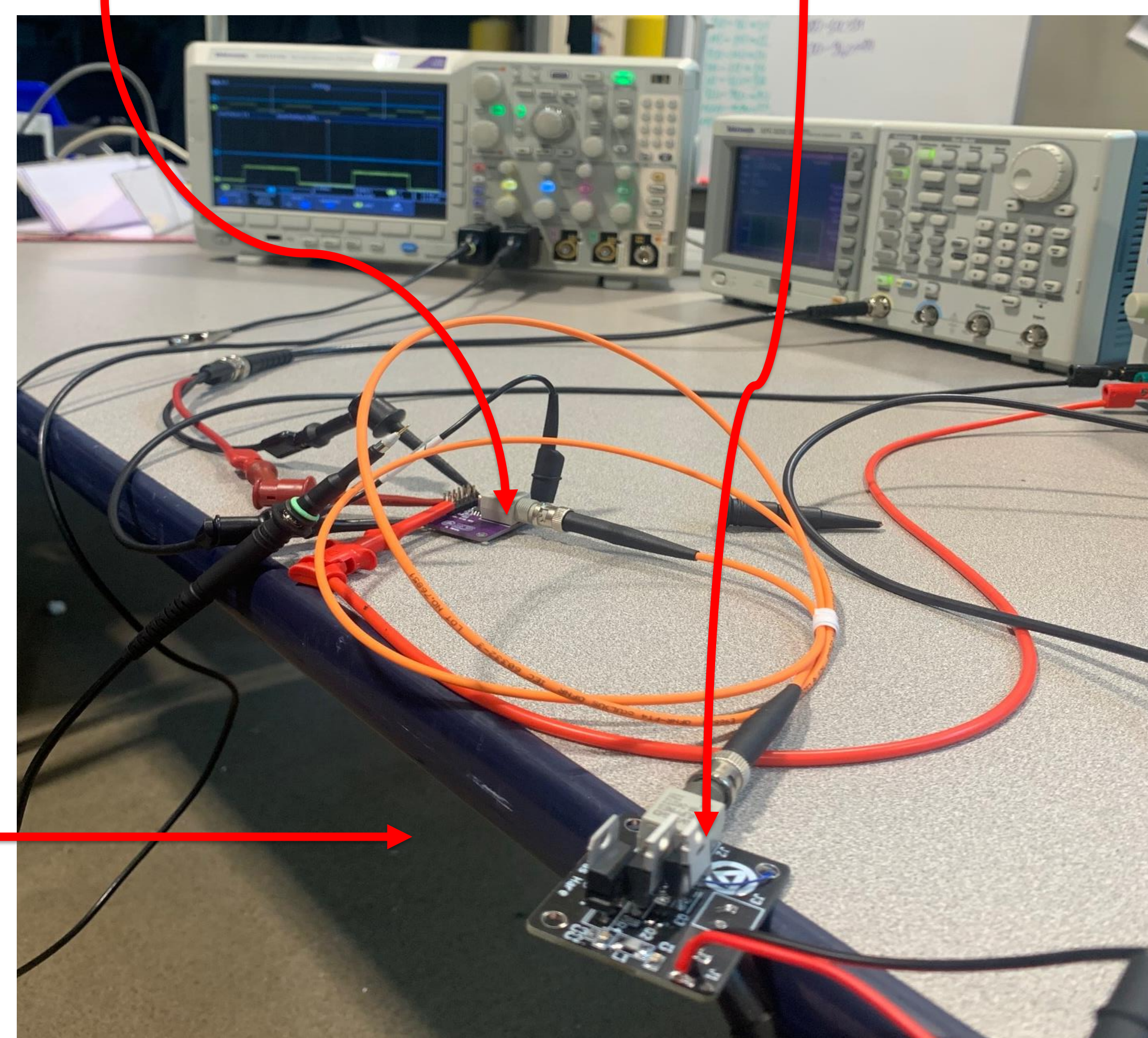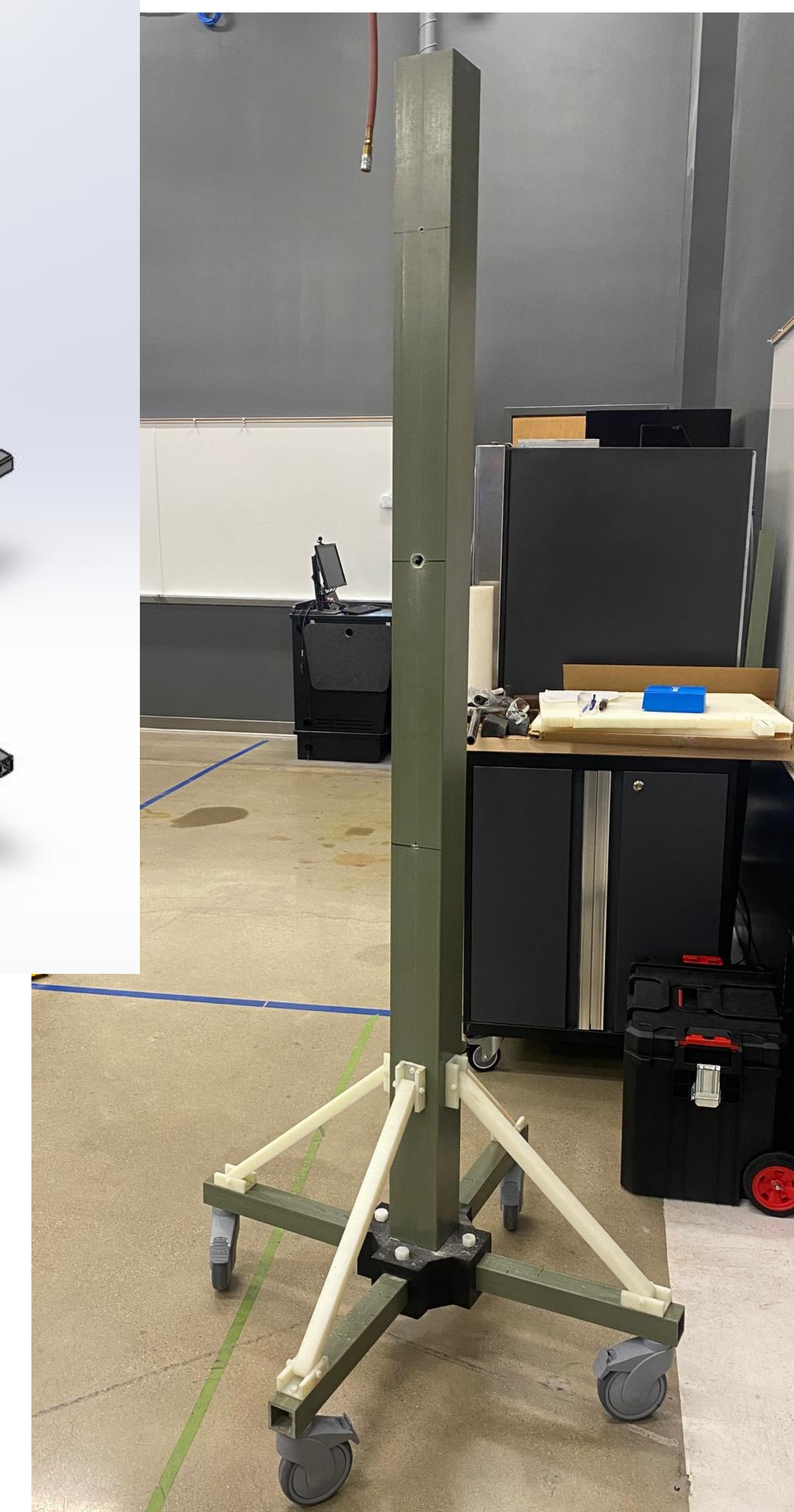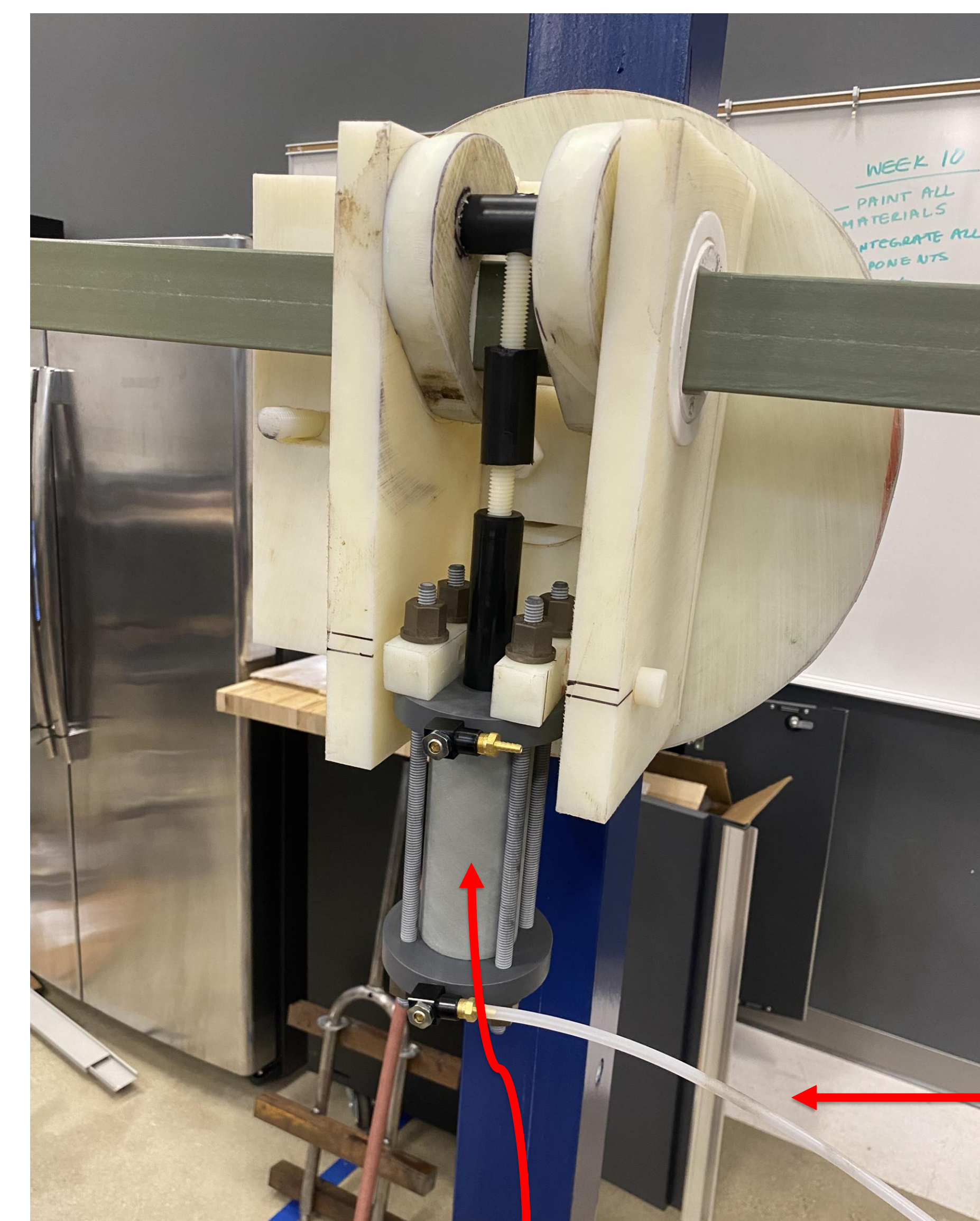

Microcontroller

Transmitter

Receiver

Communication from the MCU to the transmitter/receiver pair actuates the pneumatic cylinder piston assembly, which moves the arm either horizontally or vertically

Pneumatic Cylinder/Piston Assembly

The base, stand and arm are shown in exploded views above to illustrate the full design. The fully assembled mast is shown to the right after the detailed design was built. The pneumatics system is shown in further detail in the electrical and software sections, but there is also a role played in the mechanical portion of the pneumatic design.