VDR 3: RE-RASSOR TRANSPORTER

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Project Background

The objective of this project is to repurpose the existing RE-RASSOR mining robot into a cooperative transport system to be used on the lunar surface. Florida Space Institute's (FSI) long term goal is to make RE-RASSOR a multi-purpose robot with connection points that allow for rapid configuration.

Team 513 will design a heavy lifting mechanism to support 100 earth pounds as well as a standard connection point that will be attached to two different payloads. The transporter will lift the payload 1ft and each robot will need to support 25 earth pounds.

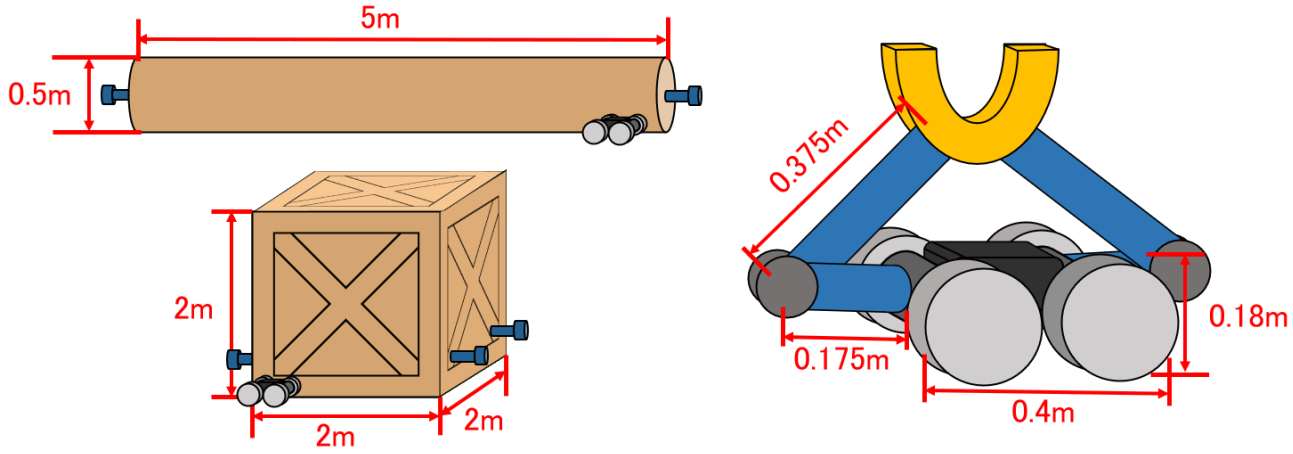

Figure 1. Payload along with the necessary connections

Current State

The concept selection process resulted in choosing the "5-Bar Shoulder" design highlighted in figure 1. This design uses 5 bar lifting mechanism attached to the RE-RASSOR shoulders with a U-shaped connector at the top to attach to a payload. To better understand the behavior of the five-bar design, as well as a potential gear connection at the end effector, a prototype was made using cardboard and DC motors, as seen in figure 2. With this design functioning as anticipated, a CAD model was created with inserted motors at the shoulders. Within the model, the forces at all major joints were calculated in effort to develop potential areas of risk that may affect the design. To lift the payload the required height of 0.3 meters, the minimum length of all the linkages were calculated and utilized in the CAD design. By using the minimum lengths in the design, potential failure regions may be more easily identified. The team is also currently working in collaboration with other RE-RASSOR groups to decide on a potential gearbox, as requested by Dr. Conroy.

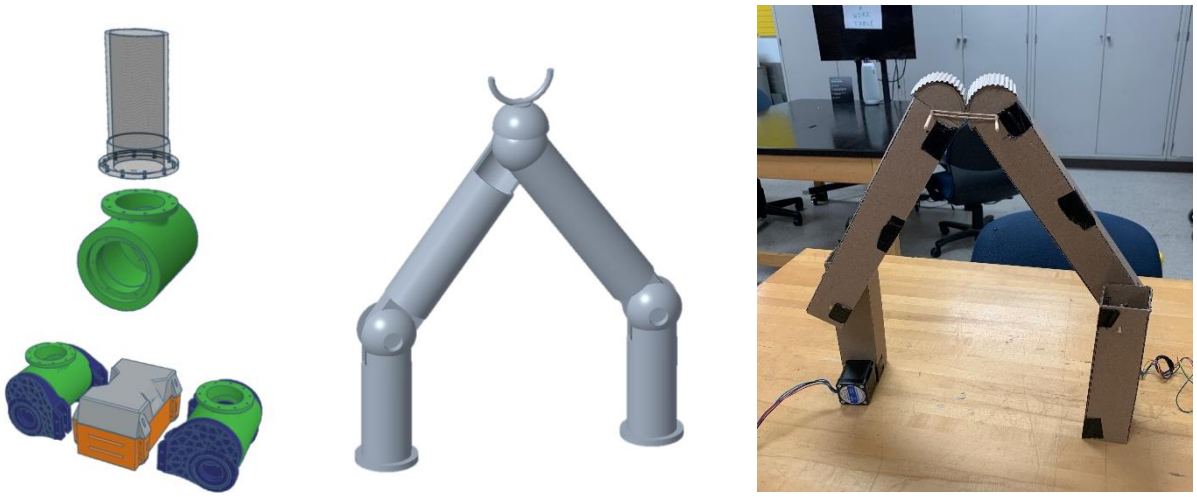

Figure 2. CAD model given by FSI (top-left), current CAD of 5-bar design (top-right), and current cardboard prototype of concept having a geared 6 link (bottom).

Future Work

The next step in the process is to polish the CAD design and send the STL files to the innovation hub to begin 3D printing. Ideally, the prints will be completed and assembled prior to winter break. In the meantime, the team will begin to build the cargo candidates and achieve the appropriate weight and connection points. Once the sample payloads are completed and the design is assembled, mechanical testing can begin. All necessary materials for the final design have been previously identified. The process of ordering all parts and materials will begin soon. Looking forward to next semester, the team will be collaborating with the UCF Swarm team to begin creating the simulation of our design.

Potential Problem Areas

As the end of the prototype stage and the beginning of our final design quickly approaches, it is important to identify any potential risks early on. There are a few gray areas within the design that will be monitored throughout the prototype and testing phases. The first being the strength of the 3D printing material. The PLA from the innovation hub will likely be unable to withstand the weight of the payload. Another problem area we have identified is the potential of tipping if the payload begins to sway. This is an issue that was considered heavily during the selection of the design, but we are unsure how to test the momentum for the design.