

SELF-RECONFIGURABLE MODULAR ROBOT

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PROJECT STATEMENT

The goal of this project was to design and build a self-reconfigurable modular robot. Each module was designed to move independently, identify and connect with other modules, and travel as a collective system.

SYSTEM DESIGN REQUIREMENTS

- Module shall be able to operate autonomously for at least 15 minutes
- Module shall be smaller than 4"x4"x8.5"
- Modules shall be able to lift 2 other modules
- Module must be able to move individually and as a system

DESIGN ITERATION

General brainstorming resulted in 3 potential designs shown in Figure 1. The 3 design concepts were evaluated based on size, connector, power, movement, and configurability.

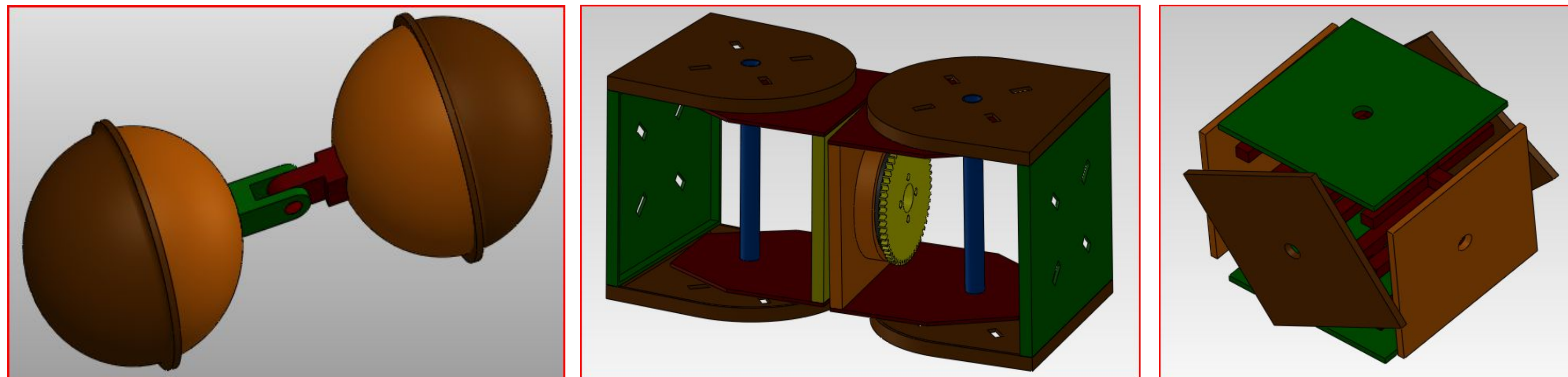


Figure 1: Design Concepts

Using a set of performance metrics, the center concept was chosen as our design and was the basis for subsequent designs and prototypes as seen in Figure 2.

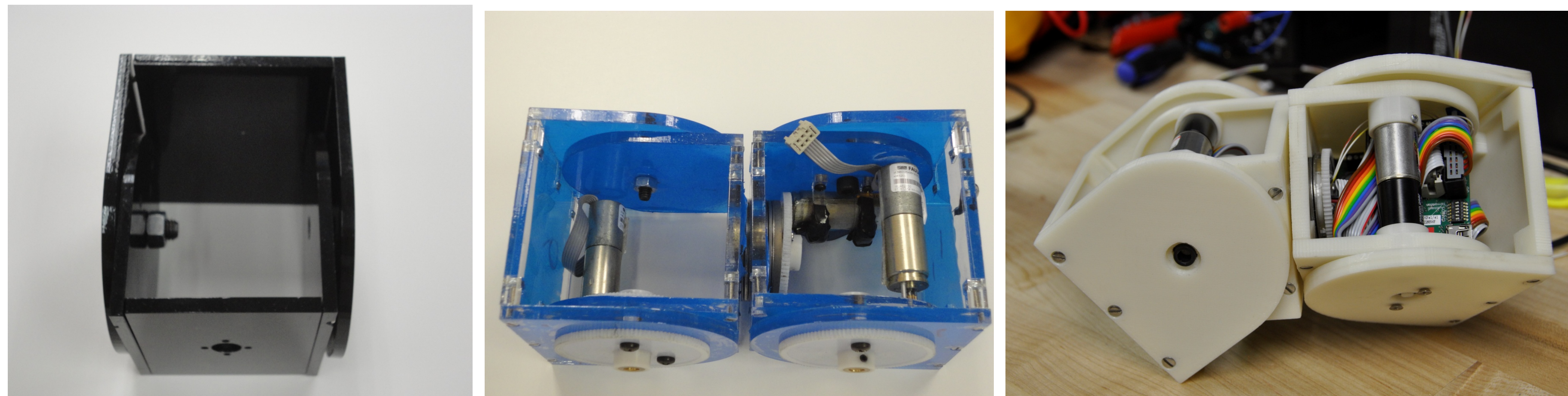


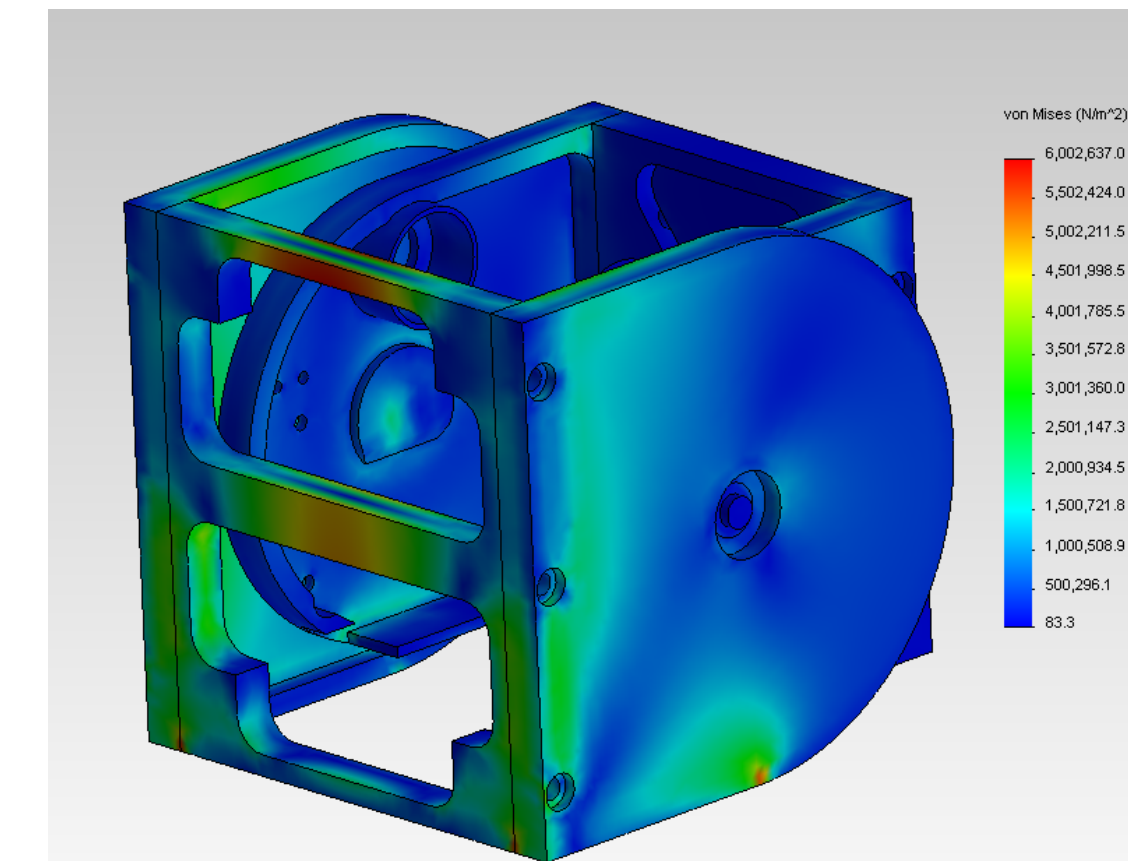
Figure 2: Prototype 1, Prototype 2, RP Prototype (Left to Right)

Several robot prototypes were used to develop the initial design. These started off very simple and ended with the final RP module.



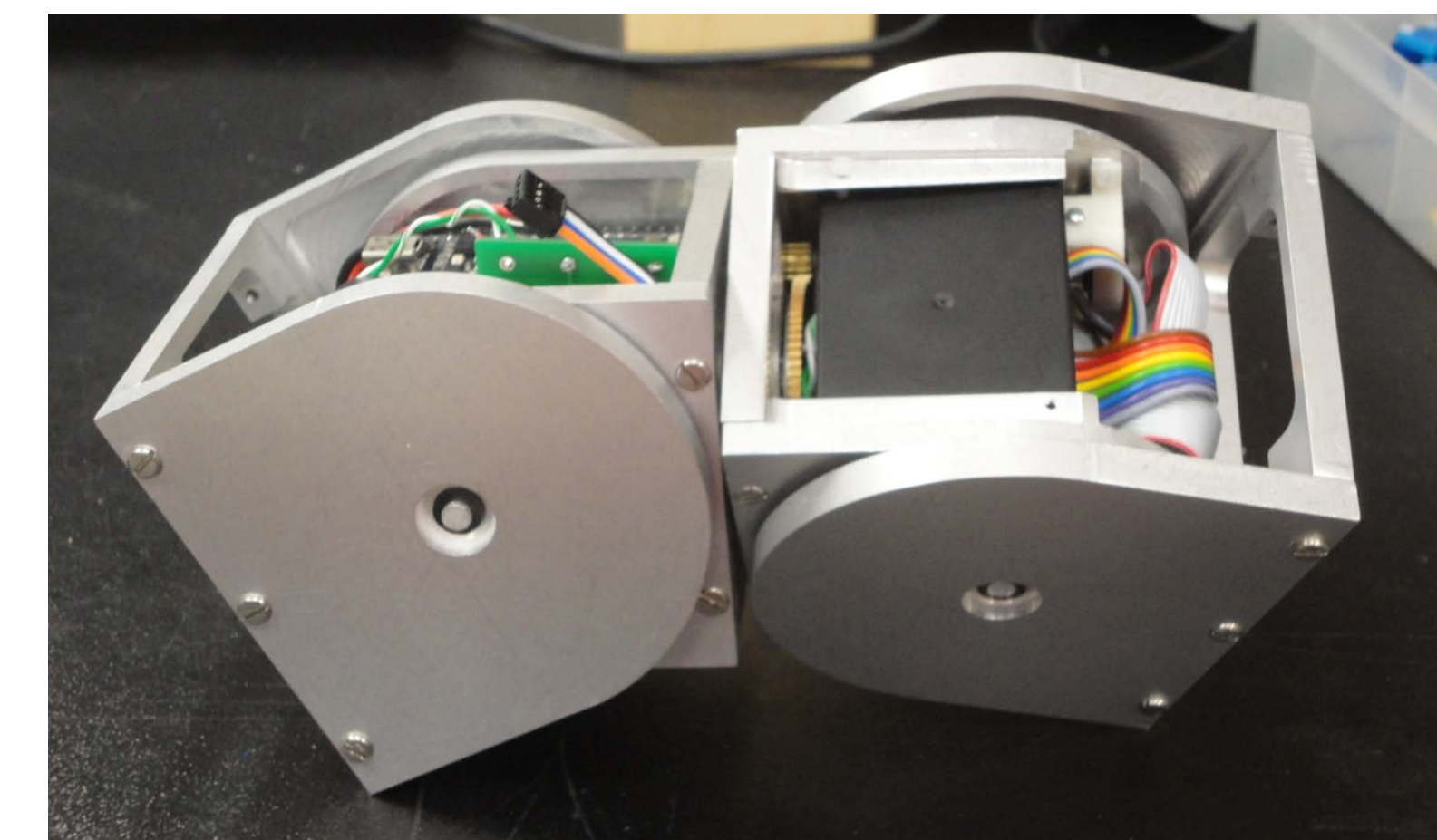
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TESTING AND ANALYSIS

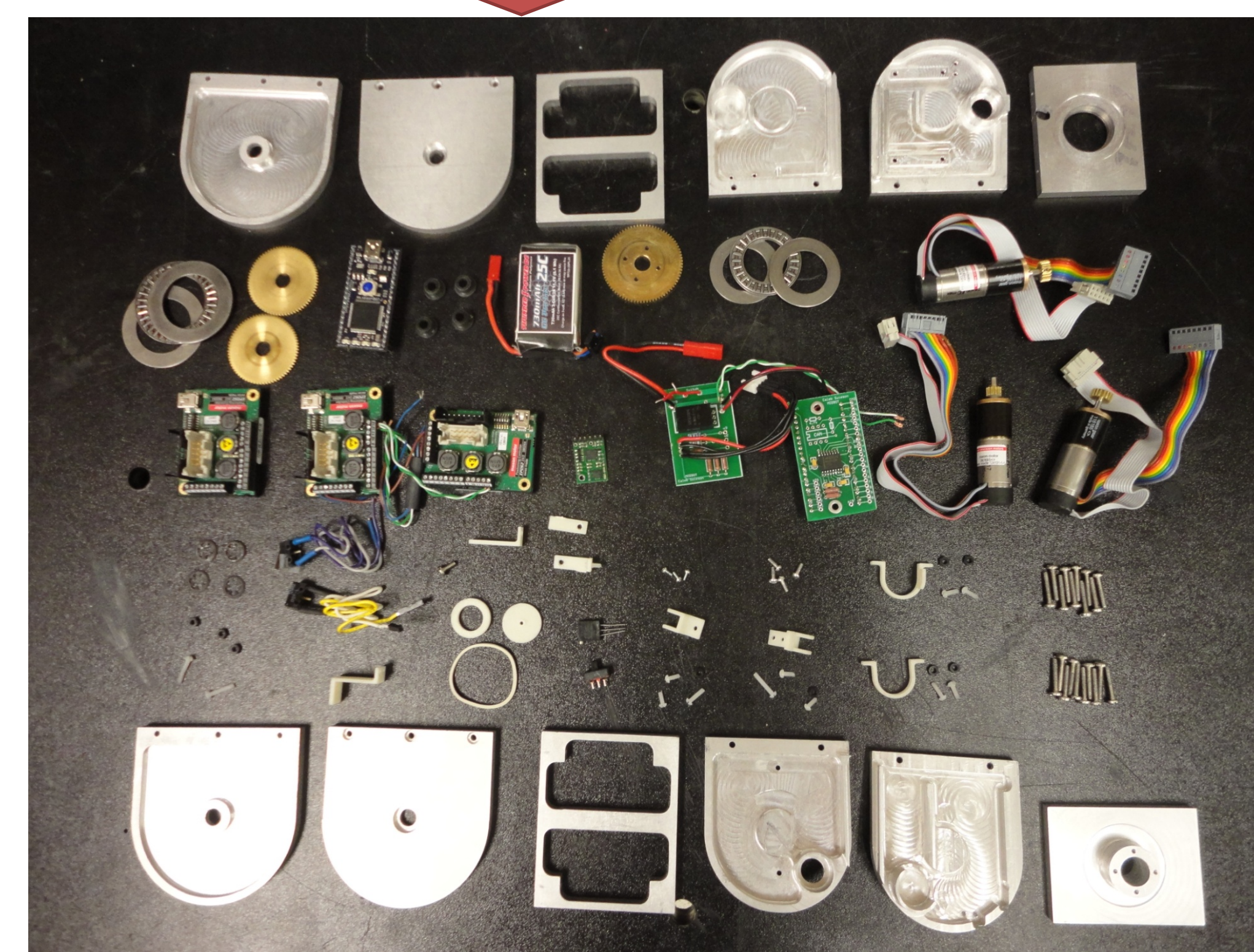


- Max stress applied = 6 MPa
- Max displacement = 0.016mm
- Can lift 2 other modules overhead
- Safety factor of 10

FINAL MODULE DESIGN



- Size: 3.125" x 3.125" x 6.25"
- Module Weight = 1.02 kg
- Maxon EC-Max motors
- Side Motors
 - Speed = 304.8 Degrees/sec
 - Torque = 372.36 mNm
- Center Joint Motor
 - Speed = 260.4 Degrees/sec
 - Torque = 620.6 mNm



SPONSORS



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