



Modular Reconfigurable Robot for Space Applications

Maryland Space Grant
Consortium Symposium

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Introduction

- Designed modular actuator
 - Self contained robot joint
 - Quick and low-cost assembly
- Researched robotic joint components
- 3D printed custom parts
- Assembled in SolidWorks

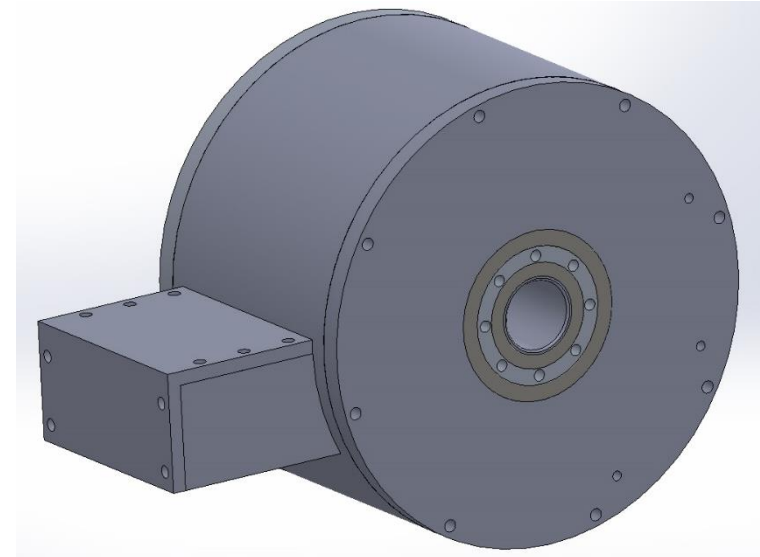


<https://www.hebirobotics.com/x-series-smart-actuators>



Design Considerations

- Torque requirement
 - 16 N-m
- Size
 - As compact as possible
- Scalability
 - Future uses may need different torques
- Reconfigurability
 - Easily accessible electronics
- COTS parts
 - Easily obtainable





Components

- Motor – drives output
 - Frameless, brushless DC motor from ThinGap
- Input Encoder – used for commutation
 - Magnetic, incremental from Renishaw
- Harmonic Drive – strain wave gear to step up torque
 - 120:1 gear ratio



<https://www.thingap.com>



<https://www.rls.si/eng/products/rotary-magnetic-encoders/incremental-encoders/>



<https://www.harmonicdrive.net/products/component-sets/cup-type/csd-2a>

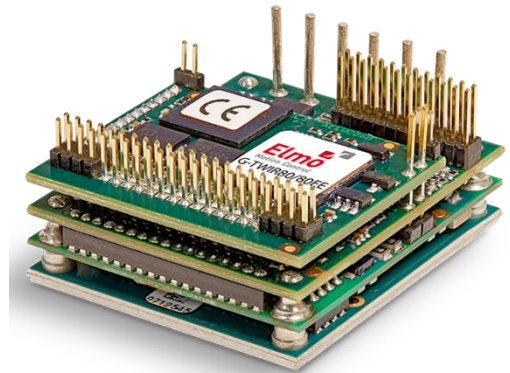


Components

- Output Encoder – tracks location of output
 - Magnetic, absolute from Renishaw
- Motor Drive – electronically controls actuator
 - Golden Twitter by Elmo Motion Control



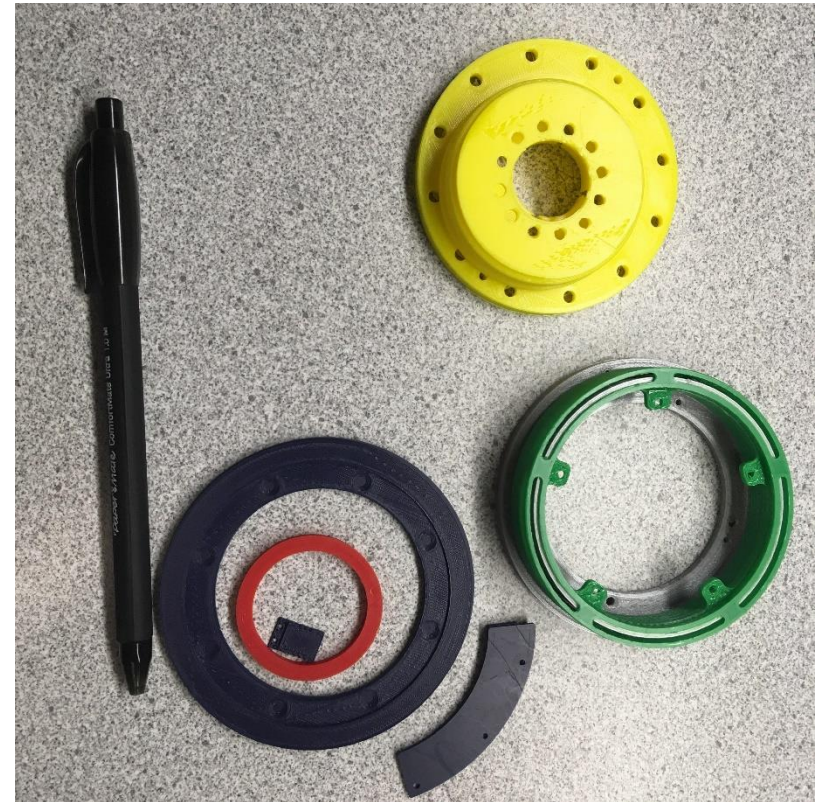
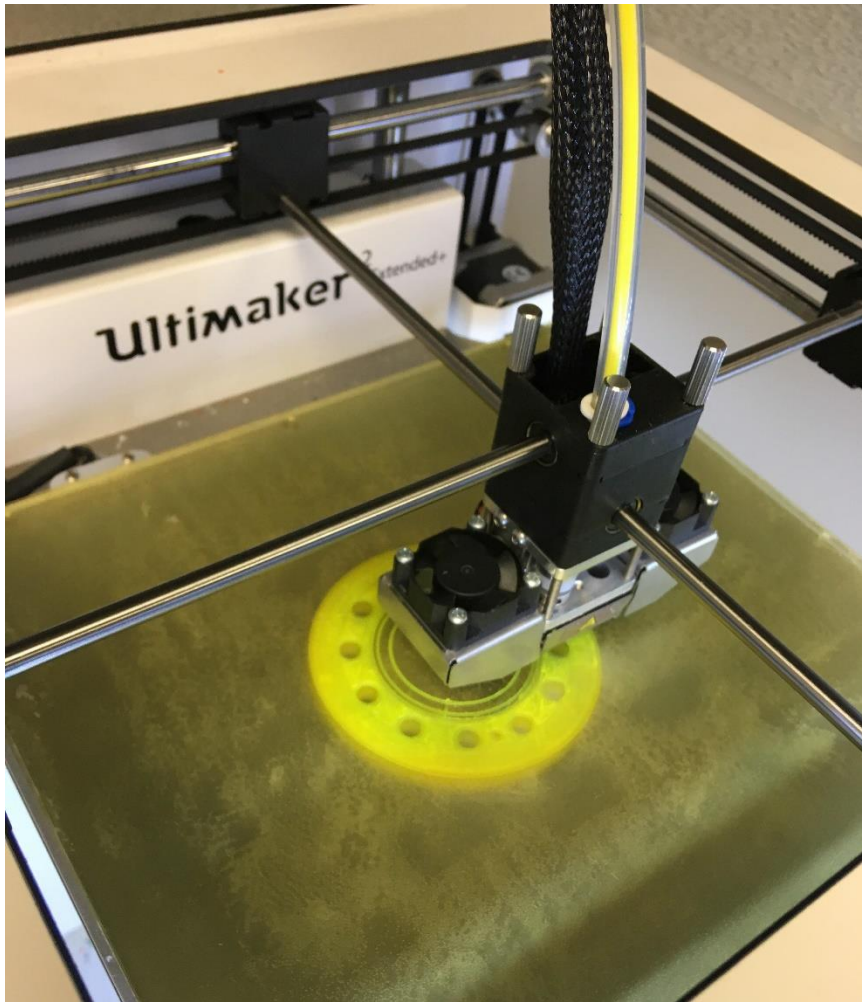
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<https://www.elmomc.com/product/gold-twitter/>

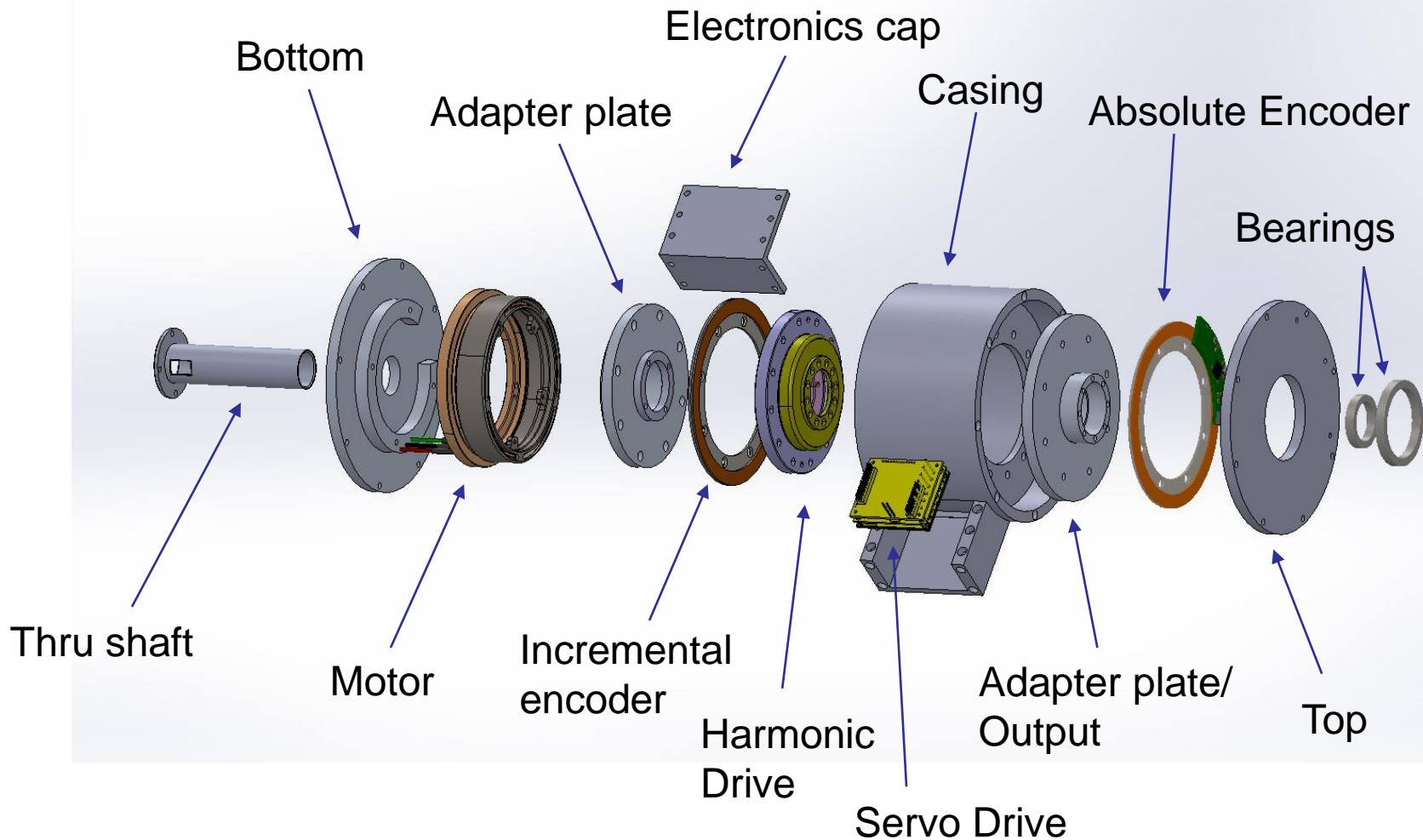


Fabrication





Assembly





Next Steps

- Complete 3D printing and mechanical assembly
- Document assembly process
- Implement force/torque sensor
- Complete electronic control
- Custom electronics board



Acknowledgements

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Questions?