Separation Connector Improvement for Orbital Sciences Corporation

College of Engineering, Forestry, and Natural Sciences
Department of Mechanical Engineering
Northern Arizona University

Koll Christianson, Luis Herrera, Zheng Lian

Presentation Overview

- Project Overview
- Problem Statement
- Design Requirements
- Design Proposal
- First Prototype
- Deflection Analysis
- Final Design
- Cost
- Results
- Conclusion

Our Client

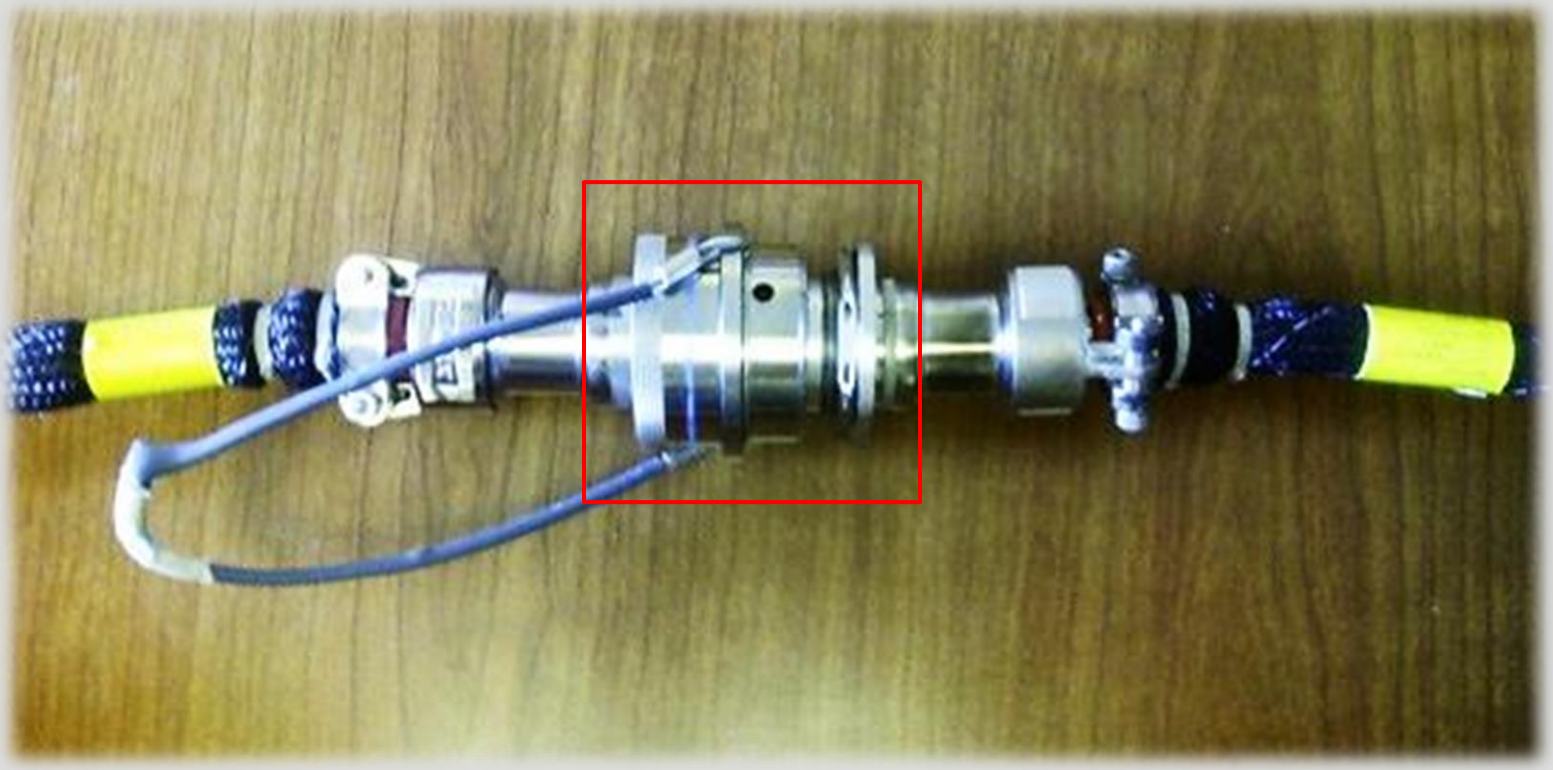
Mary Rogers

- Electronics Packaging and Actuator Manager at Orbital Sciences Corporation

Zheng Lian

Project Overview

- Original Separation Connector



Zheng Lian

Problems With Old Design

Problem Statement

- The goal of this project is to design and prototype a relatively easy to manufacture, inexpensive, and perfectly reliable separation connector.

Luis Herrera

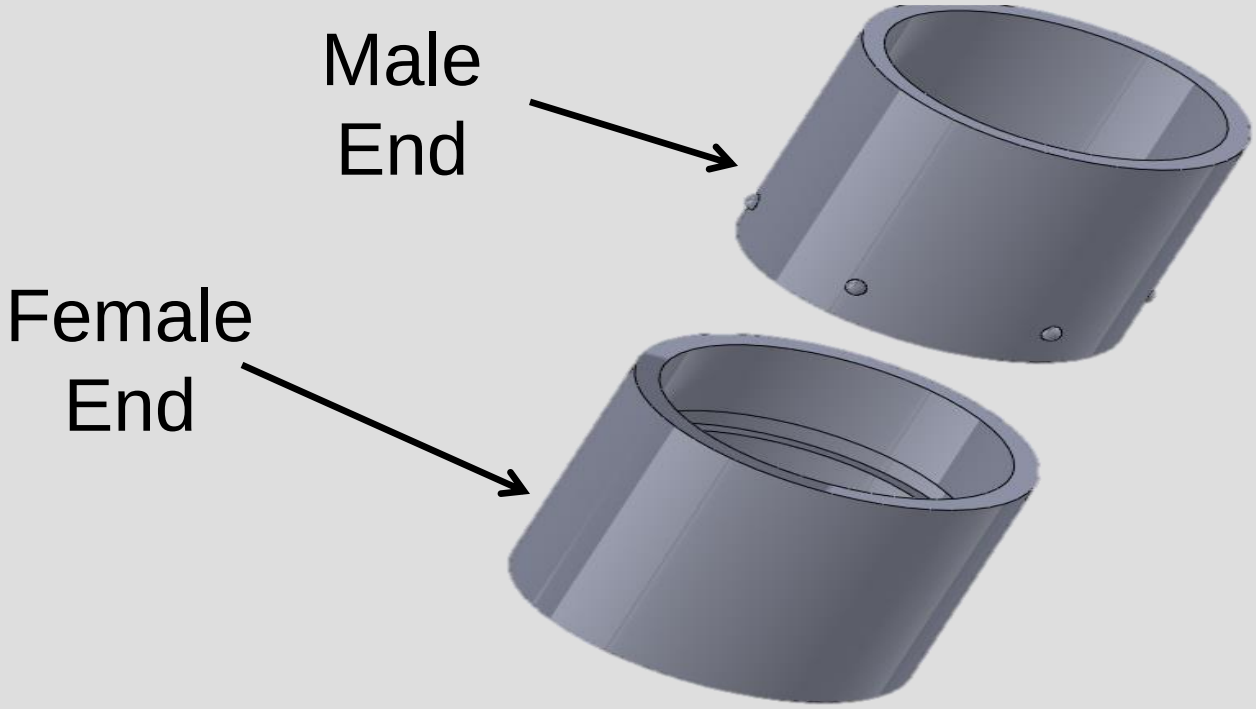
Design Requirements

- Male end cannot be changed
- Pass military specification testing
- Separates with10-30 lbf.
- Withstands 200 lbf.
- Easy to manufacture
- Mate and de-mate at least 50 times without failure
- Cannot exceed an increase in size of 25% greater than the original design

Luis Herrera

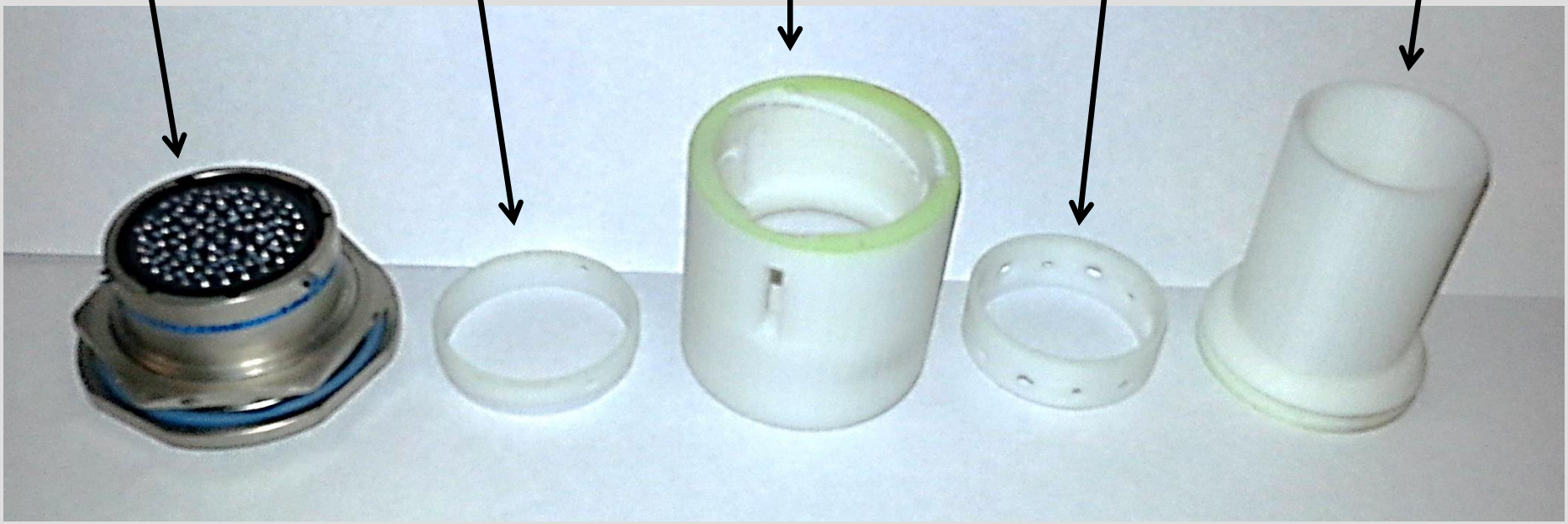
Design Proposal

- Preliminary Design



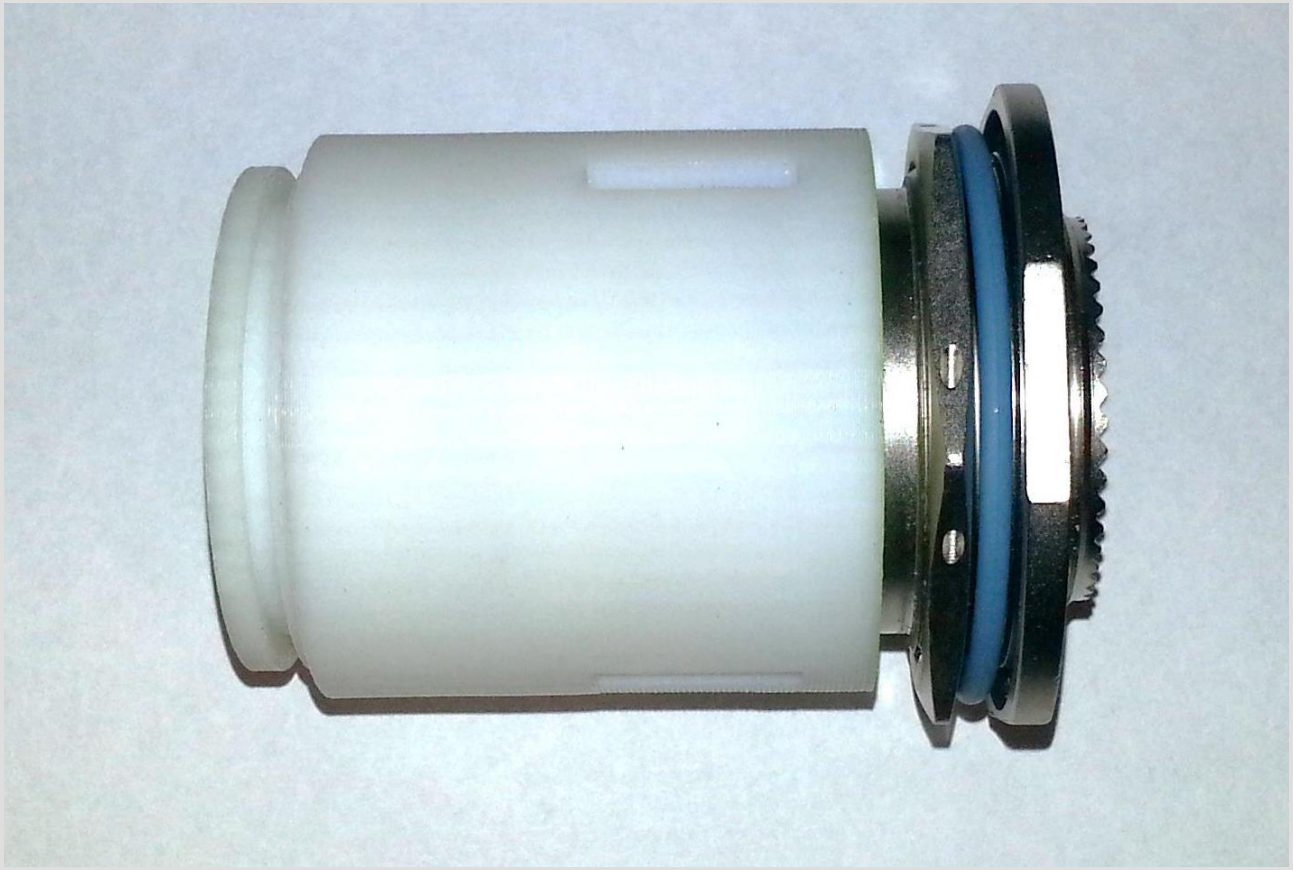
Luis Herrera

FDM Prototype



Luis Herrera

FDM Prototype



Luis Herrera

Modifications to Design

Combined:

- Female End
- Ball Bearing Retention Ring

Added:

- Spring Retention Ring

Changed:

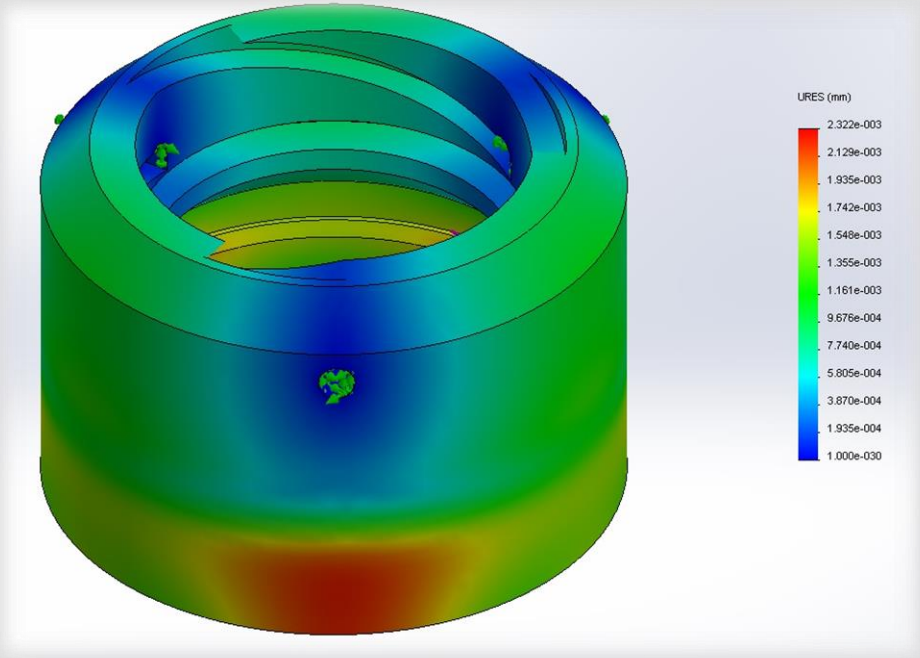
- Coupling

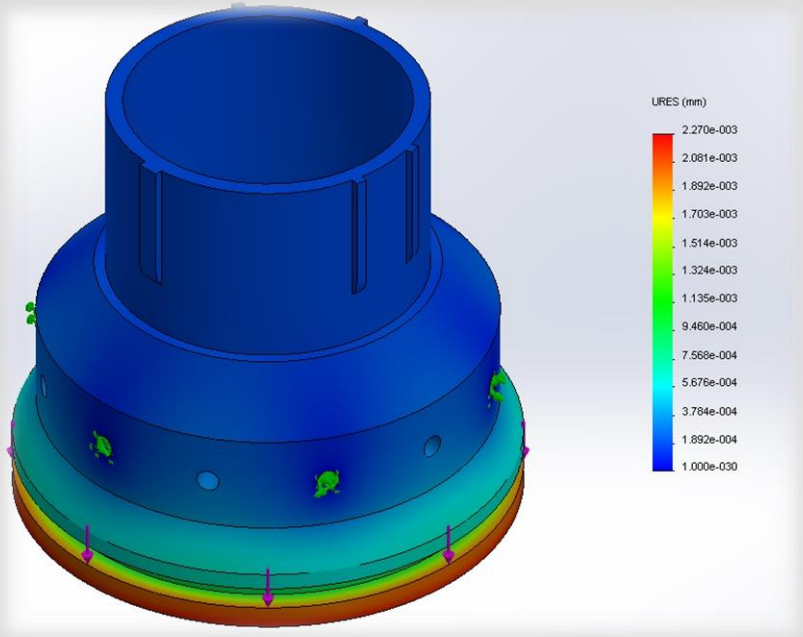
Removed:

- Pressure plate
- Ball Bearing Retention Ring

Luis Herrera

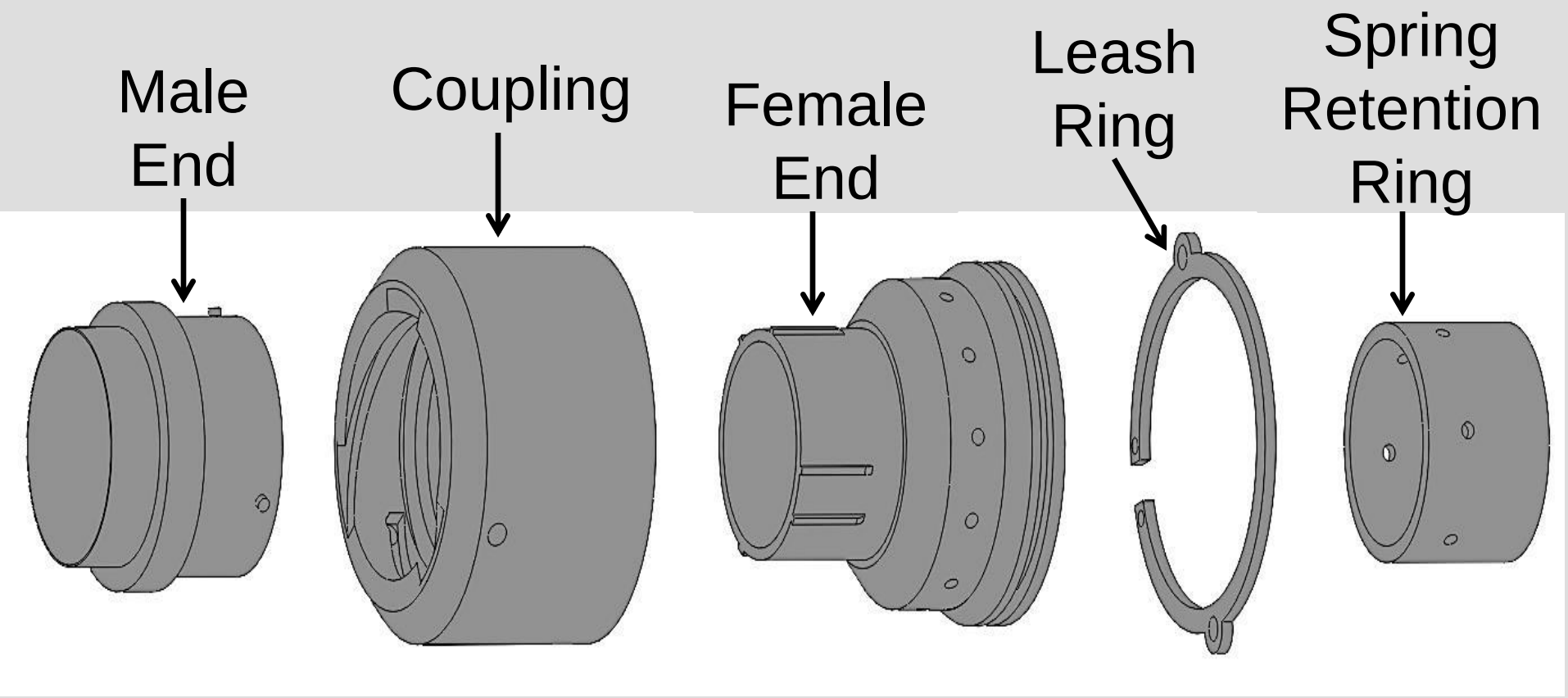
Deflection Analysis





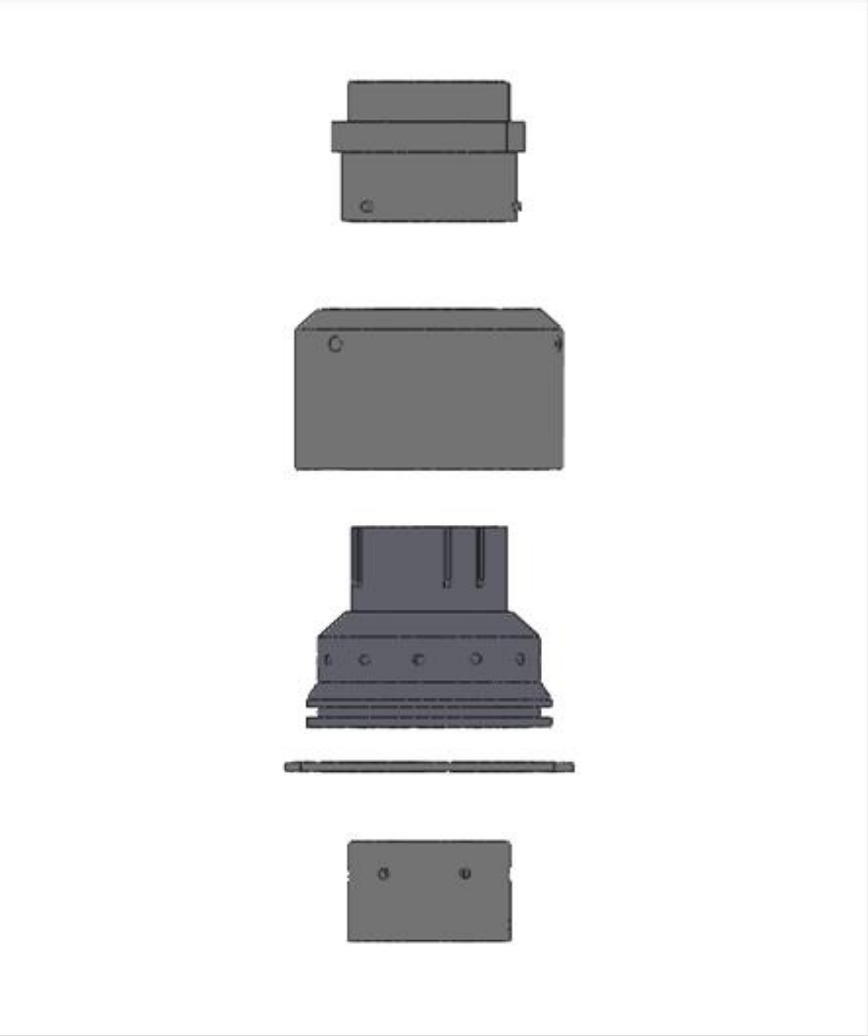
Koll Christianson

Final Design (Exploded View)



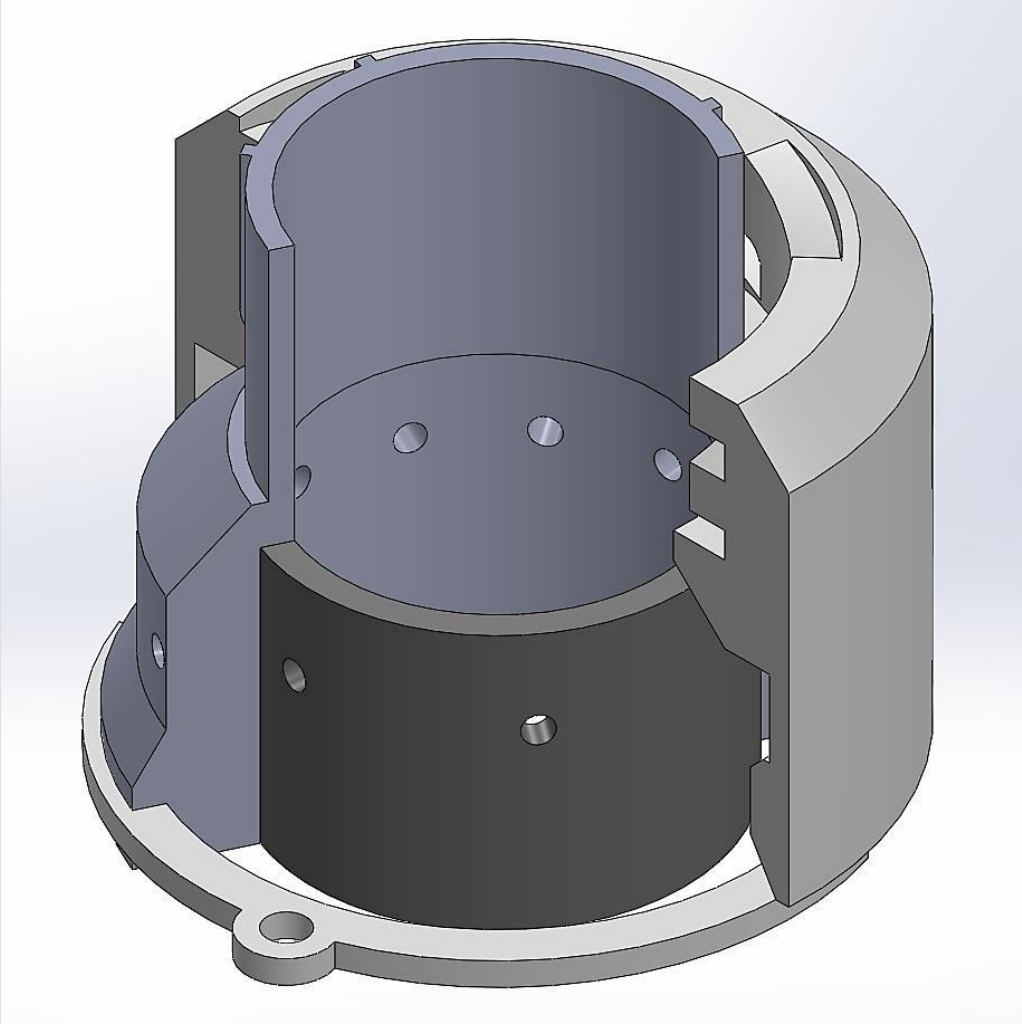
Koll Christianson

Final Design Animation



Koll Christianson

Final Design (Cross-Sectional View)



Koll Christianson

Metal prototype (Exploded View)

Koll Christianson

Metal prototype (Assembled)

Manufacturing

- Created the ball bearing crimp tool
  - Allows for the removal of the Spring Retention Ring
- Could not cut helical grooves
  - Straight slots instead for prototype

Cost Analysis

- Original connector costs ~$400
- Budget of $100
- Spent $80
  - ~$60 on Aluminum Stock
  - ~$10 on the Leash
  - ~$5 on Ball Bearings
  - ~$5 on Springs

Conclusion

- Design requirements met
  - Does not fail after 50 mate/de-mates
  - De-mates with ~27 lbf.
  - Male end was not changed
  - New design is approximately 10% larger than the original
- Merits of new design
  - Easy to manufacture
  - Inexpensive
  - More reliable

Acknowledgments

- Mrs. Mary Rogers of Orbital Sciences Corporation
- Dr. Srinivas Kosaraju of Northern Arizona University
- Professor Perry Wood of Northern Arizona University
- Tom Kothrin of Northern Arizona University's Machine Shop

Questions?