

Separation Connector Improvement for Orbital Sciences Corporation



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

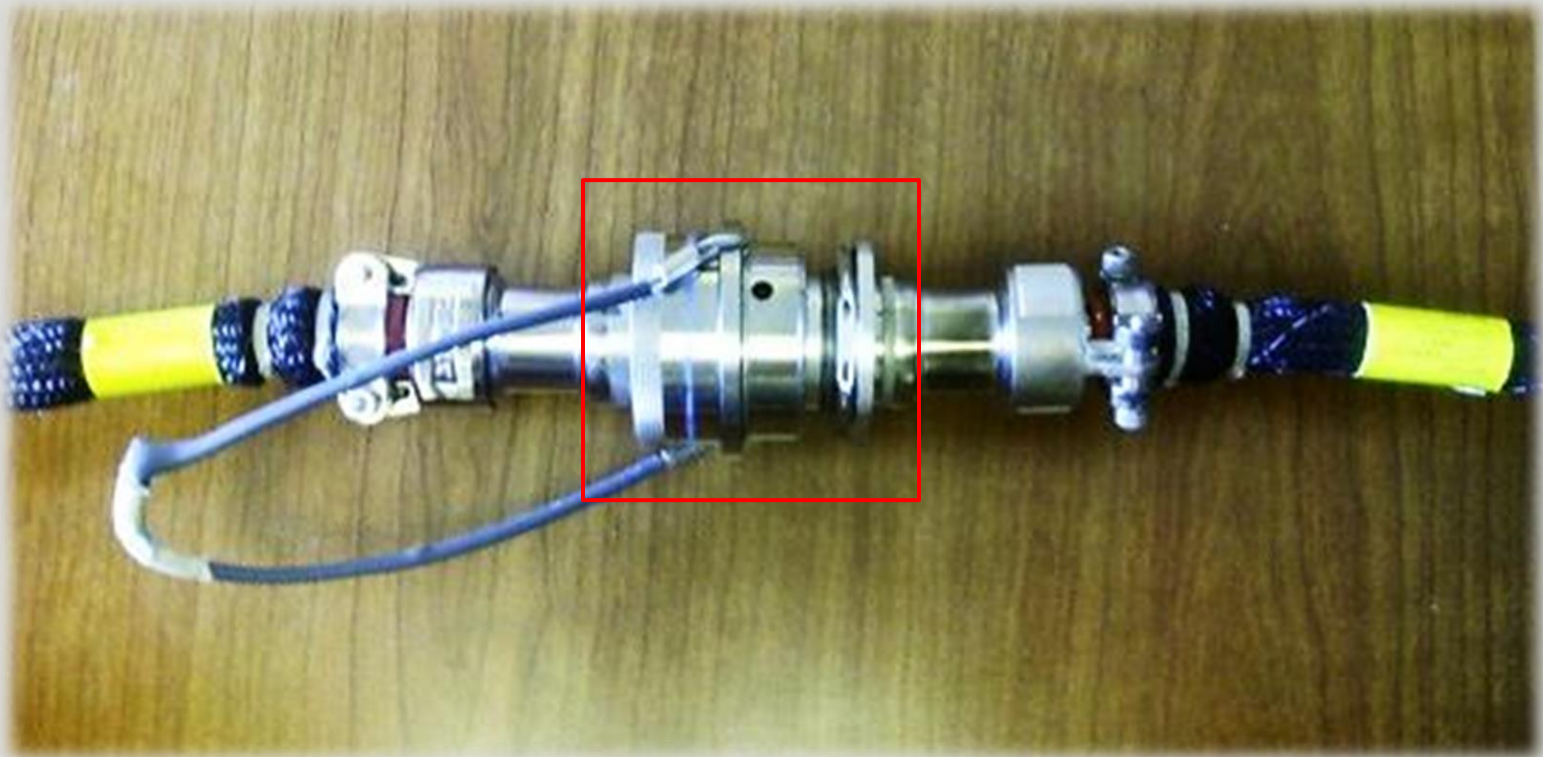
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Presentation Overview

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

Project Overview

- Original Separation Connector



Part # MIL-DTL-38999L

Problem Statement

- The goal of this project is to design and demonstrate our concept that meets cost goals (DTC), enhances design for manufacturing and assembly (DFM/DFEA), and meets or exceeds current reliability.

Current Design

- Reduce number of parts to increase reliability, enhance design for manufacturing and assembly, and reduce cost.



Design Requirements

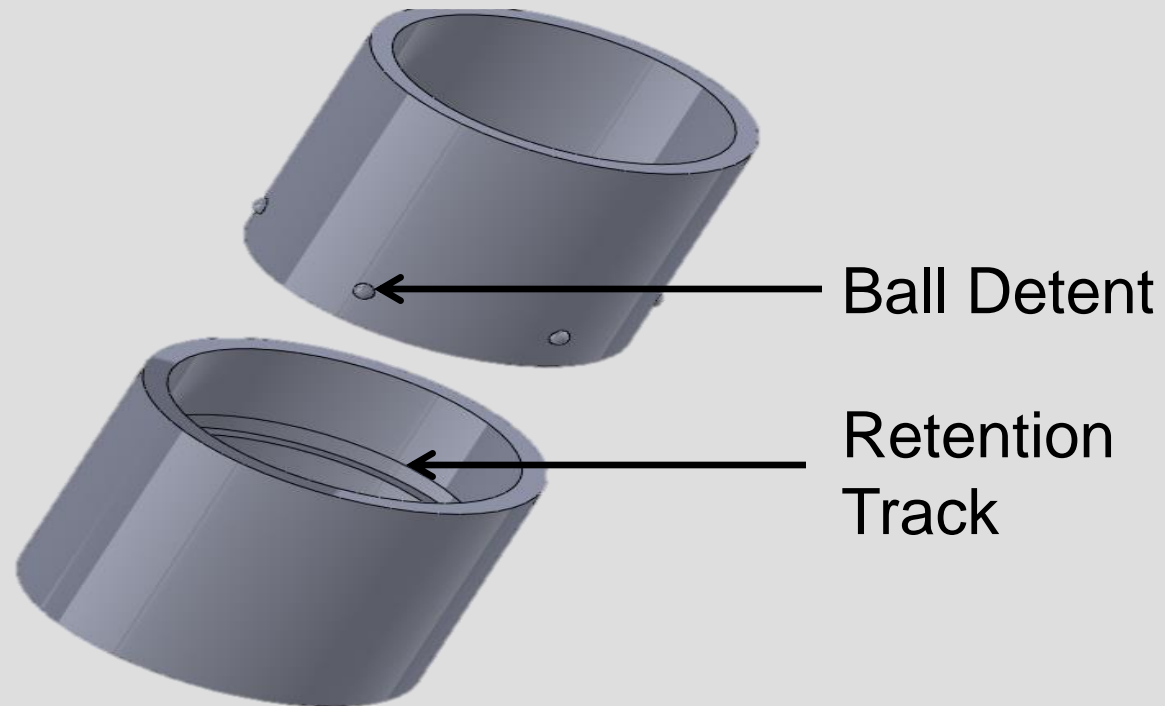
- Male end cannot be changed
- Pass military environmental requirements
- Separates with 10-30 lbf. in tension
- Structural integrity to withstand 200 lbf.
- Easy to manufacture
- Mate and de-mate at least 50 times without failure (cycle reliability)
- Cannot exceed an increase in size of 25% greater than the original design

Design Proposal

- Preliminary Design

Male
End

Female
End



FDM Prototype (Components)

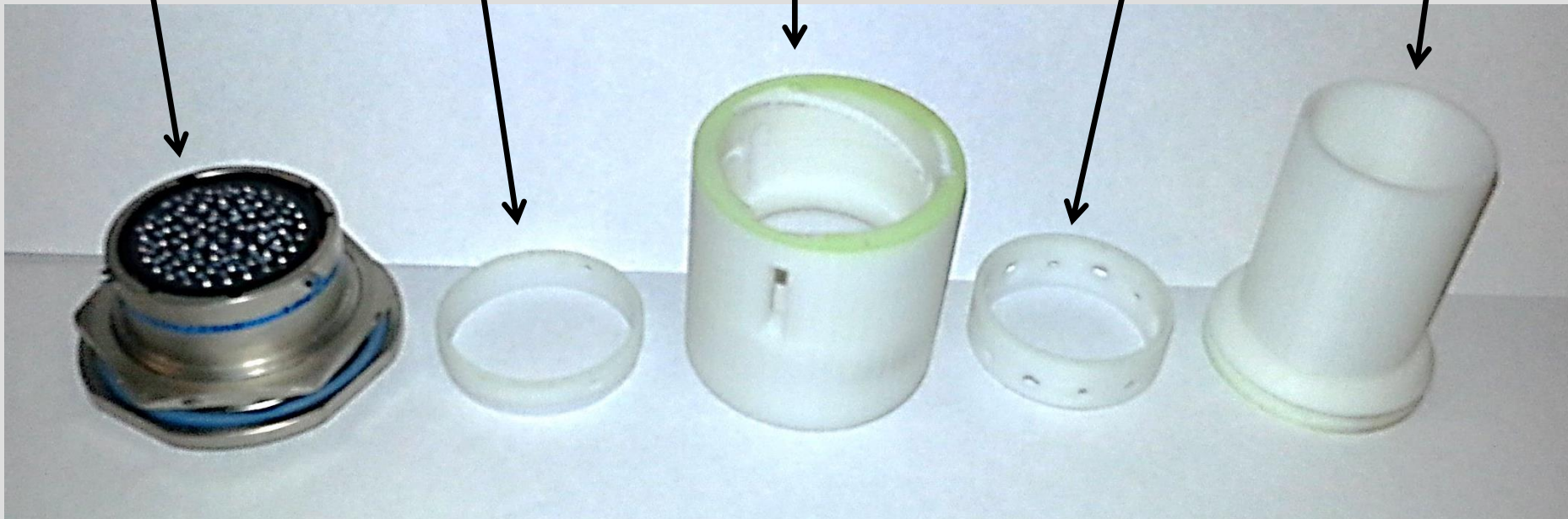
Male
End

Pressure
Plate

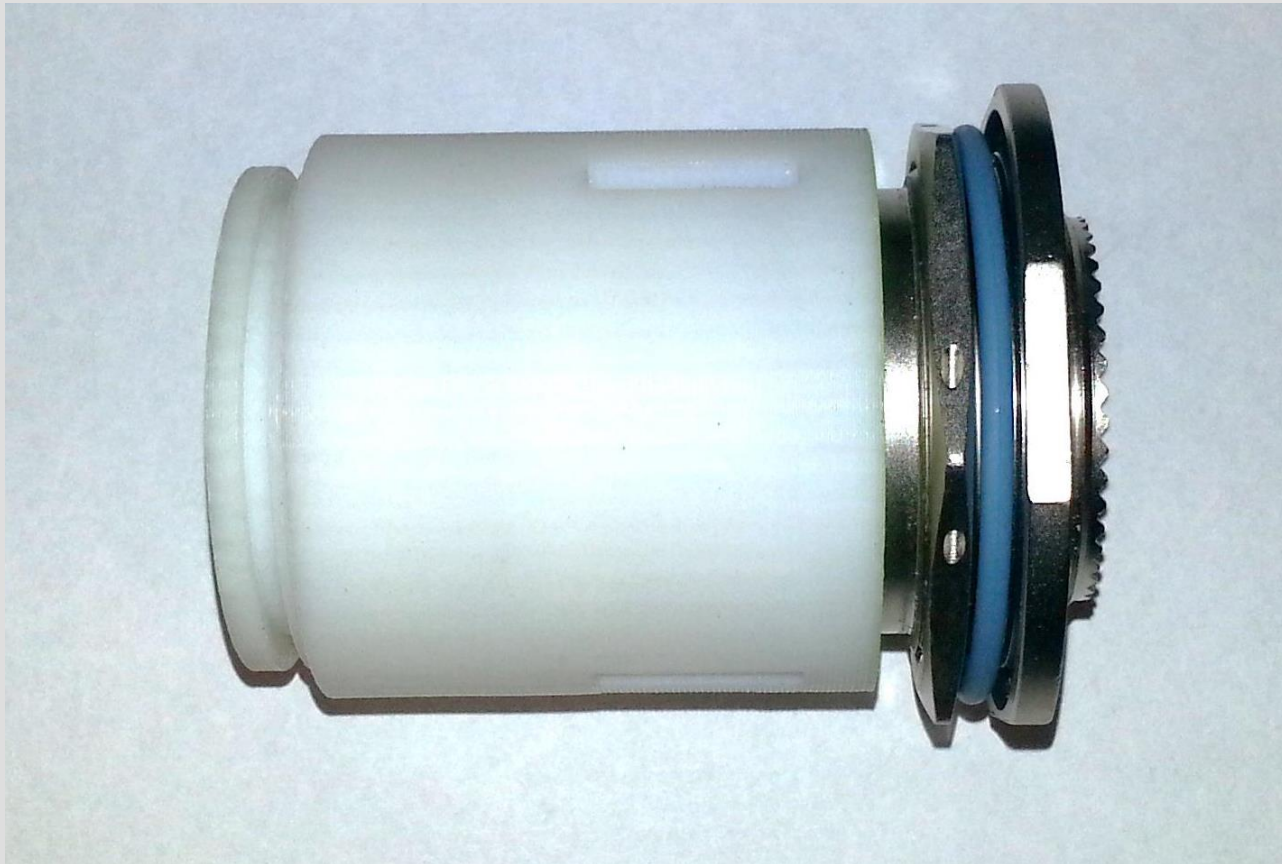
Coupling

Ball Bearing
Retention
Ring

Female
End



FDM Prototype (Assembled)



Modifications to FDM Design

Combined:

- Female End
- Ball Bearing Retention Ring

Added:

- Spring Retention Ring

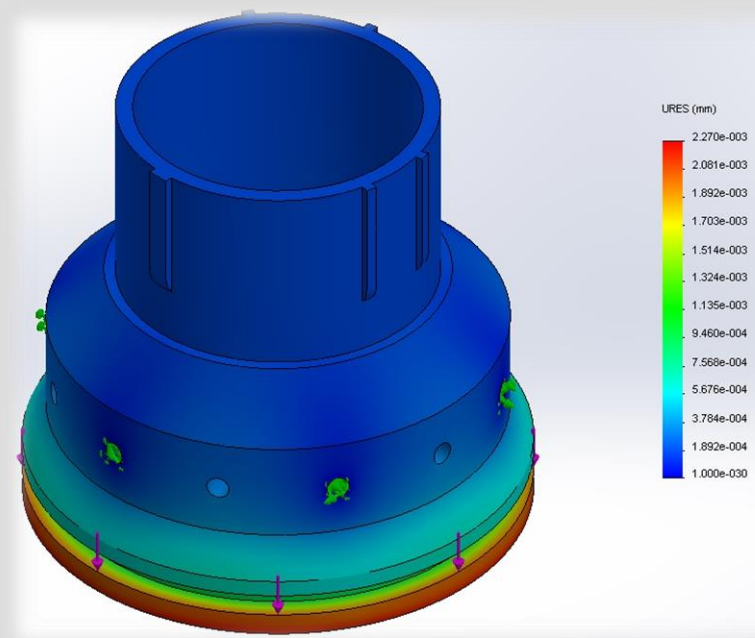
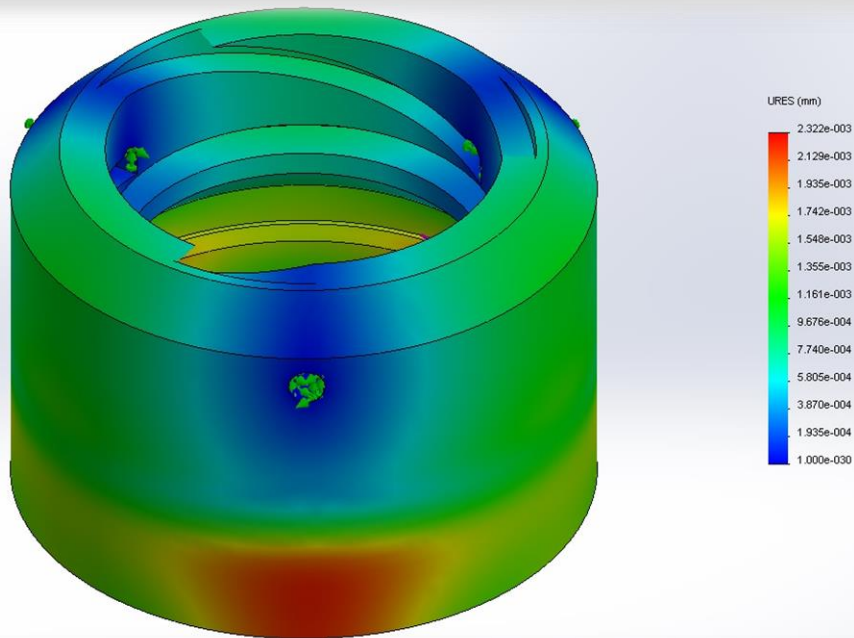
Changed:

- Coupling

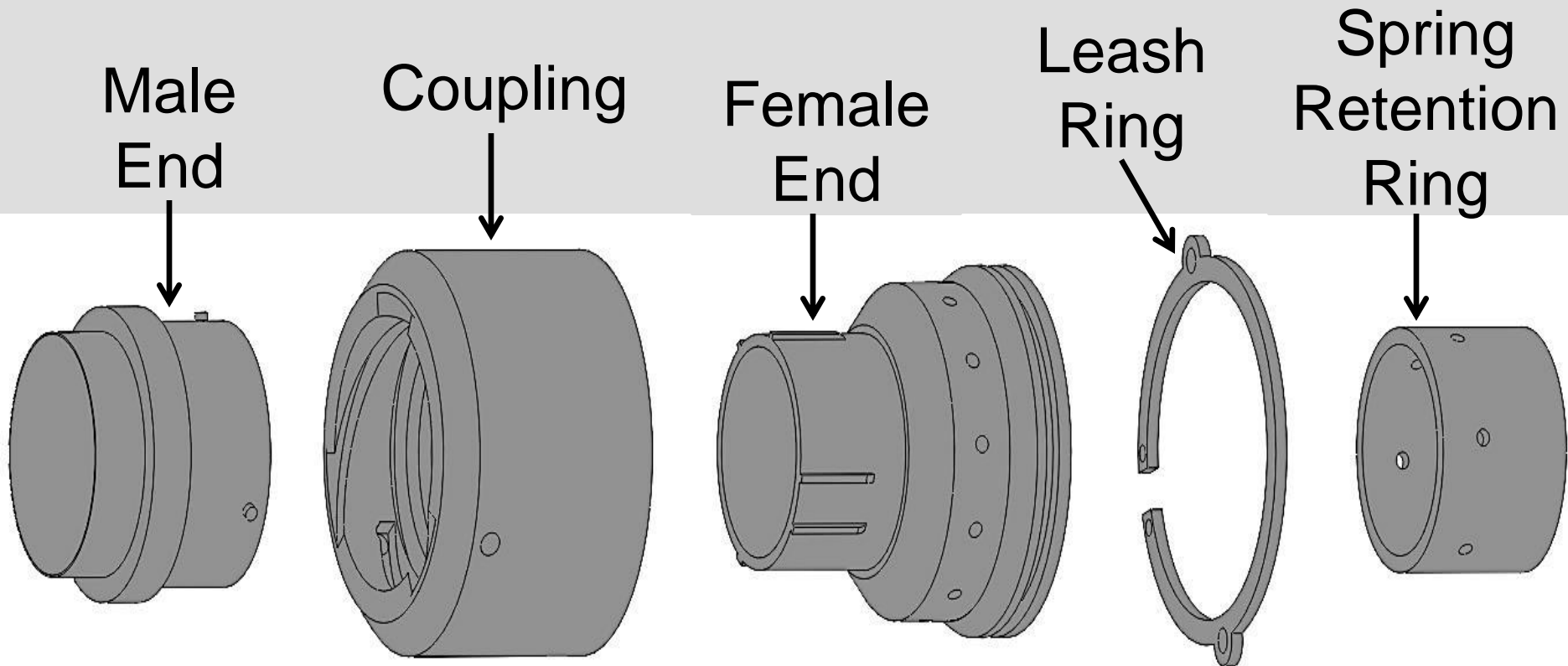
Removed:

- Pressure plate
- Ball Bearing Retention Ring

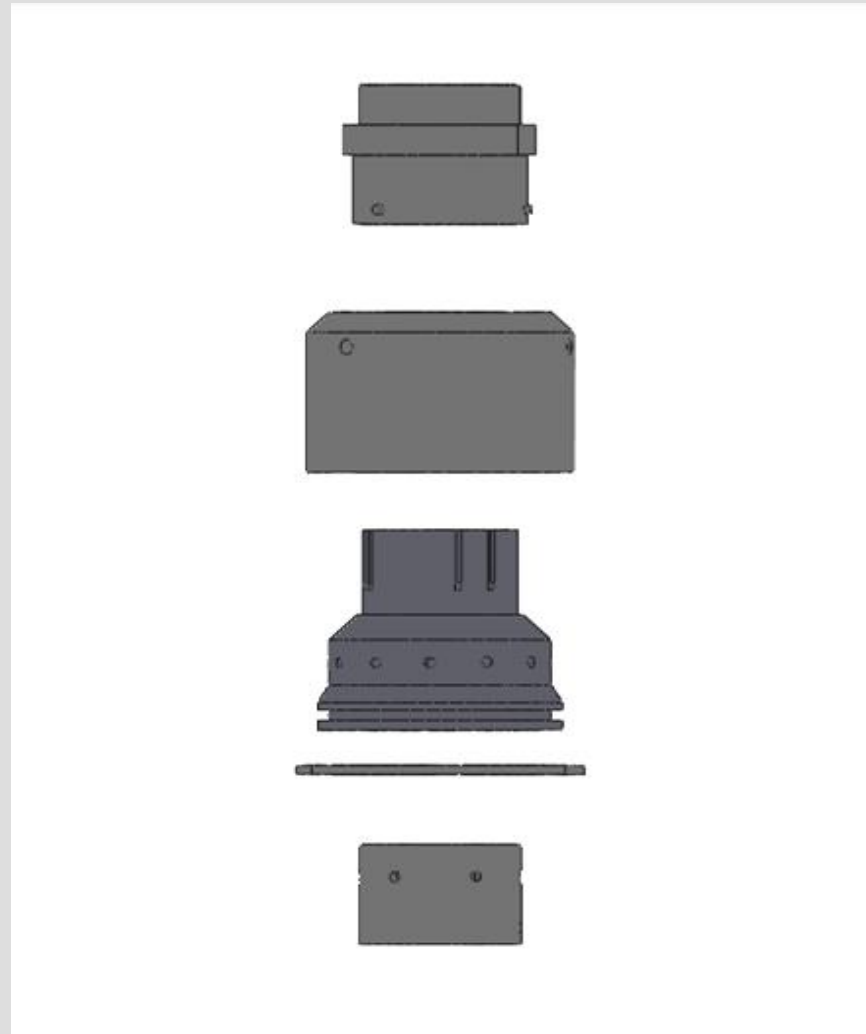
Deflection Analysis at Full Load



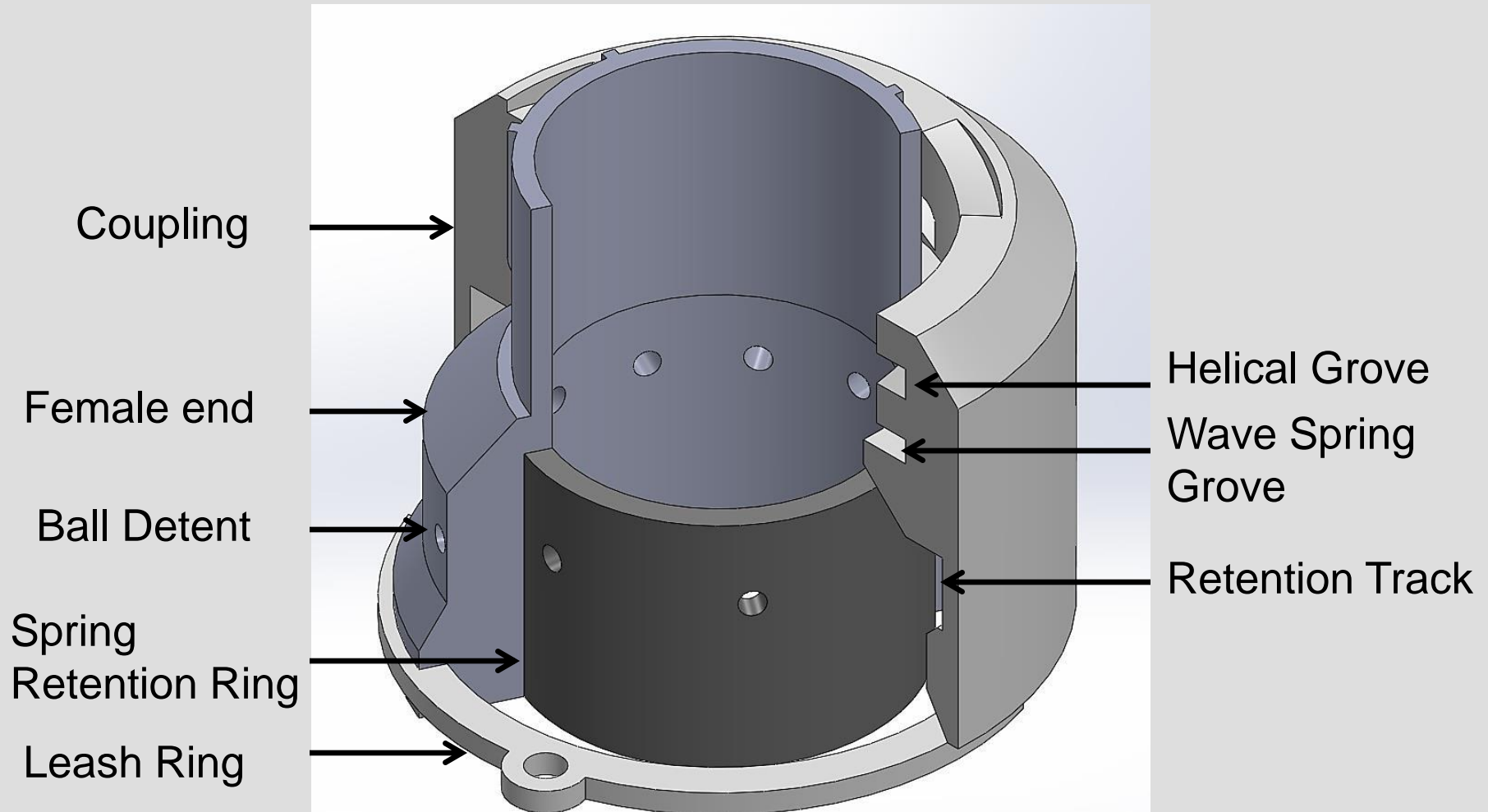
Final Design (Exploded View)



Design Assembly Animation



Final Design (Cross-Sectional View)



Metal Prototype (Exploded View)

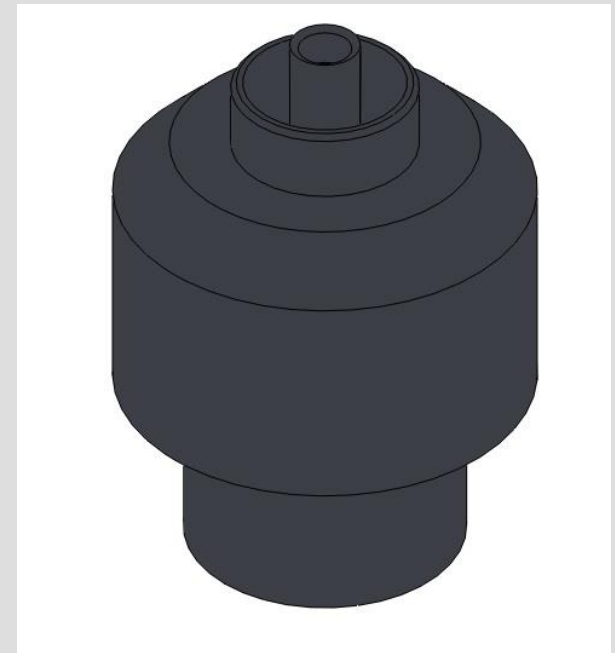


Metal Prototype (Assembled)



Manufacturing

- Created the ball bearing crimp tool
 - Allows for the removal of the Spring Retention Ring



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
 - Mechanically robust
- Merits of new design
 - Easy to manufacture
 - Inexpensive
 - More reliable

Acknowledgments

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- Zheng Lian Team Member

Questions?

