Development of a Thrust Stand for Micro-Electric Propulsion

Chloe McFadden: The University of Alabama in Huntsville
Mentors: Kurt Polzin NASA Marshall Space Flight Center

Background and Objectives

- Performance of propulsion systems is determined in part by the measured thrust of the system
- Thrust stands for Electric Propulsion cannot use load cells owing to the low thrust levels, but must measure the displacement of the moment arm instead
- Marshall Space Flight Center (MSFC) has previously built a traditional hanging pendulum stand but has not built a swinging-gate, or torsional pendulum, thrust stand before
- This design must measure 1-100\(\mu\)N thrusts and will be suitable for thruster masses between 3-5 kg
- The system must be underdamped with very little friction and use a passive eddy current magnetic dampener

Design Overview and Features

- Stationary Base which can be integrated into several vacuum chambers
- Neoprene padding as vibration isolation on all four corners
- A moving arm which is attached to two low friction flexural pivots
- Passive eddy current magnetic dampener
- LVDT measures the displacement of the arm

Analysis and Future Work

- The stand will be tested with a steady state thruster and measurements will be verified through calibrations before and after the test
- The stand must use a Linear Variable Displacement Transformer (LVDT) to measure the displacement of the moment arm and output a differential voltage
- Integration of electronics is ongoing
- Once the stand is fully calibrated it will be tested with a steady state thruster and its efficiency will be evaluated

Acknowledgements

I would like to thank my mentor, Kurt Polzin, for giving me this opportunity and for all of his assistance. I would also like to thank Tommy Reid and Harold Burts for their help with manufacturing this design. And lastly thank you to the Alabama Space Grant Consortium for their financial support of this project.