

## MISSION STATEMENT

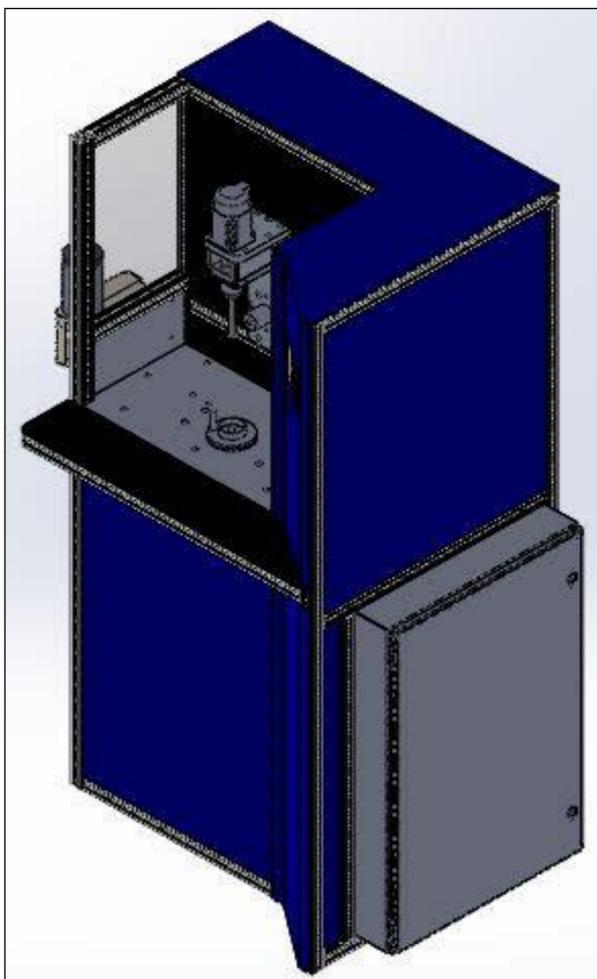
The Graco UMD senior design (G-Team) team will design, manufacture, and implement a manual load/unload automatic lapping machine to be installed at Graco's Minneapolis, MN location. The new lapping machine aims to improve both efficiency and ergonomics while maintaining operating safety. The machine is to be similar to Graco's F91605 model that is currently integrated in the automated production cell and must be implemented by May 5, 2017.

### OBJECTIVES

- Decrease lapping process and setup times
- Improved ergonomics for operators
- Increase lifetime of lapping balls
- Maintain quality surface finish on parts
- Meet safety requirements for operators
- Stay within the project budget of \$20,000

### CONSTRAINTS

- Budget of \$20,000
- Completion by May 5th
- Must be able to lap parts up to 8" tall
- 4-6 week lead time on all Graco, Inc. manufactured parts



### DESIGN SUMMARY

The design of the lapping machine consisted of five main parts: Frame Design, Component Selection, Machined Parts, Electrical Design, and Programming. The frame is made of 80/20 aluminum and an ergonomic work surface height was implemented to provide comfort for the operator. Components that include servo motors and linear actuators were chosen based on performance needs of the machine. Over 40 different machined parts were designed to accompany components and ensure proper functionality. For electrical design, wiring diagrams were made and power supplies had to be chosen based on power consumption of all electrical components. Programming was completed to store over 100 different part numbers' specifications for ball speed, rotational speed, contact force, and swing angle.

### CONCLUSION

In conclusion, the major design choices that were chosen by G-Team include a custom in-house made gripper, an all in one frame design, and a linear actuator featuring a separate motor and controller/drive with remote I/O communication. After considering all of the design choices and respective constraints, the G-Team is confident in concluding the best options have been chosen. Moreover, these options will greatly improve the current process efficiency, functionality and safety as well as see a return on investment in a few years time.



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