Project Name — Development of Test Rig to Analyze Composite Materials for Pump Wear Rings

Overview
Flowserve wishes to obtain data on wear rates for composite wear rings to use in their pumps. The team’s task was to build a test rig to replicate the wear a Flowserve pump shaft provides on a wear ring during pump start up. The hardest part of this project was learning SolidWorks, how to incorporate mechanical design into an actual project, general machining (boring, reaming, broaching), advanced machining (CNC), and data acquisition. Equally difficult was learning how to work together as a team between the students and the sponsor.

Objectives
The primary objective was to design and build a test rig for wear tests. Secondary objectives include: performing optical profilometry readings on sample composite wear rings for surface roughness, to develop a test matrix for varying PVs and run times per test, and to create a system for measuring continuous sample tests.

Approach
- Research the accomplishments from the previous semester of the project.
- Visit the Flowserve Bethlehem site to better understand the technical demands of the project.
- Build a preliminary SolidWorks Test Rig.
- Research bearings, gears, motors, and other components for the Test Rig.
- Validate the integrity of the test rig with pressure velocity, safety factor, deflection, fatigue, and gear system
- Update the Test Rig to safely allow for the shaft to output 6,500 RPM through a sprocket and timing belt design rather than gears.
- Perform finals updates on the SolidWorks model and incorporate the idea of using a VFD in conjunction with a motor.
- Perform surface roughness tests using optical profilometry and devise a test rig for testing samples.
- General machining (milling, lathing, reaming, boring, keyway broaching)
- CNC the shaft/test rig
- Construct the thermal system
- Complete test rig construction.

Outcomes
Finally, list the outcomes for this project making sure to clearly convey their implications for the sponsoring company:
- The sponsor will save $6,000 as a result of this project
- Manufacturing/production times were reduced by 120 hours/minutes as a result of this project
- The project reduced set up time, assembly time, tool wear, etc.
- Flowserve now has a fully operational test rig for performing their own R&D on wear rings.