**Introduction**

Opportunity Statement

- Due to Genesis Attachments’ high warranty costs, Blizzard Engineering was tasked with designing and simulating a hydraulic life cycle test stand that will acquire data for further advancements of equipment. A hydraulic test stand will create a higher reliability of products by gaining more information on failures through root cause analysis.

Mission Statement

- Blizzard Engineering is working alongside Genesis Attachments to design an effective hydraulic life cycle test stand for the evaluation of motors to aid in cutting costs of warranty due to failures, with a deadline of May 5th, 2017.

Objective

- Design a hydraulic life cycle test stand that will be controlled by a control system capable of running life cycle testing for hydraulic components. The fixture will provide an interface to test pressure, load, and rotational speed on motors. In addition, there will be a data acquisition system that will provide feedback. The fixture will be designed and simulated by Blizzard Engineering.

**Constraints**

Genesis Attachments established necessary constraints that must be met from the start, but as the project progressed, some of the initial constraints were modified. Listed below are the final constraints that were set, with mandatory completion.

- Cost: be able to justify the final budget for this project
- Design: complete a full design of a test stand for a hydraulic motor
- Bill of Materials: compile a complete bill of materials
- Simulation: complete a simulation that provides proof of concept

**Solutions**

The final Hydraulic Test Stand was designed initially test hydraulic motors. This test stand will allow Genesis to test every type of motor in house, before sending their final product to the customer. The schematic was developed after in depth research of the necessary components for the system performance.

Inlet and outlet conditions were set to simulate a temperature difference of 37 degrees for the cooling loop and the calculations were converged by fluent onto a steady state condition. The resulting temperature difference seen by the high pressure line is 7.56 degrees Fahrenheit (160-152.4) which simulates about 17 HP of heating. This result demonstrates that the fluid is well mixed and should not lead to any peaks in temperature throughout the tank specifically near the main suction port.

**Cost Analysis**

The payback period is reduced from 25 years to 11 years when the warranty cost savings was increased from 20% to 30%. It is recommended that Genesis Attachments set a goal of reducing annual warranty costs by a minimum of 30%, to benefit from a shorter payback period. The knowledge gained from the tests that will be conducted cannot be quantified in this analysis. It is for Genesis to decide the true value of the knowledge gained.

**Team Description**

Blizzard Engineering has seven members from both mechanical and industrial engineering backgrounds, all of which will be graduating from the University of Minnesota Duluth this May.

- **Jared Hutar**
  Project Manager

- **Randall Sedlachek**
  Mechanical Engineer

- **Cameron Hehn**
  Mechanical Engineer

- **Jared Hutar**
  Project Manager

- **David Franklin**
  Mechanical Engineer

- **Andrew Thorpe**
  Mechanical Engineer

- **Riley Kirkpatrick**
  Industrial Engineer