Planetary Gear Efficiency Analysis

Overview
Akron Brass – located in Wooster, Ohio – manufactures fire fighting equipment. They approached the team with a problem involving the planetary gear sets they use to pivot fire truck-mounted water monitors. Akron Brass wants to develop continuous oscillation monitors; however the gears as they are now are not efficient enough for such use.

Objectives
The exact efficiency of the gears is unknown. It is the objective of the team to design and fabricate a device that can determine the efficiency of a set of planetary gears.

Approach
- It was decided between the team and Akron Brass that a visit and tour of the facility would be appropriate in order to better understand the problem and how it applies to Akron Brass’ products.
- The process of analyzing gear sets for efficiencies naturally lead the team to discussing dynamometers and the multitude of options that are available.
- The team performed research (including patents and existing products) and generated a variety of dynamometer concepts.
- The concepts were subjected to a rigorous set of analysis matrices comparing cost, safety, accuracy and other factors.
- It was determined that the team make a prony brake dynamometer due to its low cost and simple design.
- A detailed design was agreed upon, built digitally, and further tweaked using the SolidWorks 3D modelling program.
- The physical prototype was then fabricated, with appropriate parts ordered – tachometer, force gauge, bushing, and leather strap.
- Testing of both the actual device and the gear sets were done simultaneously by measuring input and output power and gauging the consistency of results.

Outcomes
- Akron Brass now has a quick and simple way of testing for the efficiency of their planetary gear sets.
- The creation of this device allows Akron Brass to test new developments and eventually use these gears towards their ultimate goal: continuous-use oscillating water monitors.