Overview:

The Dresser-Rand plant in Olean, NY works on specialized z-blade impellers. It used to make these impellers by riveting pieces together, but has since updated the design. Now, Dresser-Rand’s customers are seeing failures in the older, riveted impellers. The rivets lack strength and are known to degrade and break in several different ways. Also the holes that are being made for the rivets cause stress concentrators that contribute to an impeller failing. Customers that use the older, riveted style impellers need replacements. Once an impeller breaks it needs to be replaced with an entirely new impeller. Dresser Rand wants to redesign an updated method for putting the pieces of the z-blade impeller together.

Objectives:

The main goal of the redesign was to improve the strength of the z-blade impellers. The new design had to be made in a way that didn’t affect the aerodynamic qualities of the impeller. This redesign also needed to cost a reasonable amount. Dresser-Rand needs to make replacement z-blade impellers using this new method, so general feasibility needs to be considered. Dresser-Rand is looking for a recommendation for one specific method to use to make them.

Approach:

● The team visited the Olean, NY plant to look at the z-blade impellers and factory and discuss the goals and expectations of the redesign with the sponsor. After the site visit, the team used the information from the sponsor to examine project requirements and criteria with which to decide and measure the effectiveness of designs.
● An external search on different methods for fastening metal was conducted in order to determine a group of methods to analyze and consider.
● Different methods were selected and compared: stick welding, spot welding, brazing, TIG welding, MIG welding, epoxies, 3-d printing, clinching, and alternative rivets.
● A prototype of the z-blade was designed on auto-cad, and initial strength simulations were made to get an initial sense of what methods might work better than others.
● Further research was made into the feasibility of each methods, and certain methods were ruled out leaving the group with three options: stick welding, tig welding, and spot welding.
● Prototypes were made in order to perform strength tests to provide info on the best option.

Outcomes:

Research from this project showed that TIG welding is the most superior alternative to riveting. It provides an increase in strength, similarity in cost, and the Olean facility has the capacity to perform it. The TIG welded prototypes showed such strength that the metal on the z-blade failed before the actual weld failed. Alternatives were ruled out or were outperformed by TIG welding in the selected criteria.