Overview
Dresser-Rand is a global supplier of high performance centrifugal gas compressors for the oil and gas industry. The focus of this project was on the welding of large diameter, low flow coefficient gas impellers. The current geometry of the welding torches used does not allow for a single continuous weld and the operators also have difficulty viewing the weld.

Objectives
● Design a flexible torch section that can be adjusted and maintain the proper geometry to complete the specified welds in a single pass
● Design a visual feedback device that will allow the operator to view the weld as the process is being performed.

Approach
● A site visit was done at Dresser-Rand’s facility in Olean, NY, where background information was obtained on the process as well as seeing the process in action.
● Five ideas were initially thought of, a modular linked system, a high performance flexible hose, mirror walls, a mirror tip, and an attached guide. After producing these concepts, the alternatives were ranked based off of a collection of selection criteria, weighted and based on importance. As a result, the team decided to use a combination of these three alternatives: modular snake design, a woven metal inner hose and a visual feedback device.
● A solidword model was created as a final design, shown in Figure 1.
● An impeller model was built and used to test both the improved torch design and the new visualization feedback design. This model was built to scale, and was able to test both the welding torch and mirror aid so as to understand the limitations of each deliverable.
● A finite element analysis (FEA) was performed on the design. This analysis proved that the design could withstand the temperature in the welding zone as well as all of the forces associated with the welding process.

Outcomes
● A new torch design was created with more rigidity as well as a greater manipulation in bendability by the addition of modules.
● An 80% improvement in rigidity was achieved when compared to the torch of the previous design.
● Improvement in visualization section could be describe as nearly infinite because there was no visual feedback system in place previous to this project.
● The visualization device will allow the welder to not lose sight of the weld tip after the welding torch passes the line of sight due to the curvature of the blade.
● Welding will be more efficient, thus saving time, money, and energy.