Overview
Centrifugal compressors add energy into a flow by accelerating the flow radially outwards. A fluid can be guided prior to reaching the impeller through the use of inlet guide vanes. However, the versatility of centrifugal compressors in petrochemical applications is limited by stationary inlet guide vanes. Rotating the guide vane mechanism would allow the compressors to operate under a wider range of fluid flow and improve the overall efficiency of the system.

Objectives
Dresser-Rand specified the core needs of the robust MIGV system the team was assigned to design and test to be
- Reliable – Lifetime of 20 Years
- Accurate – Accurate to 0.5°
- Variable – Range of Motion from -10° to +30°

Approach
- Visited the Dresser-Rand facility to gather data and customer needs
- Coordinated with Shanghai Jiao Tong University (SJTU) for all steps of the design process
- Generated concepts and implemented a screening process to select the best concept possible
- Reviewed existing patents and competing designs
- Preliminary models were drafted and examined on a subsystem level to select the best components
- Proposed and final designs were drafted as CAD models
- Fabricated a small-scale prototype to display functionality
- Tested proposed design via ANSYS Fluent, SolidWorks, and ADAMS
- The results of the numerical analysis proved the design met the customer needs

Outcomes
- Due to the reliability of the design, clients potentially could save millions of dollars in long-term field application
- The MIGV design reduced the required maintenance time, extended the range of fluid flow, increased the efficiency, and extended the service life of centrifugal compressors in the petrochemical industry