Overview
This semester, our team underwent the task of developing an automated heating and cooling process for polymer seals in the natural gas and drilling industry. This was a global project between Penn State and Shanghai Jiao Tong University. The goal was to replace the manual process that is currently in use by designing a mechanical and electrical system to complete the work. The Penn State team’s primary focus was the mechanical design on the device, whereas SJTU’s focus was the electrical design and heating/cooling.

Objectives
Our objective was to deliver a mechanical system that could support the range of seals that John Crane manufactures for the sleeves and retainers. In order to accomplish this, our team designed a CAD model and found commercially available components to construct this model.

Approach
- In our weekly conference calls, our team established a list of customer needs with our sponsor
- Our team conducted background research to ensure no patents could limit our design
- Concept generation took place in early design phases, each component had three designs
- Generated multiple design concepts for the motor, bracket, and heating/cooling support system
- To verify specifications, our team did mathematical calculations (Power, torque, etc. for motor)
- Our team designed a CAD model to serve as our final design
- Our team constructed an alpha prototype and beta prototype to present the project idea
- The prototypes helped our team improve our design by checking if an idea was physically possible
- Our team used Finite Element Analysis in SolidWorks to test the durability of our rig

Outcomes
- Manufacturing/production times will be reduced as a result of this project
- The sponsor will increase production by saving time
- The project reduced product loss from overheating polymer rings
- This project will provide a safe and reliable process for John Crane
- The operator can quickly adjust the arms for multiple sleeve/retainer sizes