Investment Casting Mold Handling for Factory Automation

Overview
PCC Structurals specializes in making investment castings and has decided to expand its operations. They require the creation of a trailer for the transporting and cooling of investment castings from the front end facility to the post processing facility. The castings should be able to be loaded into the holders by a programmable robot to allow for increased productivity.

Objectives
Our main objective is to create a model of a trailer in Solidworks that contains room for six investment castings. In addition to the models a prototype of a single fixture will be created as a proof of concept for visualization purposes.

Approach
● Our group gathered customer needs and design constraints through conversations with the sponsor
● A hierarchy of customer needs was created to weight the needs and decide which needs were most important to the sponsor
● Two main concepts were generated using Solidworks and evaluated using a concept scoring matrix which resulted in similar scores for both concepts
● The models were combined and adjusted to accommodate for the varying size of the castings
● Gas springs were chosen to allow for 45 degrees of rotation from the maximum height to the minimum height
● Parts were ordered to begin construction of a prototype to serve as a proof of concept
● The prototype was built using tools in the learning factory and performs similarly to the full system
● A set of assembly instructions was created to allow for the building of the full system in the same way the prototype was built
● Solidworks models were tested to make sure that they would lower with all sizes of castings
● Finite element analysis was completed on possible points of failure in the system and they were redesigned to allow for a reasonable factor of safety

Outcomes
● The mold holder can support castings from a height of 12 inches to 24 inches
● The mold holder can support castings from a weight of 25 pounds to 150 pounds
● All holders return to the same position when unloaded allowing for easy automation using a robot
● The trailer was constrained to a width of 6 feet and a length of 9 feet
● Solidworks files were generated for all parts used in the construction of the trailer