

# Tube Furnace Hot Press

Team W13 "Thermal Press" - Project 36

**Sponsor:**  
Principle Investigator Dr. Olevsky  
**Point of Contact:**  
Maricruz Carrillo

**Project Advisors:**  
Course Instructor: Dr. Shaffar  
Professor and Expert: Dr. Torresani  
Fabrication Support: Mike Lester



SAN DIEGO STATE UNIVERSITY  
Mechanical Engineering

**Powder Technology Laboratory**

## Project Overview

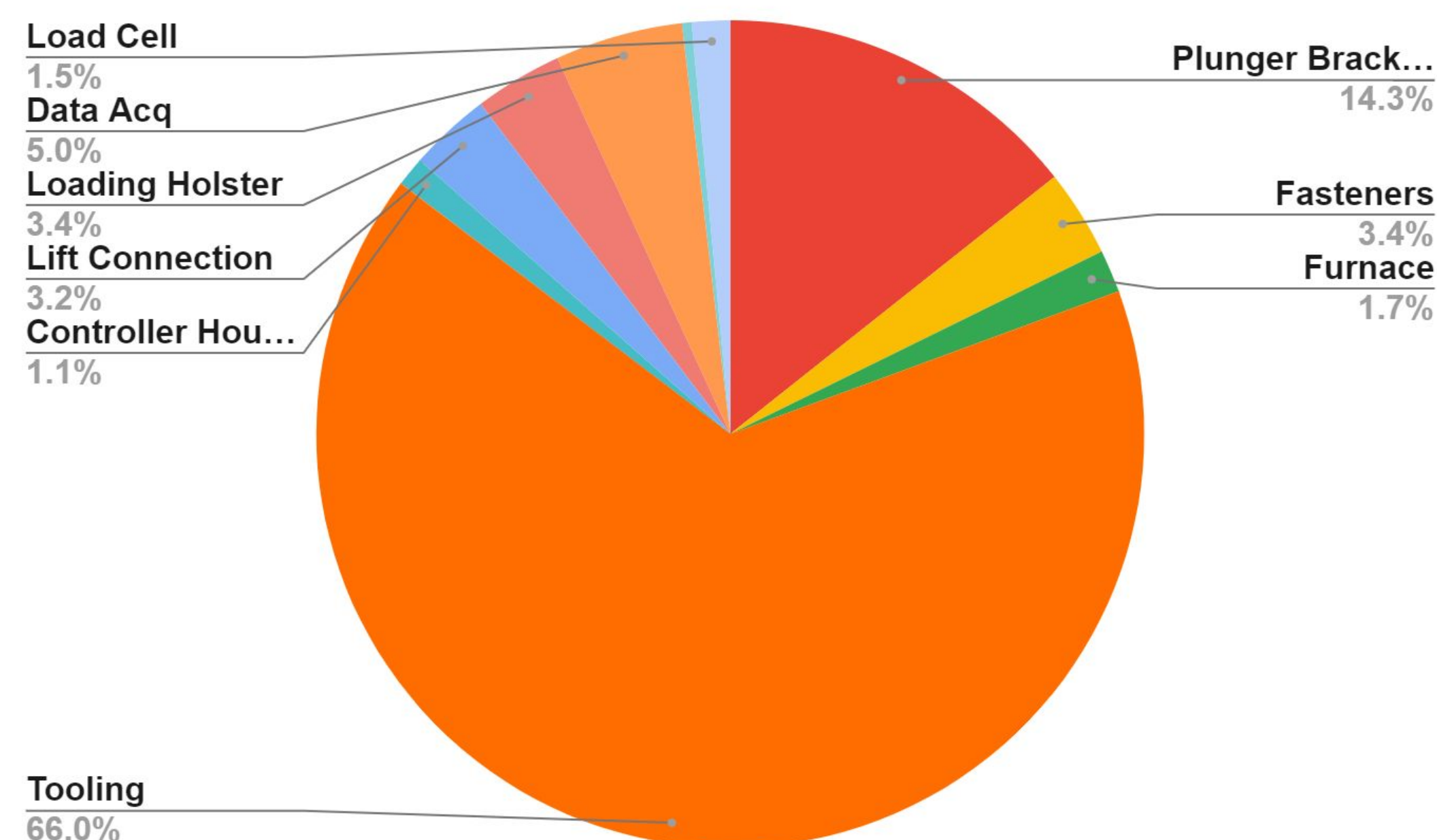
The team has been tasked with the design and integration of a hot press system utilizing an Instron machine and a vertical tube furnace that can reach up to 1050° C and 100 MPa. This is a continuation of a 2019/2020 Senior Design project that did not reach completion. The hot press system will be able to consolidate powdered metal and ceramic materials for research purposes in the Powder Technology Laboratory. This includes a data acquisition system interface to log temperature over variable intervals of time throughout the experiment.

## Major Requirements and Constraints

- 1) Instron machine and tube furnace must be allowed to work independently.
- 2) Tooling components must resist oxidation and withstand extreme conditions of up to 1050°C and concurrent 100 MPa.
- 3) Data acquisition system must be able to log temperature over variable intervals of time.

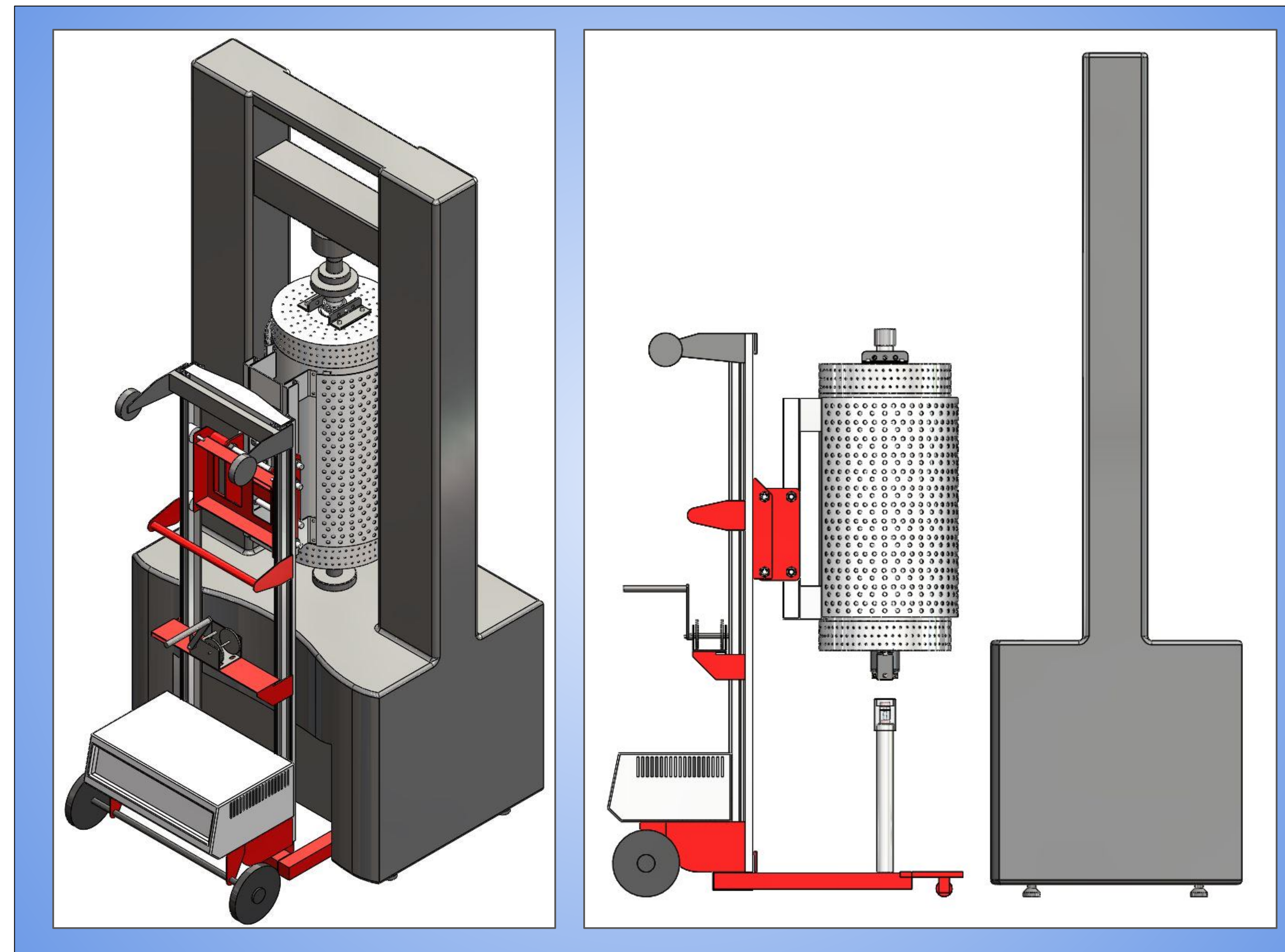
## Budget

The maximum budget given by our sponsor is \$5000. Only \$3000 was spent on material procurement and outsourced manufacturing. Materials purchased by the previous team were able to be repurposed to further reduce costs.



## Future Use

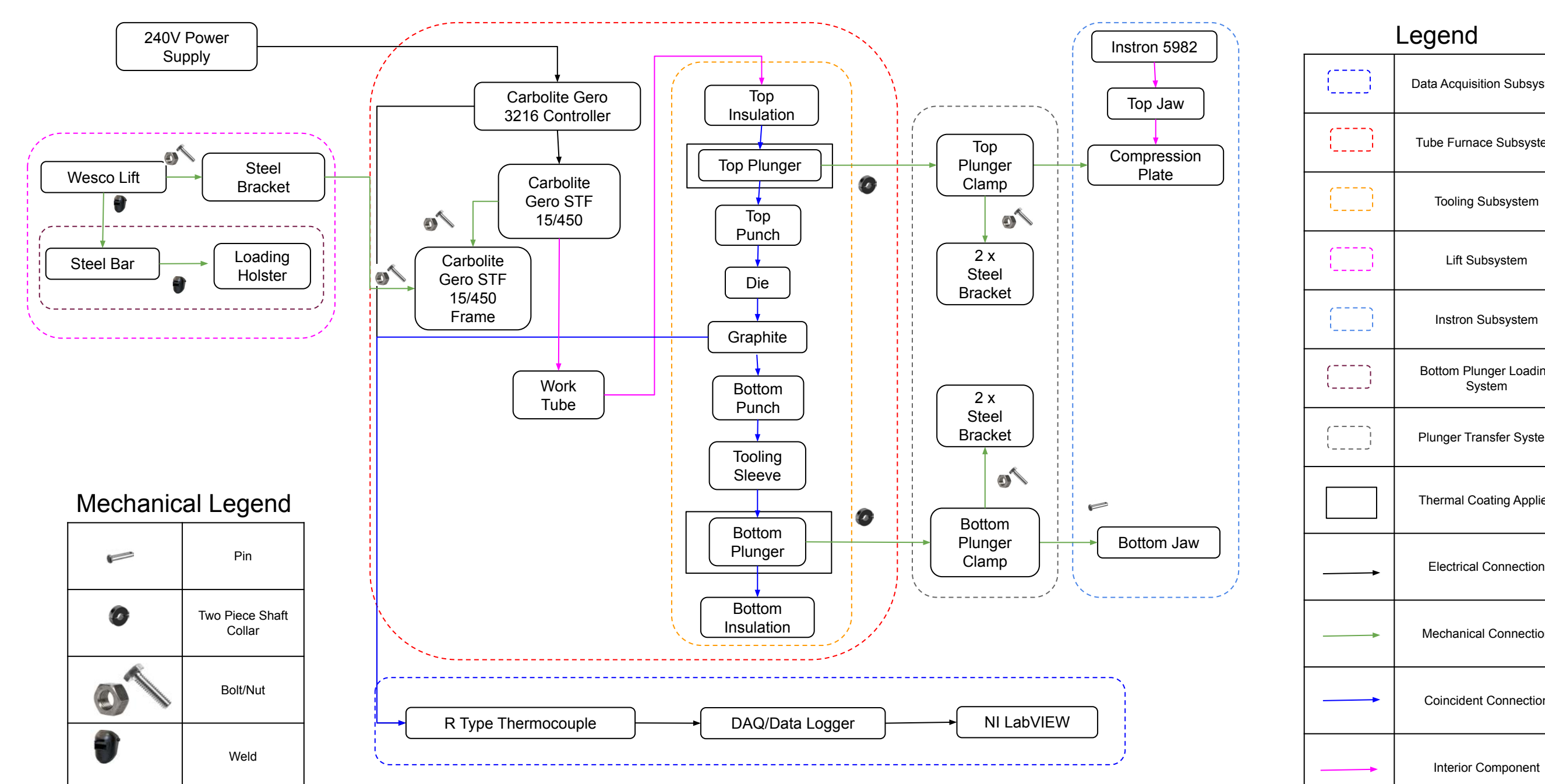
The tube furnace hot press system will be used in the Powder Technology Lab by researchers including Maricruz Carrillo to assist in the advancement of experimental material characterization.



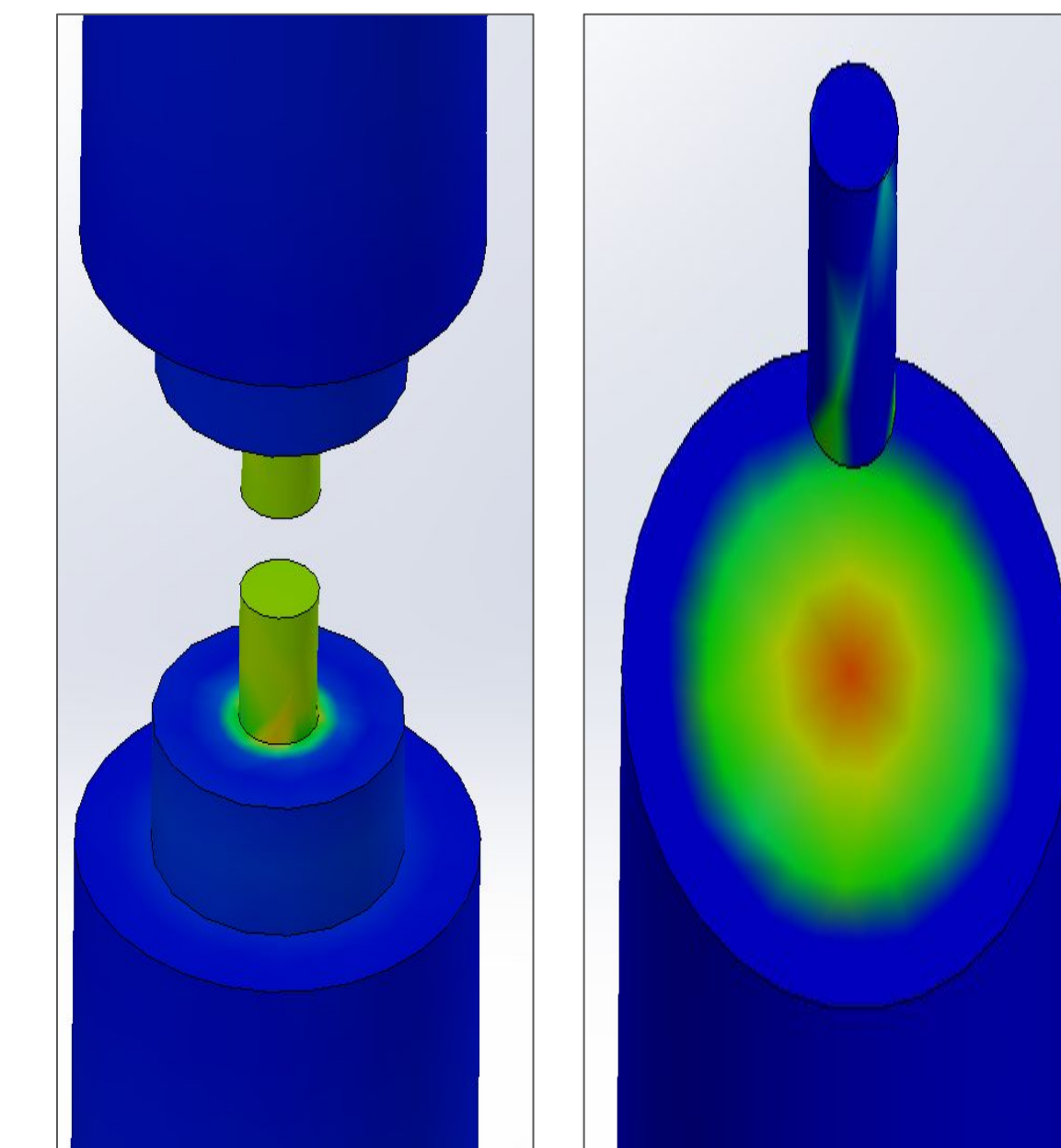
## System Specifications

Team Thermal Press designed this system to consolidate powdered metal and ceramic materials at 1050°C and 100 MPa. The furnace is mounted on a winch lift allowing for ease of use and mobility. RA-253 alloy plungers and alumina punches/die are rated to withstand the maximum temperature and pressure required for experiments. A data acquisition system will display and log temperature using a thermocouple connected to a laptop running our LabVIEW interface.

## System Level Diagram

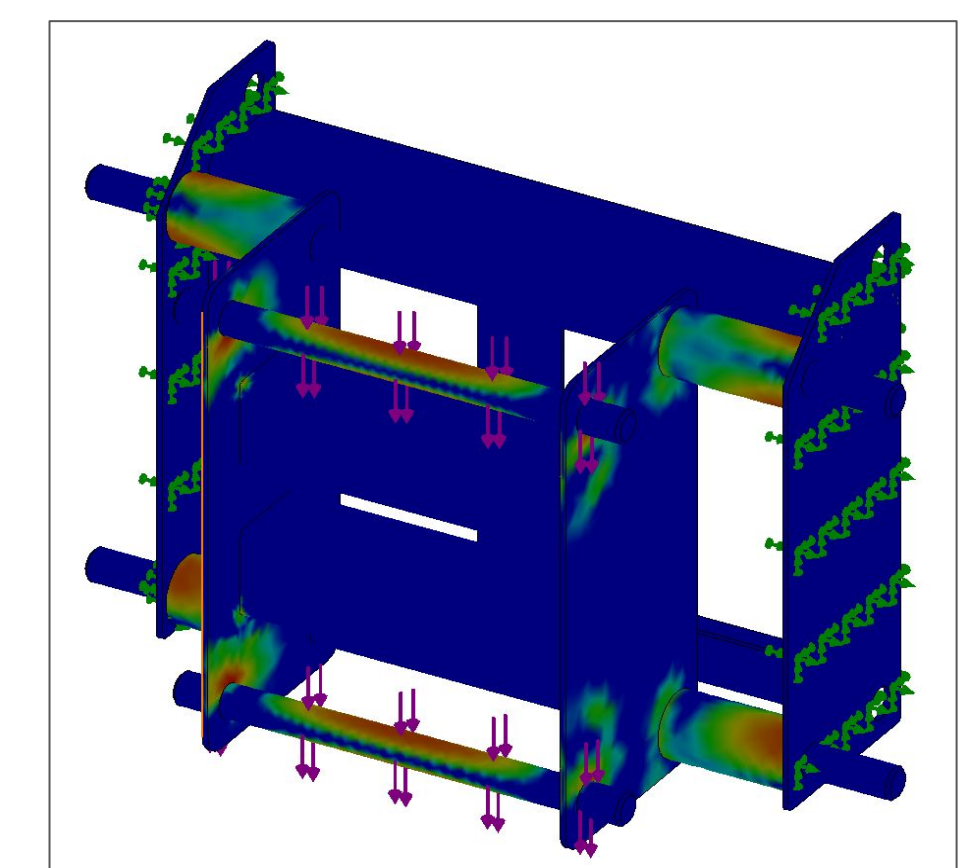
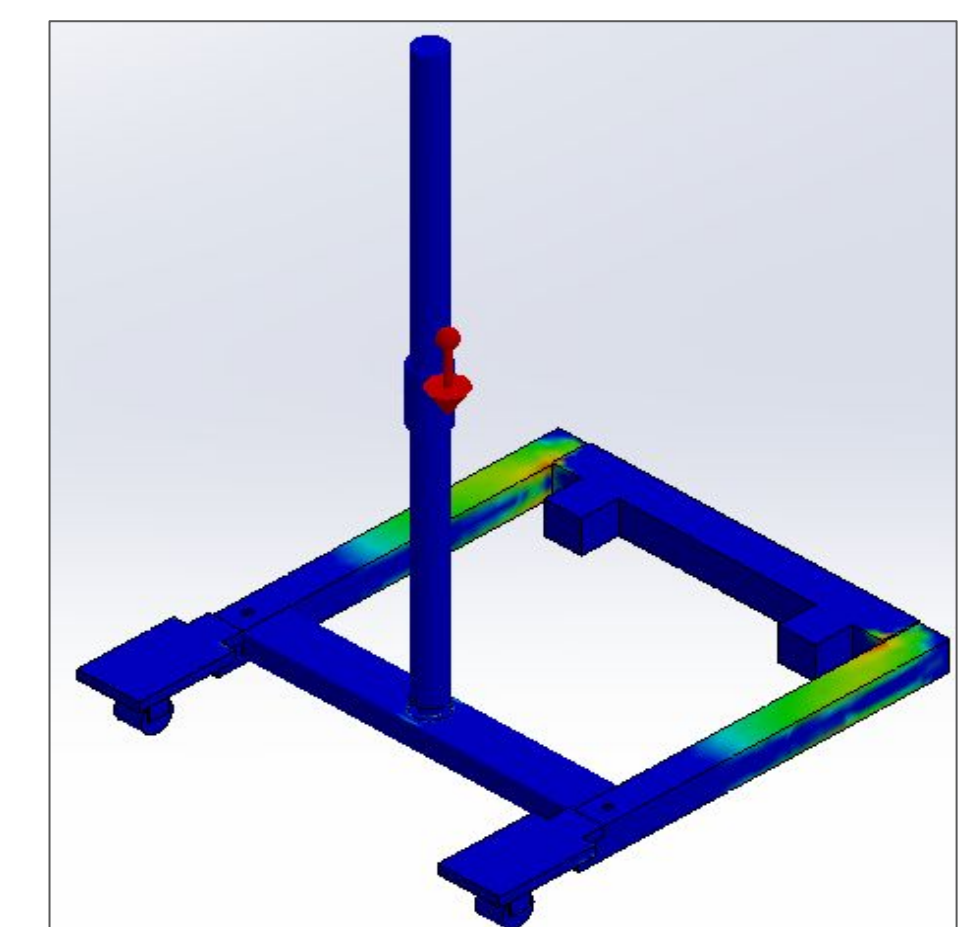


## Analysis



FEA simulations were conducted on assemblies in order to verify a minimum Factor of Safety of 1.5, per the request of the team sponsor. After many iterations, the team finalized a design in which alumina was the material selected for the punches and dies.

FEA simulations of the connecting bracket and plunger holder frame was needed in order to assure that each subcomponent could withstand the force acted upon it via the weight of the tooling system and tube furnace. This analysis assured the previously purchased lift was adequate, while confirming that steel was the proper material choice for the furnace-lift connecting bracket system.



## The Team



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**SPRING 2021**