

# PROJECT DESIGN REVIEW

AnGel-of-Insulation



# Content

- Project Goals
- Background
- Design Conditions
- Assumptions
- Specifications
- Design –(SW Model)
- BOM/Budget
- Alternative Design
- Uncertainty
- Project Schedule
- Future Goals



# Project Goals

- Measure Temperature Gradient of various insulations
  - Measure Surface Temperature on interior & exterior surface
  - Compare the temperature profile over time
  - Calculate instantaneous heat transfer
  - Analyze results and draw conclusions
  - Deliver design to ME department



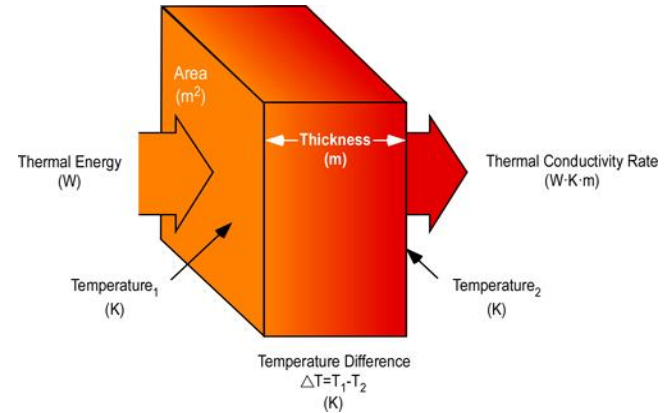
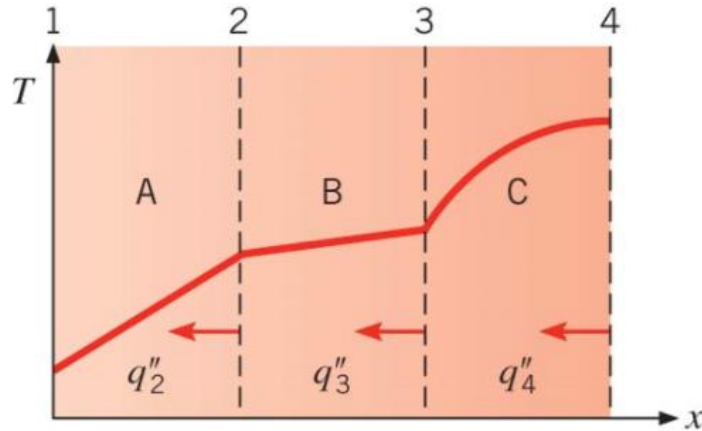
# Background

Insulation Type	Description
Aerogel	Aerogel is a lightweight, porous substance created by evaporating a solvent from a silica base. Aerogel contains around 50-9.8% air while maintaining a rigid structure. The end result is a material that has very low thermal conductivity.
Thermasheath	Closed cell polyisocyanurate foam core board very similar to styrofoam.



# Background

- 1-D Transient analysis
- Infiltration considerations
- Natural Convection inside box



$$Q = UA(T_o - T_i)$$



# Design Conditions

- Testing Site
  - Free from human interference
  - Initial conditions of box at room temperature
  - Evening testing
  - Testing period approximately 30~60 minutes
- Sampling frequency of 1Hz



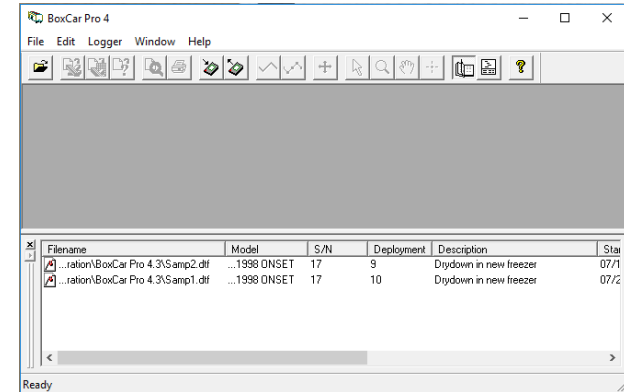
# Assumptions

- Air tight construction (no infiltration losses)
- Negligible contact resistances
- Neglect radiation effects (evening testing)
- 1-D heat transfer analysis



# Specifications

- Thermal Sensor requirement
  - Accuracy:  $\pm 0.01^{\circ}\text{C}$
  - Range:  $-20^{\circ}\text{C}\sim 70^{\circ}\text{C}$
  - Measurement capacity: 7944 measurements total, stored in non-volatile memory
- Software
  - Boxcar 4.0/4.3 Pro
  - Data exports to Excel file
  - Matlab



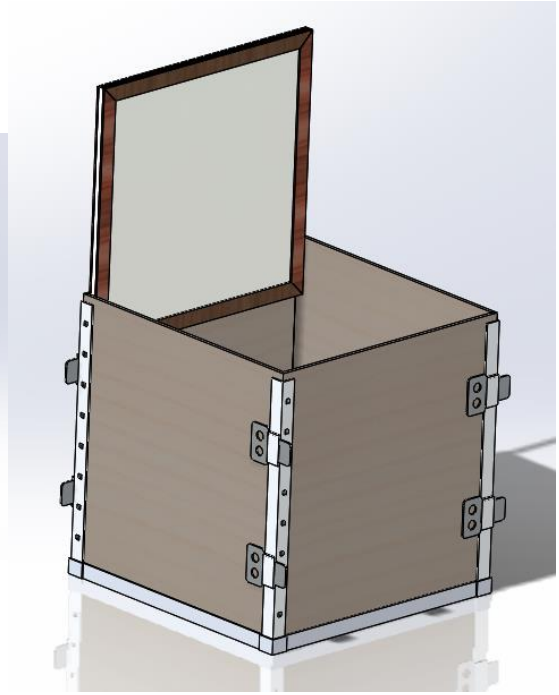
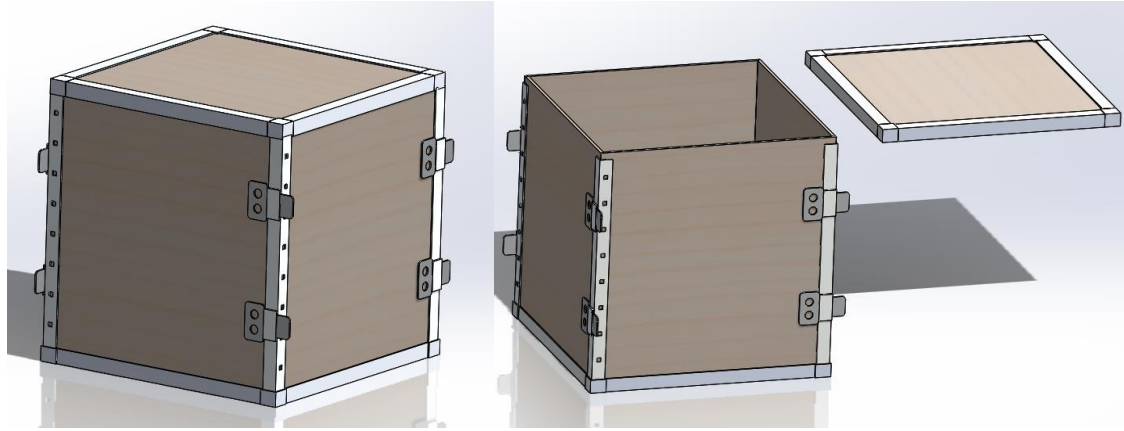


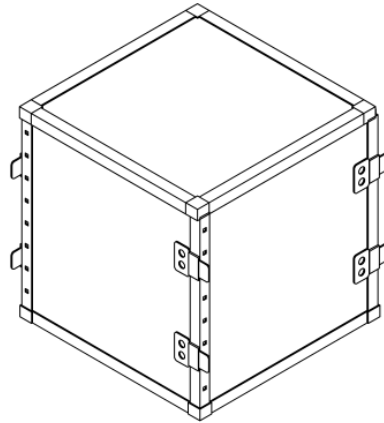
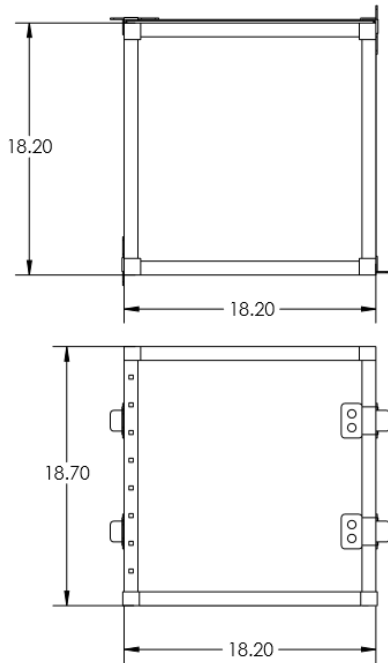
# Specifications (cond.)

- Model Configuration
  - 18" X 18" X 18" Plywood Box
  - Transportable
- Test Specimens
  - Similar thickness in all insulations.
  - Consistent environmental testing.



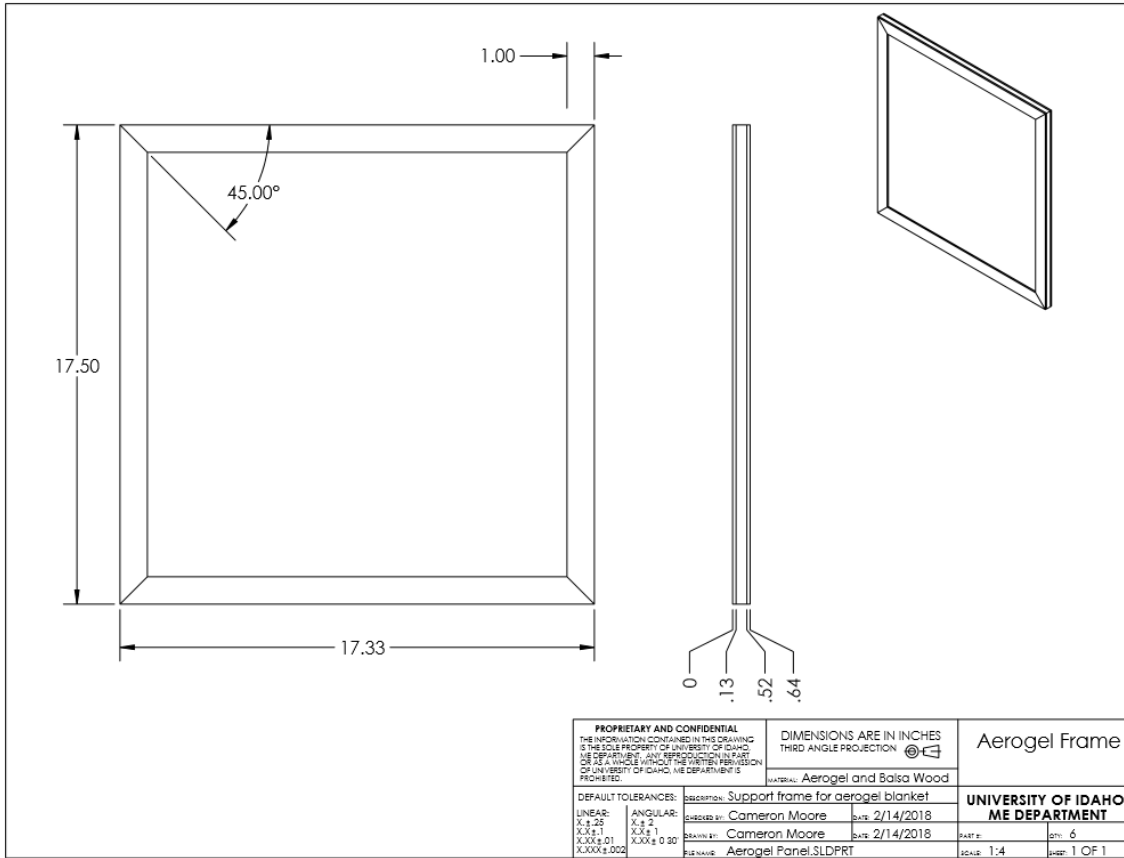
# Design





<b>PROPRIETARY AND CONFIDENTIAL</b> THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF UNIVERSITY OF IDAHO. NO REPRODUCTION, IN WHOLE OR IN PART, OR AS A SINGLE UNIT, WITHOUT THE WRITTEN PERMISSION OF UNIVERSITY OF IDAHO. USE DEPARTMENT IS PROHIBITED.		DIMENSIONS ARE IN INCHES THIRD ANGLE PROJECTION		Box	
		MATERIAL: Plywood and metal			
DEFAULT TOLERANCES: LINEAR: X.X ± .05 X.X ± .1 X.XXX ± .01 X.XXX ± .002		DESCRIPTION: Testing box		<b>UNIVERSITY OF IDAHO</b> <b>ME DEPARTMENT</b>	
ANGULAR: X ± 2 X.X ± 1 X.XX ± 0.50		DESIGNED BY: Cameron Moore	DATE: 02/14/2018	PART #:	QTY: 1
		DRAWN BY: Cameron Moore	DATE: 2/14/2018	SCALE: 1:8	SHEET: 1 OF 1
		FILENAME: Assem1.SLDPR1			

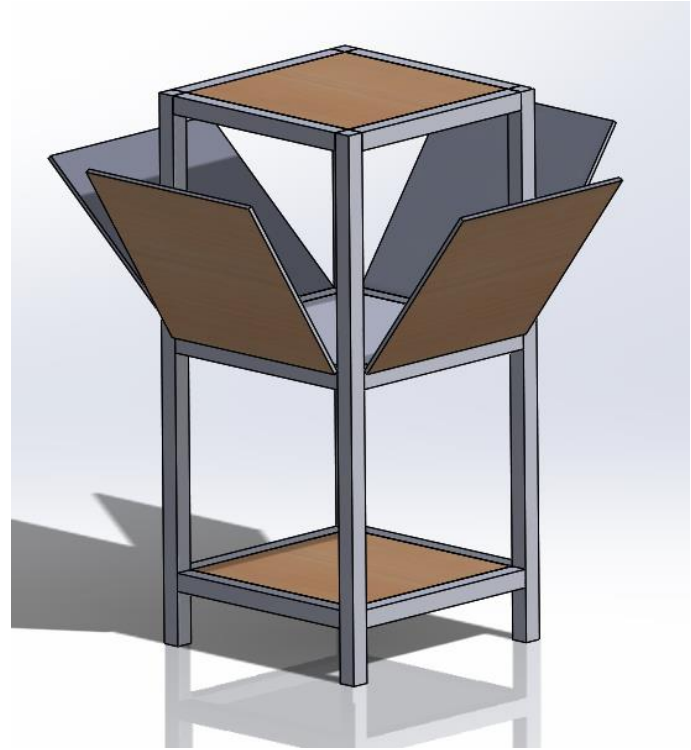






# Alternative Design

- Plywood Construction:
  - Framed 15.625 ft<sup>3</sup> elevated box
  - Bottom storage shelf
  - Hinged side panels
  - Castors



# Uncertainty

- Accuracy of sensors
- Variability of ambient conditions
- Sensor calibration







# Future goals

- Seal the interior of our box with silicone to be close to air tight
- Design and laser cut wood for the aerogel panel frame.
- Apply rubber foam tape to top panel to make air tight.
- Initiate testing of both insulation types.
- Collect temperature data from experiments.
- Perform analysis.



# Questions?

