
# BUV Milk Transport

Group #8

Sean Galligar, Brian Reynolds, Joshua Pitts, and Emmitt Hanner

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# Acknowledgements


- Our sponsor: BUV and Will Austin
- Our mentor: Professor Lew
- Our Professor: Clay Bass
- The ONU Engineering Department
- Physical Plant

# Team Experience

Emmitt Hanner : Mechanical Engineering

- Product Validation Intern, Design Intern, and Mechanic for Cummins Engine Co.

Sean Galligar: Mechanical Engineering

-R&D Intern: Bradley Machining, Performance Validation: CSL

Brian Reynolds: Mechanical Engineering

-Design Intern: Vactor Manu., Ag Technician: LK Service and Repair

Joshua Pitts: Electrical Engineering

-IEEE Member, PTC Creo experience, Programming and Software experience

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# Our Sponsor: BUV

BASIC VEHICLES | CHANGED LIVES

- Mission Statement

"To create unique transportation solutions, which relieve daily burdens and empower sustainable economic development to help transform communities in Africa and beyond."

- Based in Indianapolis, IN
- Main Contact: Will Austin
- Belongs to The Institute for Affordable Transportation

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# Project Description

- Design a BUV bed that keeps milk in milk cans from spoiling
- Transport Milk cans from farmers to a Milk Collection Center (3 hours total, 1.5 hours with milk)
- Design a sun protective roof that can support 50kg
- Allow space to carry misc. items as well as a winch, shovels, and lumber
- Allow milk can and bed itself is easily loadable and unloadable

# Functional Requirements

- Transportation of milk without spoilage
- Space for miscellaneous consumer goods
  - Feed for farmers, tools etc.

https://www.npr.org/sections/thesalt/2014/06/20/323957894/going-against-the-grain-fda-threatens-brewers-feed-for-farmers

# Functional Requirements

- Transportation of milk without spoilage
- Space for miscellaneous consumer goods
  - Feed for farmers, tools etc.
- Space for a full repair kit

https://www.amazon.com/OCGIG-121PCS-Socket-Repair-Mechanics/dp/B07B7HF8WC

# Functional Requirements

- Transportation of milk without spoilage
- Space for miscellaneous consumer goods
  - Feed for farmers, tools etc.
- Space a full repair kit
- Simple way to load and unload 50L milk cans


https://www.ebay.com/itm/50L-13-25-Gallon-Stainless-Steel-Milk-Can-Wine-Pail-Bucket-Tote-Jug-in-one-piece-/232902714235

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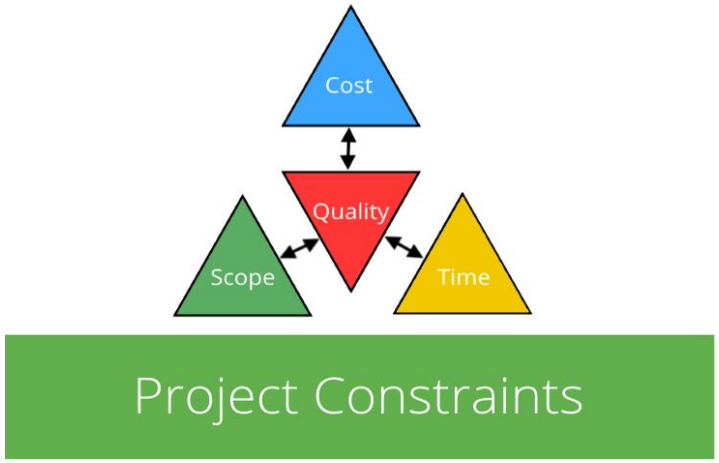
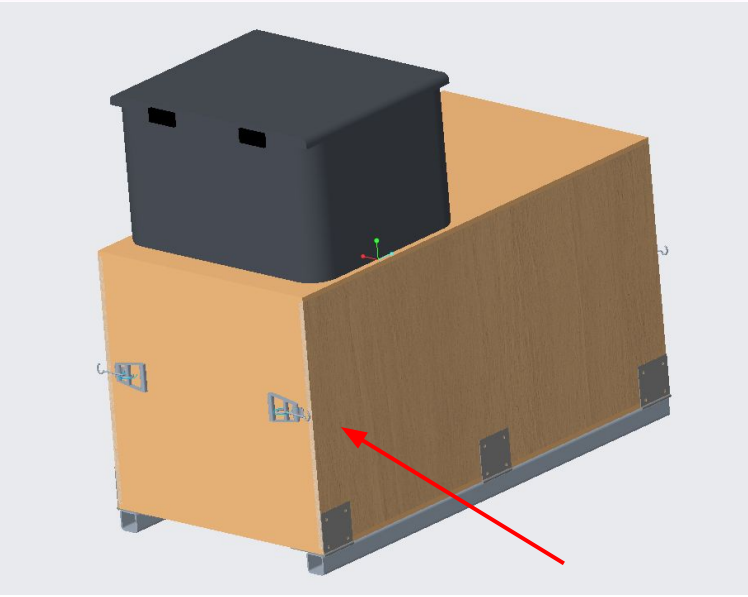
# Design Constraints

- Budget: $1000
- Time Frame: Finished design by April 2020
- Size: Form to the 6’ X 4’ frame
- Weight: Supports a min of 1200 lbs
- Time: Keeps milk from spoiling over a 1.5 hr minimum timespan
- Usability: Easily accessible milk cans




https://www.inloox.com/company/blog/articles/a-guide-to-dependencies-constraints-and-assumption
s-part-2-managing-constraints/

# Design Selection/ Alternatives



Evaporative Cooling

- Pros: Best in low humidity environments
- Cons: Needs low humidity to operate effectively

Liquid nitrogen cooling

- Pros: Cheap solution
- Cons: LN2 not readily available

Cold Plate Technology

- Pros:Higher power input required
- Cons: Limited power allotment from the vehicle battery

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# Final Design

| Names of Members | Date | Work Done | Hours |
|---|---|---|---|
| Sean and Emmitt | 2/12 | Mark cuts on all 3 3/4 plywood sheets 1 1/2 plywood sheet | 1.5 Hours |
| Sean and Emmitt | 2/18 | Finish cut lines on 1/2 in sheets. cut reinforcement 1"x2" for doors | 1.5 Hours |
| Sean, Emmitt, Josh | 2/19 | all plywood cut and one door support structure assembled | 1.5 Hours |
| Sean and Emmitt | 2/23 | Completed 2 full door assemblies with insulation | 3 Hours |
| Sean and Emmitt | 2/25 | All doors assembled and insulated | 3 hours and 45 minutes |
| Sean and Emmitt | 2/29 | Floor frame,floor cut, subfloor cut and attached, Ceiling supports, | 4 Hours |
| Sean and Emmitt | 3/5 | Floor insulated and assembled, Ceiling assembled, Doors modified | 3 Hours |




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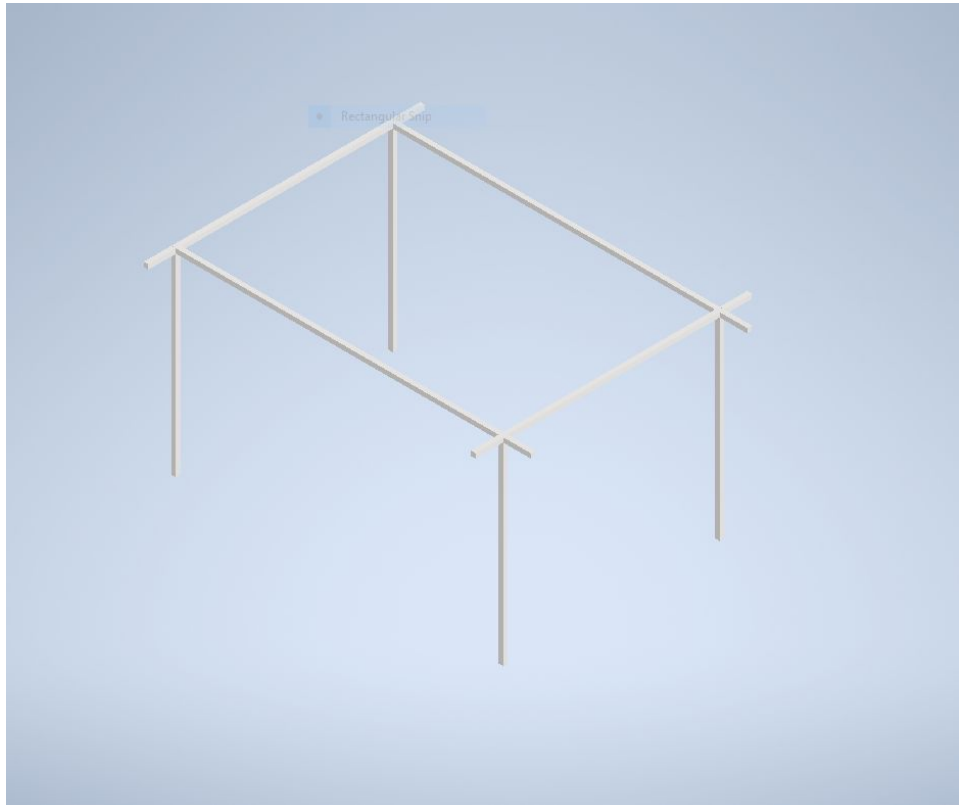
# Final Design

## Sun Shield

- Metal Frame Above Box
  - Tarp/ sunshield attached
- Heat radiation blocked
- Possibility for hanging tools



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# Final Design

## Cooling

- Provided small chest freezer
- Freezer packs (7.5inx5.75inx1.5in, 32 oz)
- Place packs inside the cans before each collection
- Pour Milk over the packs to decrease temperature
- Cold mass is naturally agitated over the route
- Packs are cleaned alongside milk cans to standard

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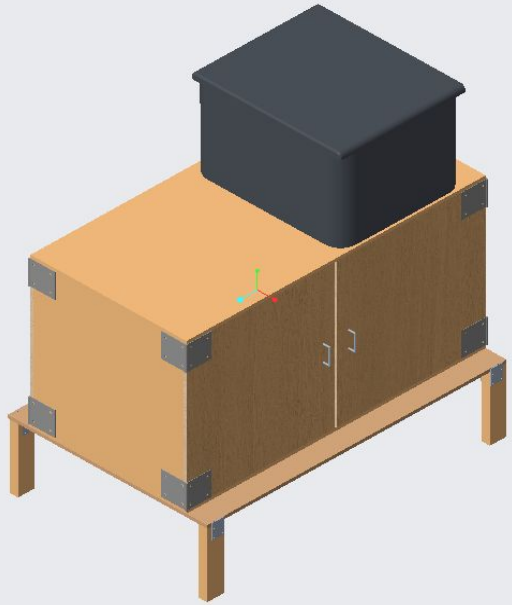
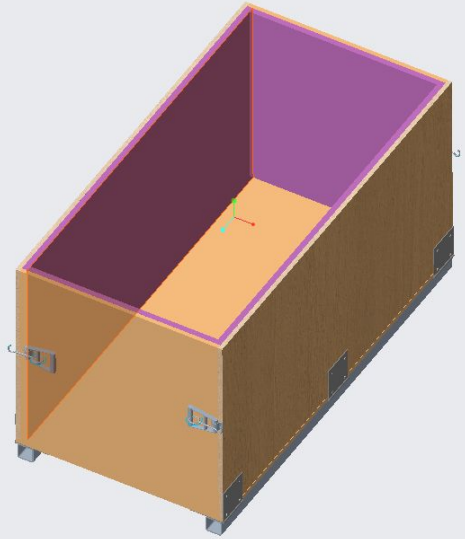
# Final Design

- All models in CREO
  - FEA Analysis, Assemblies
- 6’ X 3’x3’ Frame with insulation lining all w
  - Floor of bed blown-in insulation
  - Walls PS-Hard Foam
- Exterior Waterproof Storage
  - Capacity for tools or miscellaneous
- Horizontal Opening Side Doors
  - Ease of load and unload
- Floor plan to match the existing BUV
  - For easy installation





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# Verification and Test Plan

- Test one
  - $T_0$=75°F, $T_I$=65°F
  - Measure temperature change after 1.5h
- Test two
  - $T_0$=85°F, $T_I$=65°F
  - Measure temp change after 1.5h
- Test three
  - $T_0$=95°F, $T_I$=65°F
  - Measure temp change after 1.5h

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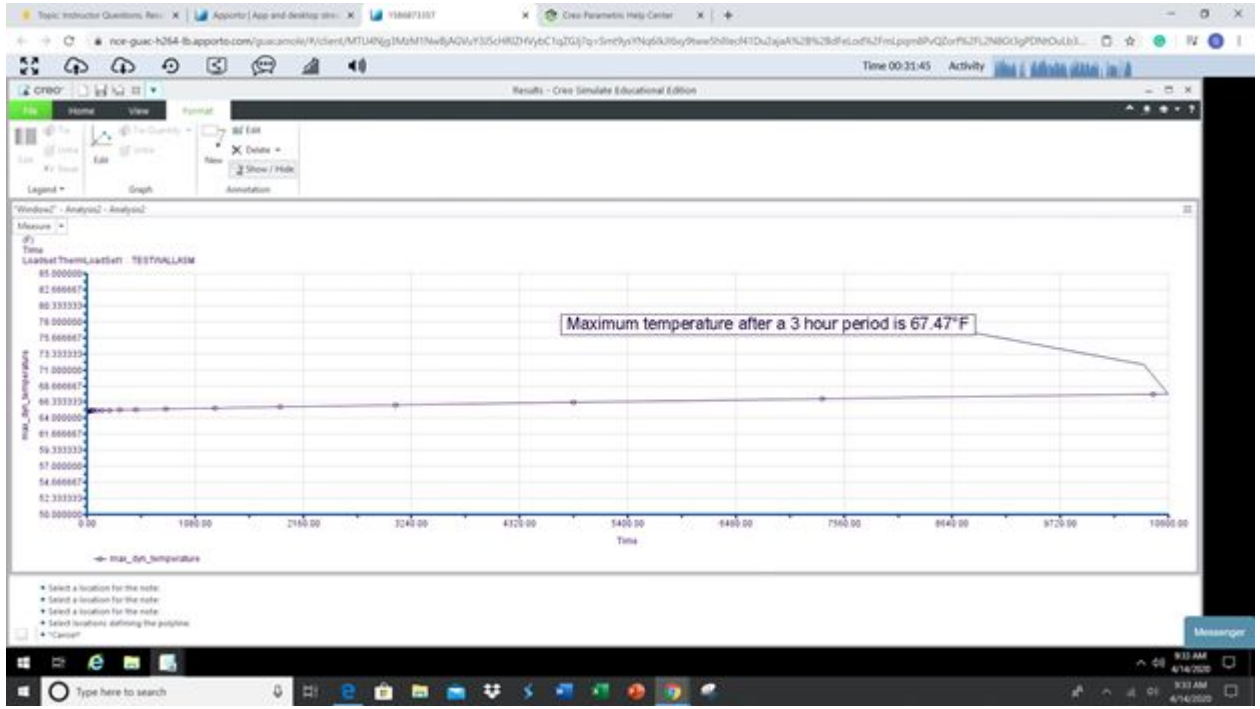
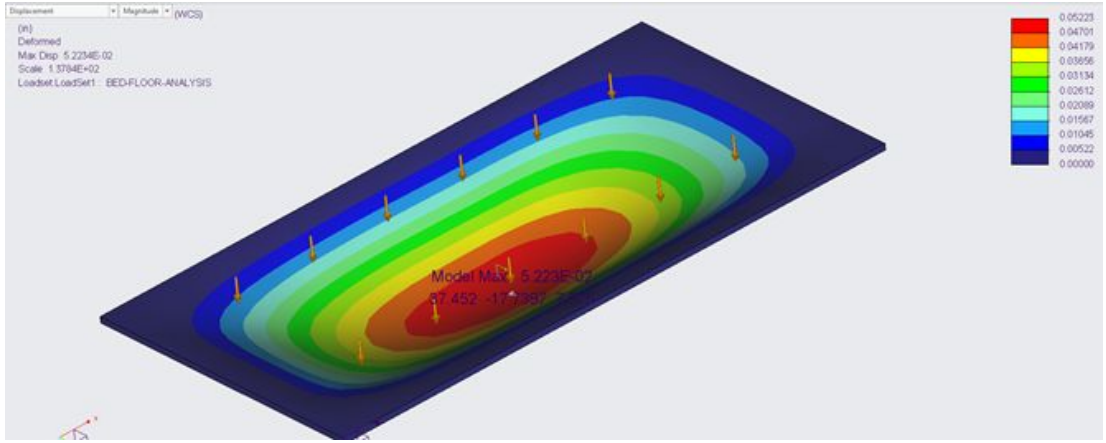
# Verification and Test Results

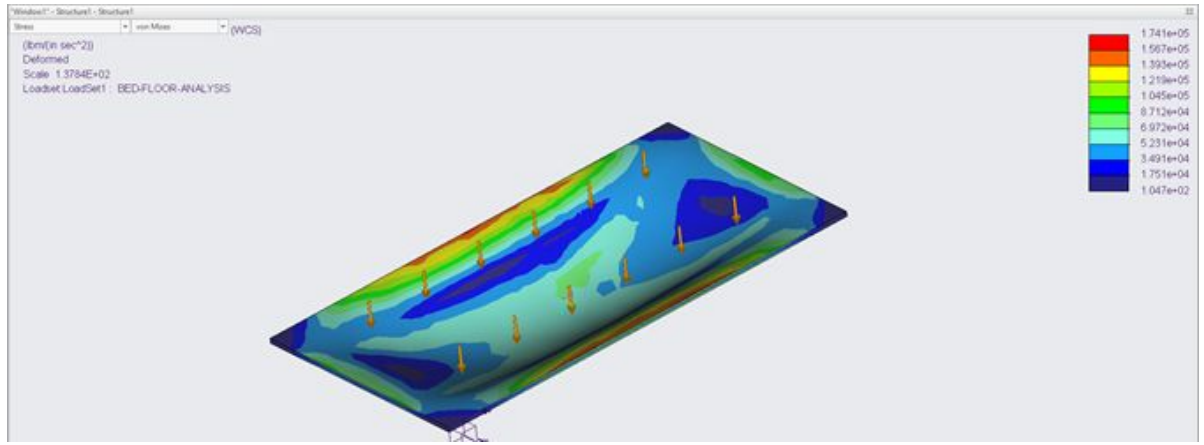
- Transient heat transfer analysis
  - Neglecting Radiation
- Interior Temperature
  - 65°F
- Exterior Temperature
  - 95°F
- 3 Hour Period ΔT of 2.4°F



# Verification and Test Plan cont.

- FEA analysis of box floor
  - Tested with 110lbs
  - Distributed in 5 spots over 6’
  - Max Displacement 5.223E-2”



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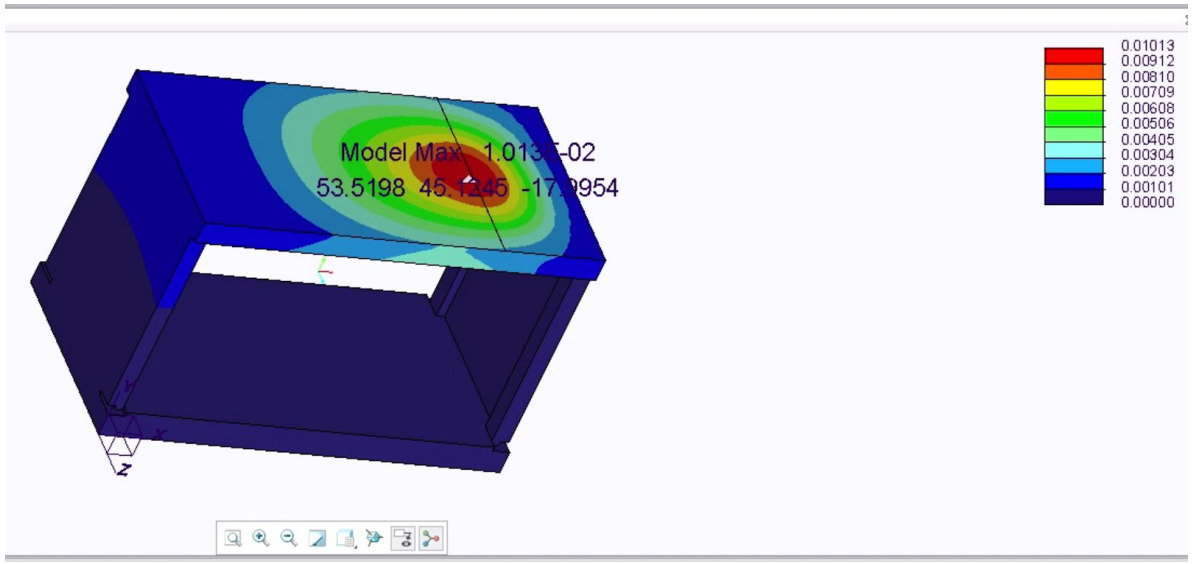
# Fea Analysis of Bed and Ceiling

- Cargo Storage on Top of Bed
- Tested with 150lbs
  - Distributed over 4.5’²
- Maximum Displacement
  - 1.013E-2”



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# Discussion

- What we left unfinished
  - Attaching the doors and sidewalls
  - Building the sunshield
  - Painting the bed
  - Attaching the final floor
- Things we would've done differently
  - Finished the actual project
  - Better teamwork
  - More Testing and Validation
- Suggestions for future groups
  - Attach the walls first then the doors then paint everything
  - Build the sunshield sturdy
  - Have fun, building is always fun

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# Conclusion

- Professional Development
  - Communication and Presentation Skills
  - Dealing with issues inside of a group
  - Adjusting expectations and design plans based on need and budget
  - Flexibility in design requirements
  - Have fun

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# Q+A

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