PURDUE UNIVERSITY

Agricultural and Biological Engineering

CAPSTONE/SENIOR DESIGN EXPERIENCE 2020

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SB-1 ABE Hydraulic Equipment Demonstrations Unit

Problem and Objective:

The Agricultural and Biological Engineering department needs a hydraulic demonstrator particularly on using parts previously acquired to explain to future students how the front end of a front wheel assist type tractor functions.

Design Considerations:

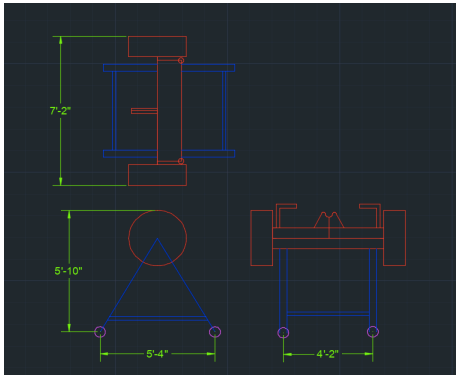
Size: Must be able to fit through a 60-inch set of double doors in the new ABE building.

Weight: The unit should be able to be picked up by a fork truck and moved around a shop by a single person.

Safety: We want the unit to be as safe as possible. Even novice users should feel comfortable operating.

Ease of use: This product should be easy to use and operate.

Alternative solution:

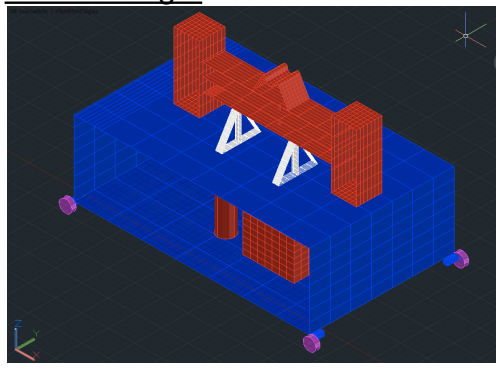


Drawbacks:

- Minimal structural integrity
- Easily tipped over
- Minimal hydraulic component space

Refined Solution:

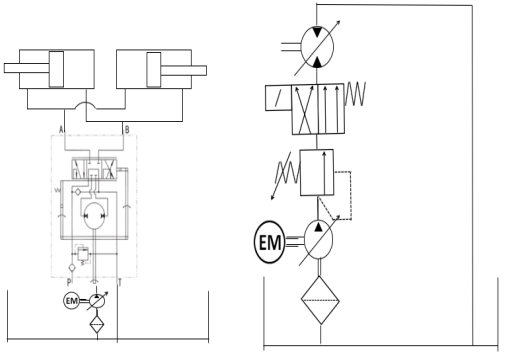
Stand Design:



Benefits:

- Stronger structure
- Lower CoM. Less likely to tip over.
- Lower profile which allows users to observe the unit easier.

Hydraulic Schematics:



Benefits:

- Plenty of hydraulic space
- Structurally sound design
- Tradeoff of cost for tip-safety

Use of Previous Materials:

We were asked to use materials from past projects to create our demonstration unit. Here is a list of those materials:

- Case IH Puma front end
- Retired Parker demonstrators
- Steering components off past quarter scale projects.

Center of Mass:

CoM Height= $\sum w_i \cdot h_i / \sum w_i$

=(233 lbs ·17.5 in)+(1,298 lbs ·44in)/1,531 lbs

= 40 in

Force Required to Tip Unit

Force = $2 \cdot h \cdot w_T / b$

=(2· 40 in· 1,531 lbs)/ 68 in

= 1,801 lbs

Budget

Component:	Cost Per Unit:	Total Amount of Unit	Total Cost
Steel, Tubing, 3/16"	$167.04	$66.66	$556.80
Steel Plate	"	$5.00	$25.00
Misc Steel	"	"	$50.00
Casters	$26.09	$4.00	$104.36
Hydraulic Fittings	"	"	$30.00
Threaded Rod	$3.00	$2.00	$6.00
Plexiglass	$57.00	$2.00	$114.00
		Total Cost	$886.16

Impact:

As a team, we strived to deliver a product that was durable, educational, and safe for the end users. We worked to develop a demonstrations unit that ABE would be proud to display in their new facility. We expect this demonstrations unit to educate many generations of Purdue students to come.

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