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:

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.

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

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

Use of Previous Materials:

Budget

<table>
<thead>
<tr>
<th>Component</th>
<th>Cost Per Unit</th>
<th>Total Amount of Unit</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel, Tubing, 3/16&quot;</td>
<td>$167.04</td>
<td>$56.66</td>
<td>$56.80</td>
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<tr>
<td>Steel Plates</td>
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<td>$25.00</td>
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<td>Misc, Steel</td>
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<td>Casters</td>
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<tr>
<td>Hydraulic Fittings</td>
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<tr>
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<tr>
<td>Pneumatics</td>
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<tr>
<td>Total Cost</td>
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<td>$209.80</td>
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</tbody>
</table>

Center of Mass:
CoM Height = \( \sum w_i \cdot h_i / \sum w_i \)
\( = (233 \text{ lbs} \cdot 17.5 \text{ in}) + (1,298 \text{ lbs} \cdot 44 \text{ in}) / 1,531 \text{ lbs} = 40 \text{ in} \)

Force Required to Tip Unit
Force = \( 2 \cdot h \cdot w_r / b \)
\( = (2 \cdot 40 \text{ in} \cdot 1,531 \text{ lbs}) / 68 \text{ in} = 1,801 \text{ lbs} \)

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.