The Alabama Cooperative Extension System (ACES) has requested assistance designing a mechanical device that reduces the labor required during energy auditing of poultry house attics in the state of Alabama. Currently, a significant portion of the time for a poultry farm audit is spent in the attics of poultry houses. During the inspection, the structural integrity and energy efficiency of the attic is assessed. The dangerous audit procedure is currently done with considerable difficulty due to minimal footing on attic floor and cramped space between the truss web members.

**Objective and Constraints**

The objective of the project was to design a mechanical device that will facilitate the transportation of an energy audit inspector along the “ratboard” across five foot spacing trusses of a 500 foot long poultry house attic. The manually powered, portable conveyance device should improve the efficiency and performance of the inspection by reducing fatigue and safety concerns thereby enhancing the quality of the audit. The device should be less than 50 pounds of total weight, be less than $1000 before fabrication, be adjustable for the variation in attic construction, be able to move and support a 225 pound load, and be able to fit through the 3 by 3 foot attic entrance hole.

**Problem Statement**

The Pedal Drive Inspection System (PDIS) design will improve auditing procedures by allowing the inspector to perform a more thorough attic inspection while reducing fatigue and risk factors compared to the current energy audit procedure. The device should be less than 50 pounds, will not exceed the budget by more than 10%, and be able to fit through the attic entrance hole.

**Design Drawings**

![Back View](Image)

![Side View](Image)

![3D Rendering](Image)

**Cost and Weight Analysis**

<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
<th>Total Weight (lbs.)</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum Square Tubing</td>
<td>1</td>
<td>1.76</td>
<td>23.00</td>
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<tr>
<td>Aluminum Wheel House</td>
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<td>Aluminum Seat Frame</td>
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<tr>
<td>Aluminum Ski</td>
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<td>5.29</td>
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<tr>
<td>Steel Ski Rod and Locking Collar</td>
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<tr>
<td>Lock Hinge</td>
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<tr>
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<td>Pedals and Crank Arm Set</td>
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<td>Polyamide Flange Wheel</td>
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<tr>
<td>Nuts/Bolts</td>
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</table>

Fabrication Cost (Excluding Equipment): $2342.00

Approximate Material Totals:

- Cost: $719.00
- Total Cost: $3,061.00

*All prices are rounded to the nearest dollar. Price does not include shipping, handling, or sales tax.

**Conclusion**

- The PDIS design will improve auditing procedures by allowing the inspector to perform a more thorough attic inspection while reducing fatigue and risk factors compared to the current energy audit process for poultry house attics.
- The device has met goal weight by weighing under 50 pounds.
- The device is under budget by costing less than $1000 for materials and components.

**Acknowledgments**

Special Thanks To:

- Dr. Tim McDonald and Dr. Jesse Campbell
- Alabama Cooperative Extension Service (ACES)
- Auburn University Biosystems Engineering
- National Poultry Technology Center at Auburn University

**Safety and Engineering Analysis**

The following components were implemented in the design to ensure safety during the inspection:

- Adjustable rod and ski for stability and center of gravity.
- Flanged-wheels with springs to keep on the “ratboard.”
- Locking mechanisms on all adjustable components.
- Non-slip steel grip for ski rod.

The engineering analysis needed to prove the device will function as designed has been conducted, and the results confirm that the pedal power and gear ratio are adequate. The actual stresses applied to the truss members by the combined load are less than the allowable stresses, and the friction force between the skis/wheels and the truss members will not overcome the momentum force of the pedaling.

**Figure 1. Pedal Drive Inspection System (PDIS) 2D Side View Design Drawing (Not to Scale).**

- Steel Grip
- Drive Flange Wheel
- Wheel House
- 2x4 “Ratboard”
- Hinge
- Locking Hinge

**Figure 2. Pedal Drive Inspection System (PDIS) 3D Rendering Shown in Multiple Views (Not to Scale).**

- Typical 500 ft. poultry house with roof and some trusses removed for clarity.

**Figure 3. Pedal Drive Inspection System (PDIS) 2D End View Design Drawing (Not to Scale).**

- Steel Grip
- Locking Collar
- Drive Shaft
- Flanged Wheel

**Figure 4. Pedal Drive Inspection System (PDIS) 3D Drawing With Attic Truss System (Not to Scale).**

- Drive Support Tubing
- Truss King Post
- Truss Web Member
- Spring
- Drive Flange Wheel
- Wheel House
- Idle Flange Wheel w/ Spring
- Handle
- Adjustable Tubing
- Pedals and Crank

**Figure 5. Pedal Drive Inspection System (PDIS) Design Drawings Shown in Multiple Views.**

- Back View
- Side View
- 3D Rendering
- Top Right Isometric View
- Front Right Oblique View
- Back Left Oblique View