Hood Latching Mechanism Improvement

**Introduction**
- Problem Statement
  - Identify a system that automates the open/close motion with the push of a button for the Case IH Magnum series tractors.

**Background**
- New tractor designs are creating limitations of the current gas strut opening/closing system, in order to eliminate limitations a new design idea is required and an automated solution will be implemented.

**Design Criteria**
- Target open/close time should be 10 to 20 seconds
- Must operate on a 12 volt circuit
- Support a hood weight of 1295N

**Constraints**
- Must fit in currently available space
- Must maintain minimum opening angle of 25°
- Must withstand high ambient temperatures
- Support a hood weight of 1295N

**Alternate Solutions**
- High Torque Rotary Motor
  - Advantage: Compact
  - Disadvantage: Intricate opening mechanism
- Hydraulic Cylinder
  - Advantage: Very robust and strong
  - Disadvantage: Additional hydraulic capabilities needed
- Air Cylinder
  - Advantage: Simplicity of system
  - Disadvantage: Additional air compressor system required
- Linear Actuator
  - Advantage: Simplicity and ease of compatibility
  - Disadvantage: Product Capability

**Design #1**
- Gas Strut Replacement
  - Force Calculations with Excel Tool
  - Actuator Sizing
  - Insufficient force capabilities

**Design #2**
- Single Actuator in Available Space
  - Modeling of space available for actuator
  - Available mounting bracket is available in the space allotted for the design
  - There is insufficient space for actuator with the required stroke length

**Social Impacts & Sustainability**
- Benefits
  - Customer has access to a solution that requires little aptitude
  - Operator ease
  - Adaptability to other models
- Disadvantages
  - More costly design
  - Mechanical solution for in case of design failure
  - Ease of engine repair

**Failure Mode Effect Analysis (FMEA)**
- Possible Points of Failure
  - Actuator processor failure
  - Damaged Wire
  - Bracket failure (bending or breaking)

**Project Outcomes & Expectations**
- Completed
  - Multiple design trial and error
  - Actuator exploration and knowledge
  - Tool for calculating forces
  - Identification of vast limitations
- Future
  - Examine linear actuator relocation
  - After radiator
  - Closer to hinge point
  - Special mechanisms to compensate for stroke length

**Design Calculations**

<table>
<thead>
<tr>
<th>Component</th>
<th>Force (N)</th>
<th>Y Component (mm)</th>
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</thead>
<tbody>
<tr>
<td>Force Required</td>
<td>2478.4</td>
<td></td>
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<tr>
<td>Force Applied</td>
<td>1483.1</td>
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<tr>
<td>Moment Balance</td>
<td>1295</td>
<td></td>
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<tr>
<td>Actuator Sizing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Force Triangle</td>
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**Conclusion**
- A new design idea is required to eliminate limitations created by new tractor designs.
- A new automated solution will be implemented to meet customer needs.

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