

Hood Latching Mechanism Improvement

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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 10 to 20 seconds
- Must operate on a 12 volt circuit
- Should meet IP68 rating
- Operating temperatures from -40°C to 125°C
- 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
- Must maintain user safety

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

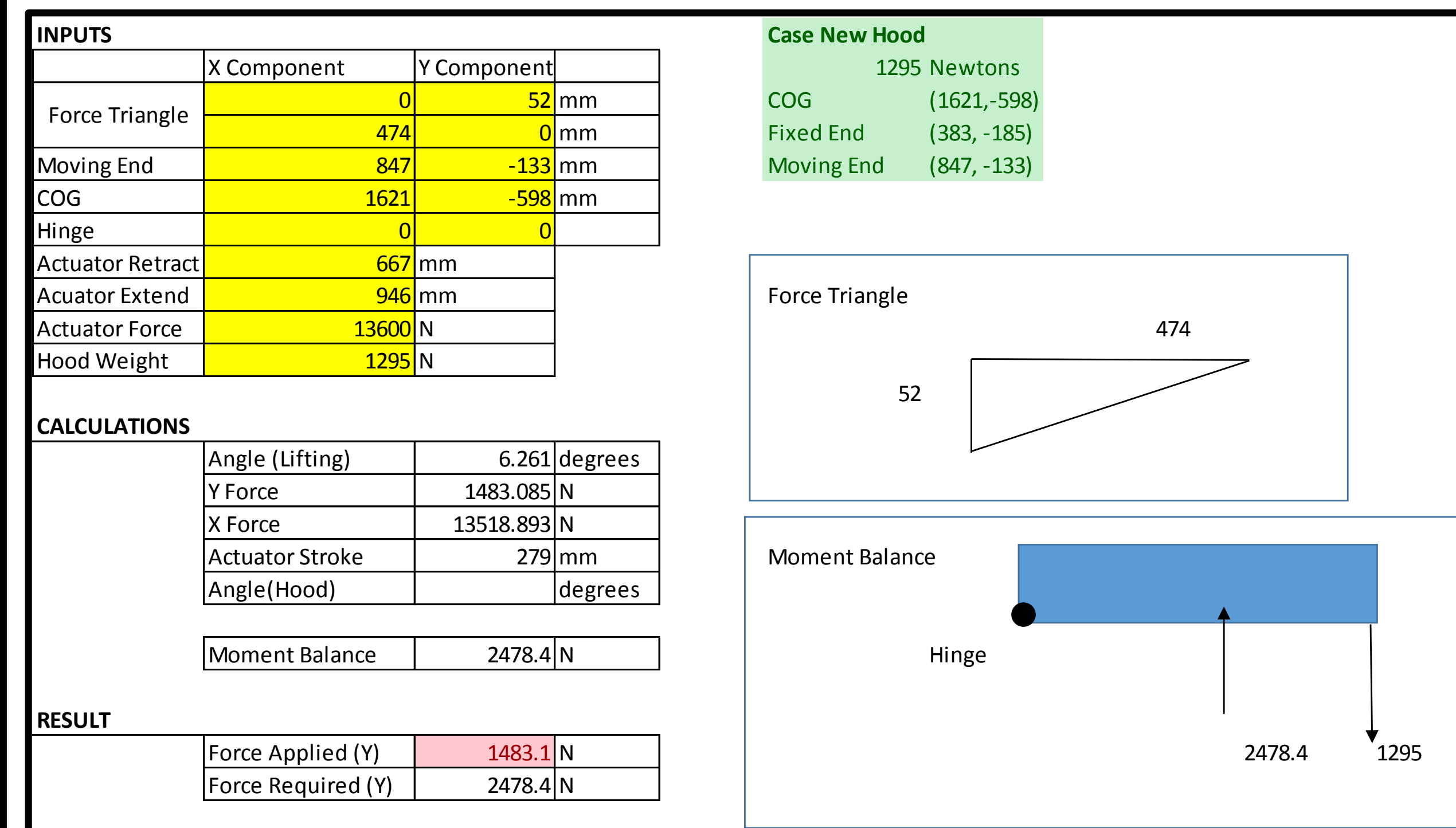
Linear Actuator

- Advantage: Simplicity and ease of compatibility
- Disadvantage: Product Capability

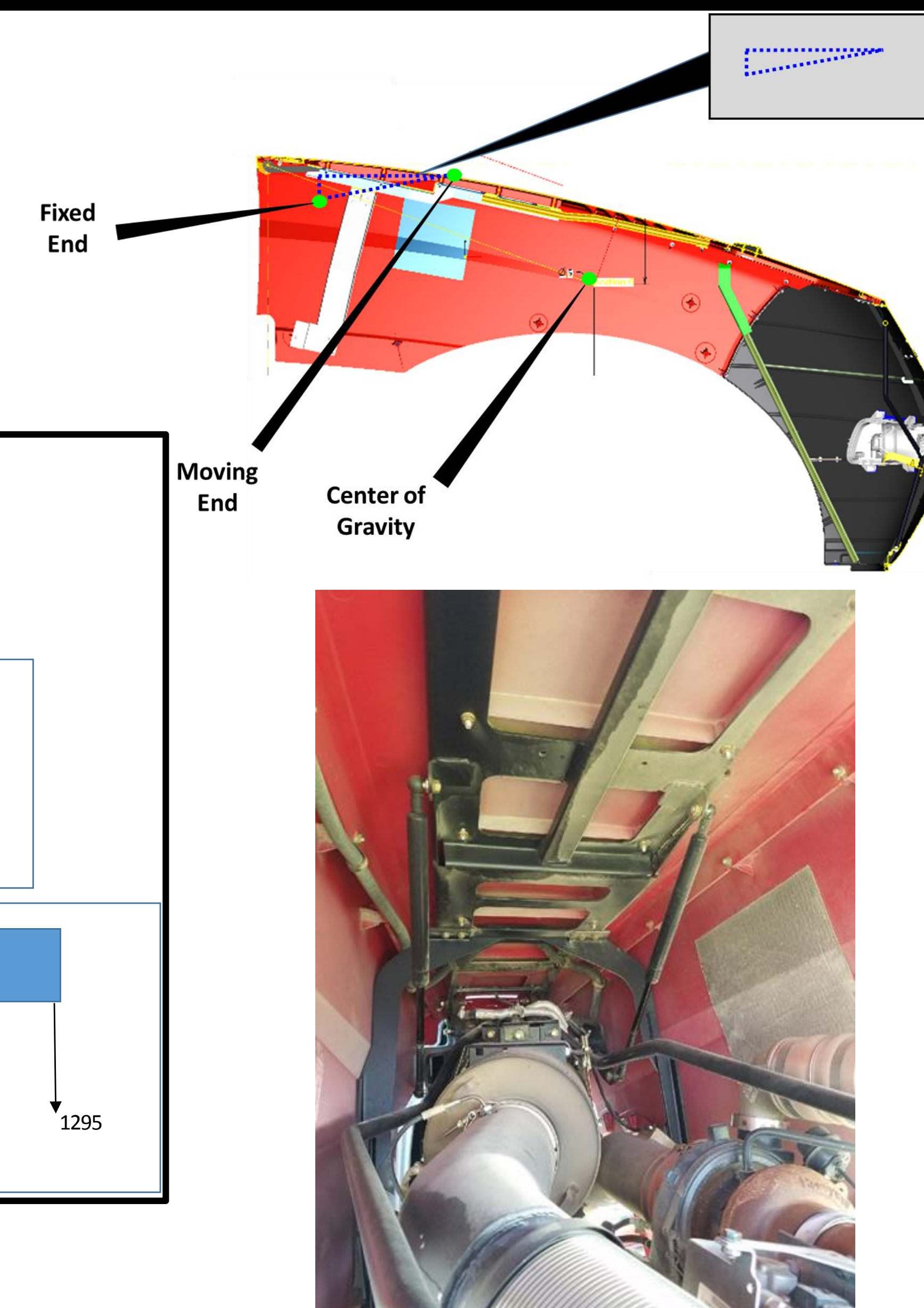
Design #1

Gas Strut Replacement

- Force Calculations with Excel Tool
- Actuator Sizing
- Insufficient force capabilities



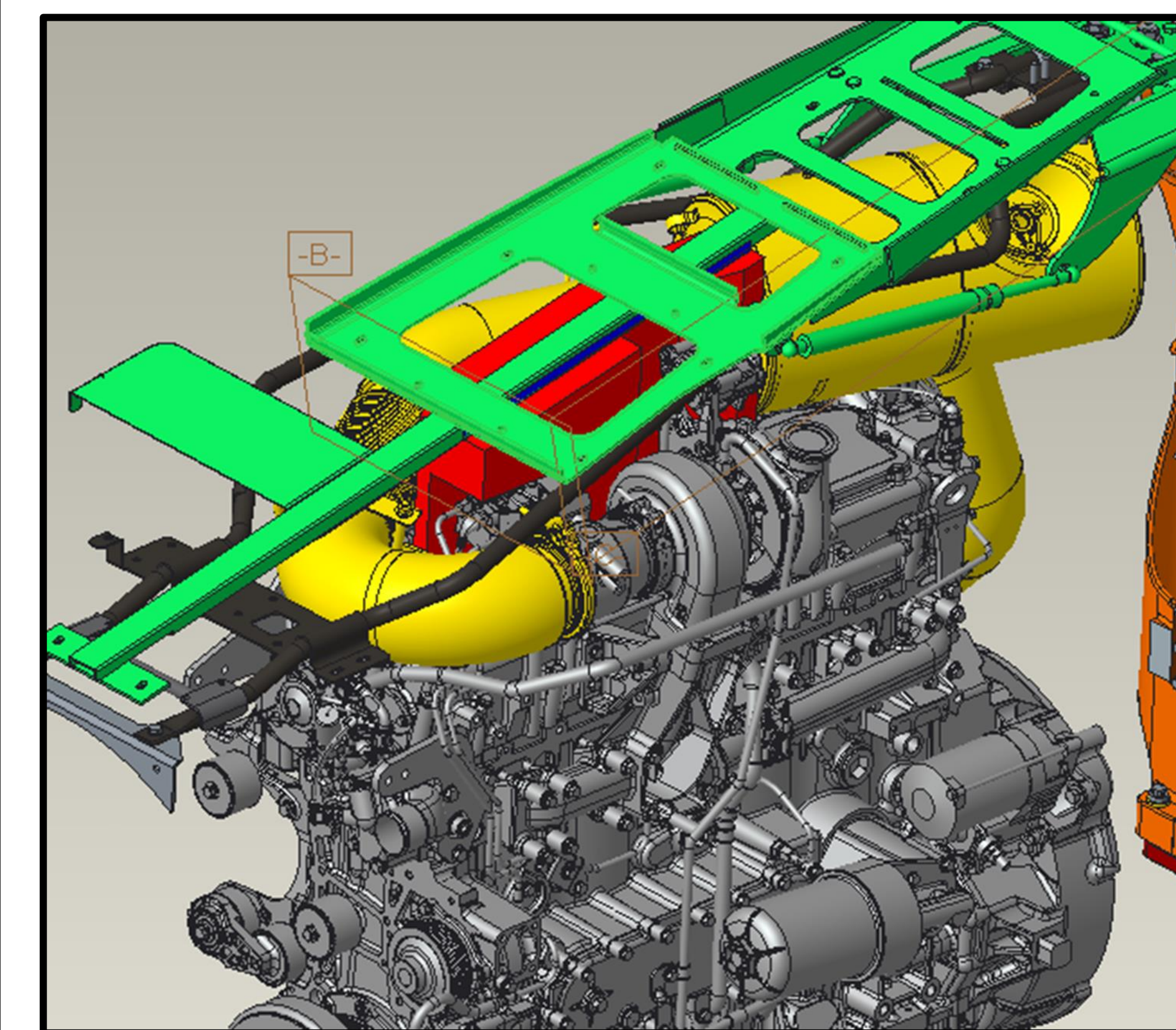
Linear Actuator (\$150 X 2) = \$300



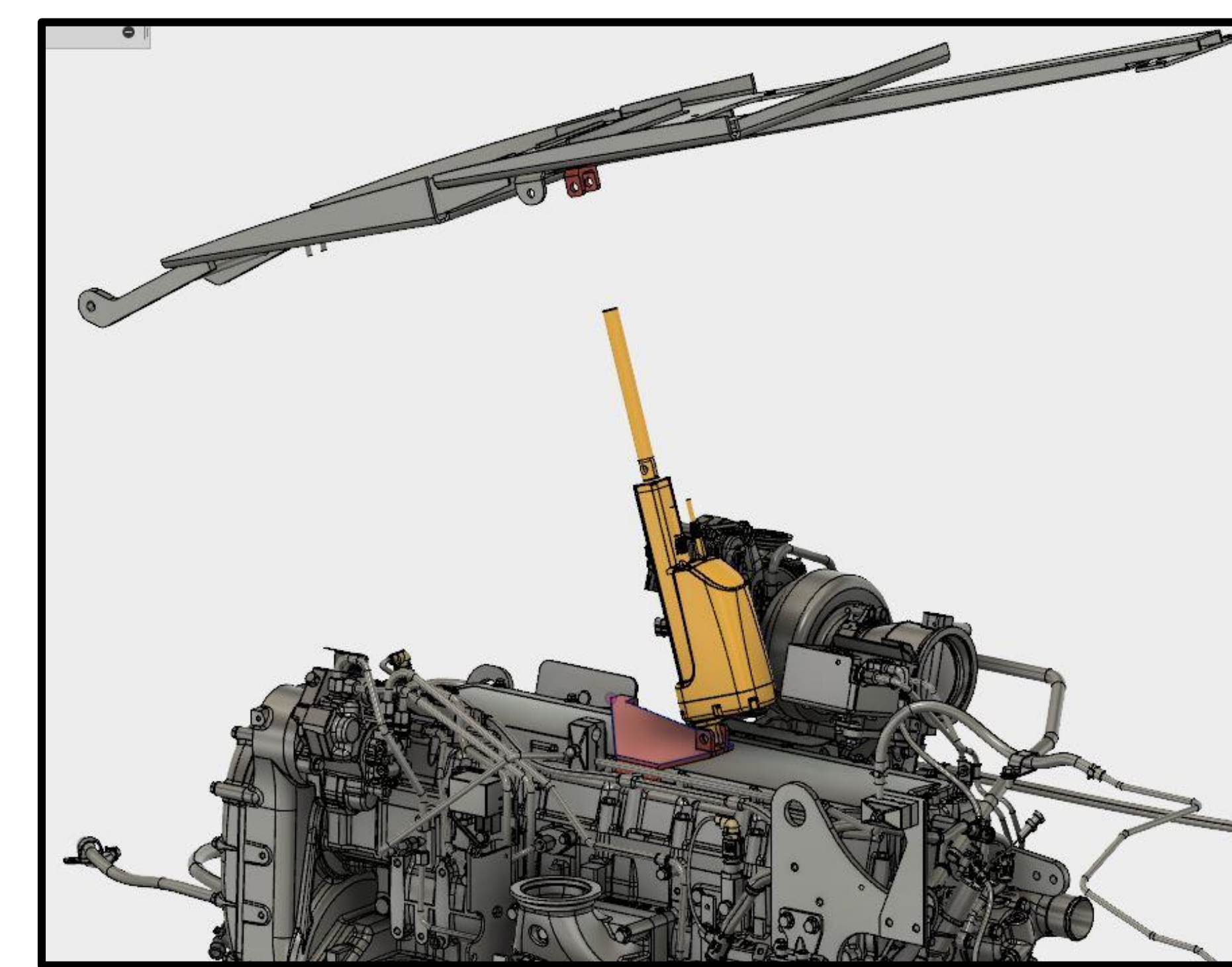
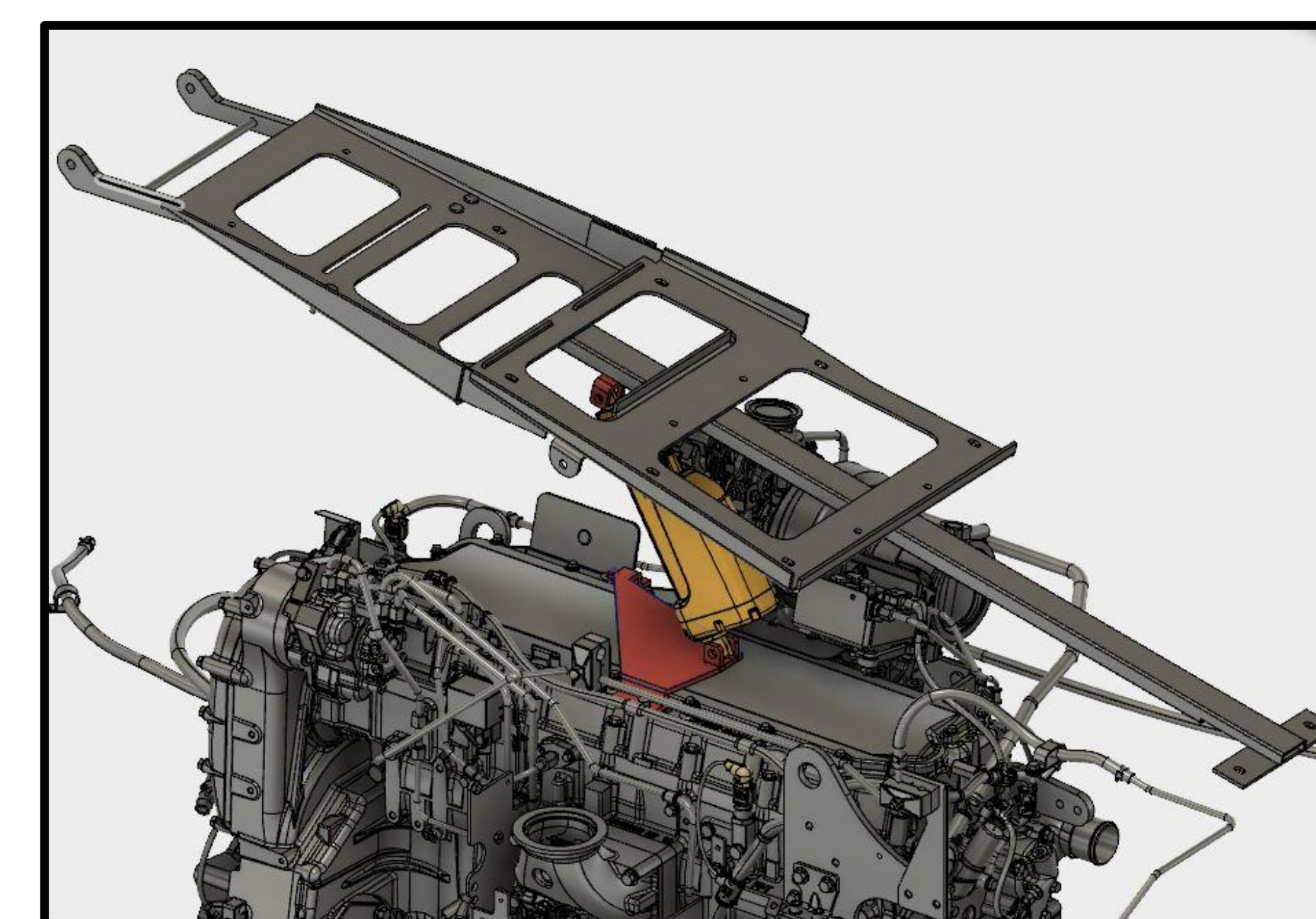
Design #2

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



Linear Actuator (\$150) + Steel (\$21/sq. ft) = \$171



Social Impacts & Sustainability

Benefits

- Customer has access to a solution that requires little aptitude
- Operator ease
- Adaptability to other models
- Allows company to align with automated ease of 21st century
- Mitigate design degradation

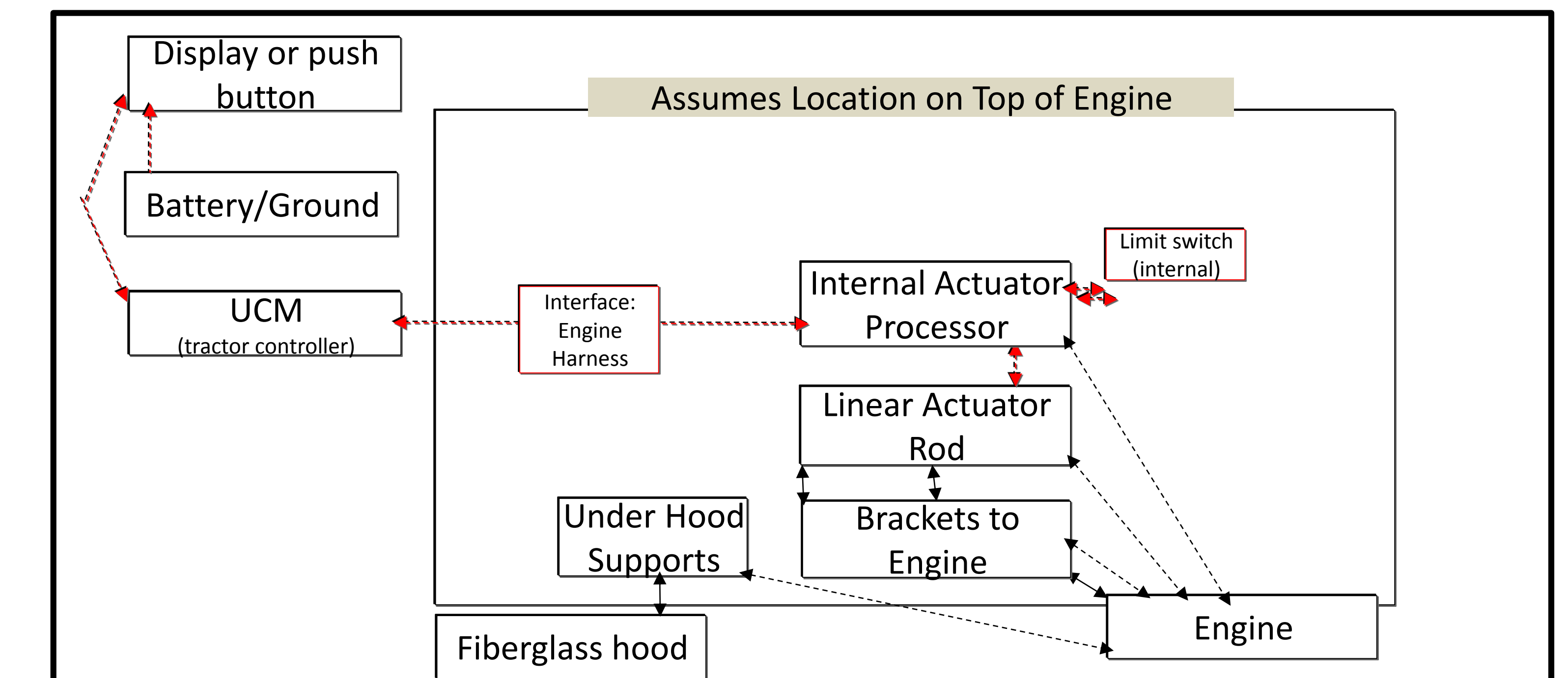
Disadvantages

- 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)
- Limit switch failure
- Incorrect command transfer



Project Outcomes & Expectations



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

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