



Battery Pack Mechanical Mounting and Thermal Interface | PACCAR Inc.

Marcus Drienyovszky¹, Cardin Chau¹, Jorge Pleitez¹, Jane Poluianova¹, Dave Stowers¹, Mohammad Malakooti¹, Steve Ciatti², Greg Bonsen²

¹University of Washington Department of Mechanical Engineering ²PACCAR Inc



Problem & Solution

The UW E-Truck team is converting a PACCAR medium-duty Class 7 truck into an electric truck. This capstone project focuses on supporting the battery system through both structural mount design and thermal management. The mount was designed, validated, and optimized using FEA with PACCAR dynamic inputs, while the cooling system analysis sized the pump required to remove battery heat through the cold plate loop.

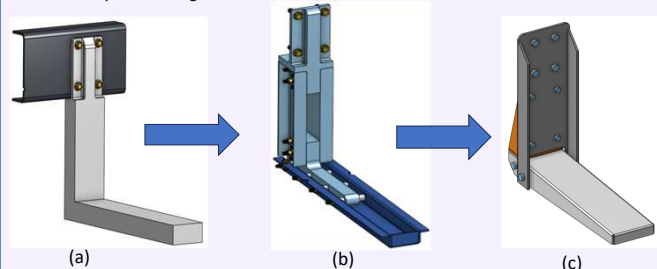


Fig. 1 Team considered various designs for the mechanical mount, starting with a simplified "brick" design (a), this was refined into a multi-part arm assembly (b), then team experimented with minimalist arm design (c). Design (b) had best initial FEA screening and was chosen for refinement

Finalized Mount Design

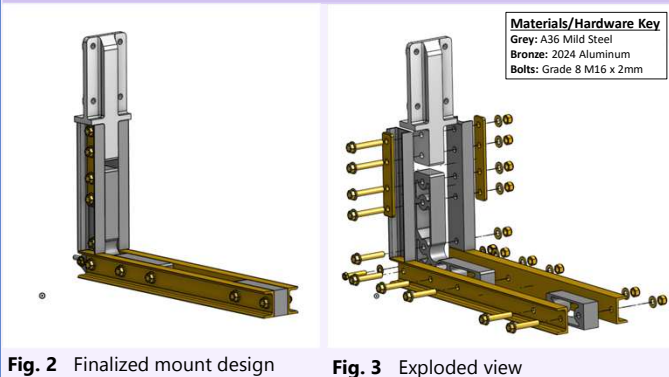


Fig. 2 Finalized mount design

Fig. 3 Exploded view

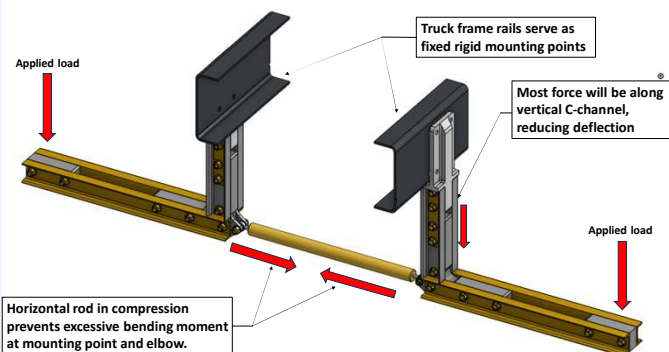


Fig. 4 Frame rail and arm assembly with horizontal connecting rod

Finite Element Analysis

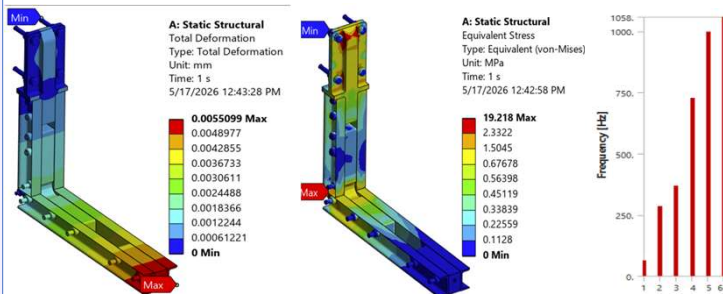


Fig. 5 Simulation of total deformation under the load of the battery. (A). Simulation of equivalent stress caused by the load of the battery. (B). Modal analysis showing natural frequencies and mode shapes. (C)

Topology

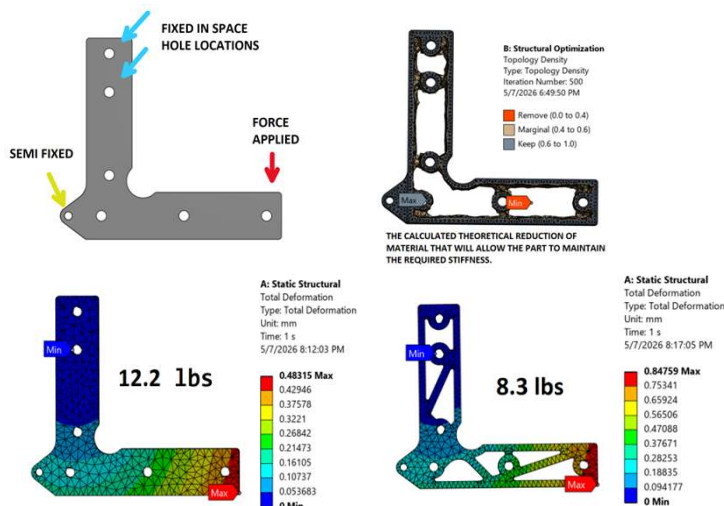


Fig. 6 Topology. Minimizing the weight of the mount while retaining structural integrity.

Results Summary

Tested Spec.	Target	Result	Passed?
F.O.S. (Yield Stress)	2	2.5	Yes
Material Cost (per arm)	\$1,500	\$1,354	Yes
Manufacturing Cost (per arm)	\$750	\$550	Yes
Topology Weight Reduction	25%	32%	Yes
Arm Weight (lb)	75	59	Yes

Thermal Interface Calculations

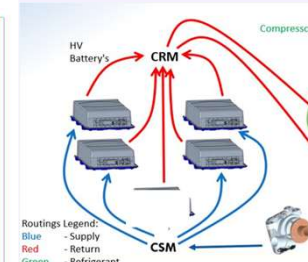


Fig. 7 Cooling Loop Schematic



Fig. 8 Coolant Pump

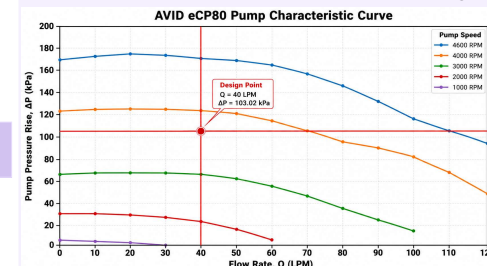


Fig. 9 Pump Characteristic Curve

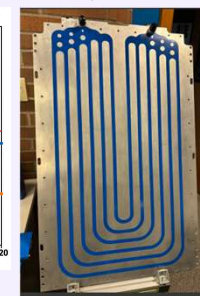


Fig. 10 Battery Cold Plate

Target:

- Remove 14 kW of heat from each battery (4 total).
- Find total system pressure loss from friction and bends

Results:

- Total pressure loss ~103 kPa
- Required pump must flow 40LPM and 10.5 m of head

Future Work/Truck Integration



Fig. 11 Future work: integration with the truck and mounting strategy

Acknowledgements

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