Electrification of Light Commercial Vehicles

Objective:

- Design an electric drivetrain for a light commercial vehicle by replacing the internal combustion (IC) engine with an electric motor while maintaining equivalent performance, achieving minimum retrofit cost.

Approach:

- Selected Tata ACE for retrofitting due to its widespread use in the LCV segment.
- Analyze drive configurations using fixed gear ratios and the existing 4-speed manual gearbox, coupled with an axial flux DC motor. Calculate torque requirements for fully loaded cargo with 14.5° gradeability.
- Reverse-engineer gearbox to map bolting/locating hole coordinates to replicate them in the motor–coupling assembly to ensure shaft concentricity.

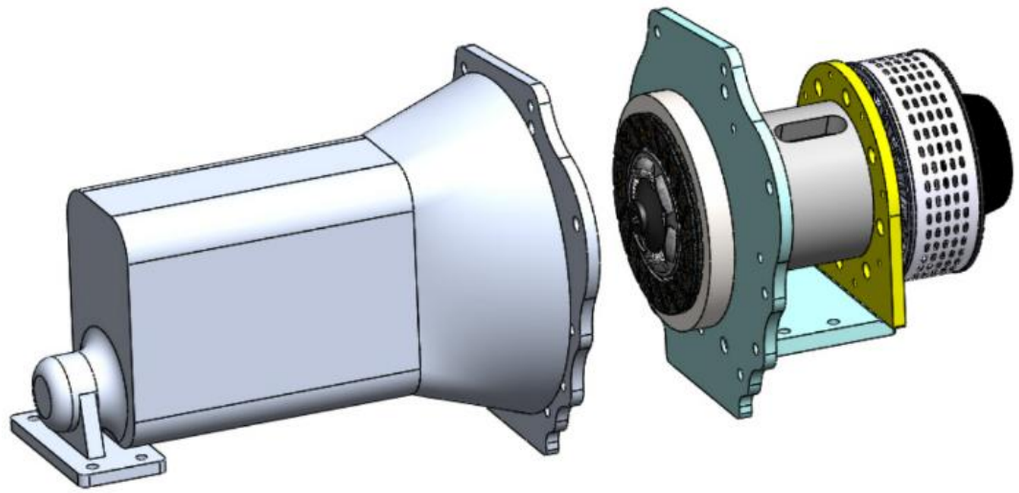
Solution:

- Engineered an electric drivetrain by replacing the IC engine with an axial flux DC motor; validated manual gearbox reuse, achieving target performance with 40% lower motor power and 12% lower retrofit cost.
- Reverse-engineered gearbox to map bolting/locating hole coordinates, and replicate them in motor–coupling assembly, ensuring precise shaft concentricity.
- Designed the motor–gearbox assembly with a flexible coupling to protect the motor during prototype testing.
- Developed mounting points to reuse the existing bracket with minimal chassis modifications, simplifying integration.
- Maintained the post-gearbox drivetrain unchanged, preserving compatibility with the OEM spare supply chain.

My Role:

- Conceptualized and developed CAD, Drawings, GD&T for precise manufacturing.
- Performed Reverse engineering of location points on the gearbox casting.
- Applied Design for Manufacturing & Assembly (DFMA) principles to streamline manufacturing and assembly.
- Assembly and Testing of prototype.

- **CAD Model of Drivetrain:**



- **Electrical drivetrain after manufacturing:**