Long-Range Battery Electric Vehicle with Megawatt Wireless Charging

Project ID: elt262

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Kenworth Truck Company

DOE Vehicle Technologies Program
2020 Annual Merit Review

Overview

Budget

- Total Project Funding: $8M
- DOE share: $5M
- Partner Cost Share: $3M

Timeline

- Start Date: 1 Oct 2019
- End Date: 12 Dec 2022
- 13% Complete

Problem Statement

Barriers to broad acceptance of battery-electric power for heavy trucks:

- Range
  - Typical today is 100 miles
- Re-Charge Time
  - Typical today is 2-10 hours

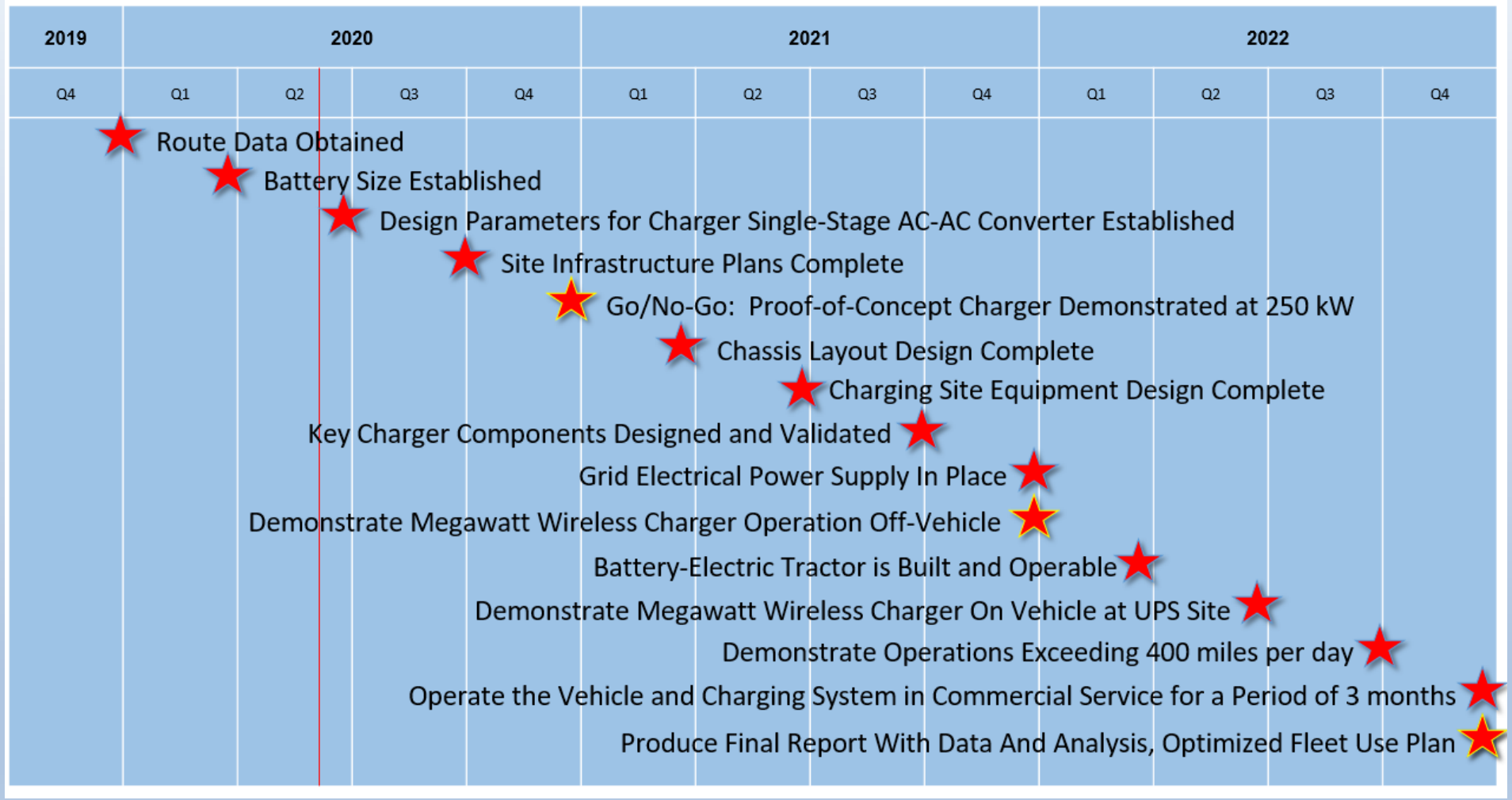
This project will research, develop and demonstrate a Class 8 tractor capable of two-shift operation, exceeding 400 miles per day. The tractor will have range of at least 170 miles and will be recharged in 30 minutes.

Project Partners

A strong and diverse team has been assembled:

- **Kenworth Truck Company** – Heavy Truck OEM
- **UPS** – Global Transportation & Logistics Fleet
- **Utah State University** – Academic Institution with Extensive Wireless Charging Expertise
- **WAVE** – Technology Startup Producing & Deploying Wireless Chargers For Heavy Vehicles
- **Seattle City Light** – Local Government-Owned Utility
- **Portland General Electric** – Local Public Utility
- **eIQ Mobility** – Technology Startup Working To Simplify Fleet Electrification

Project Timeline and Milestones



Progress

Route Analysis:

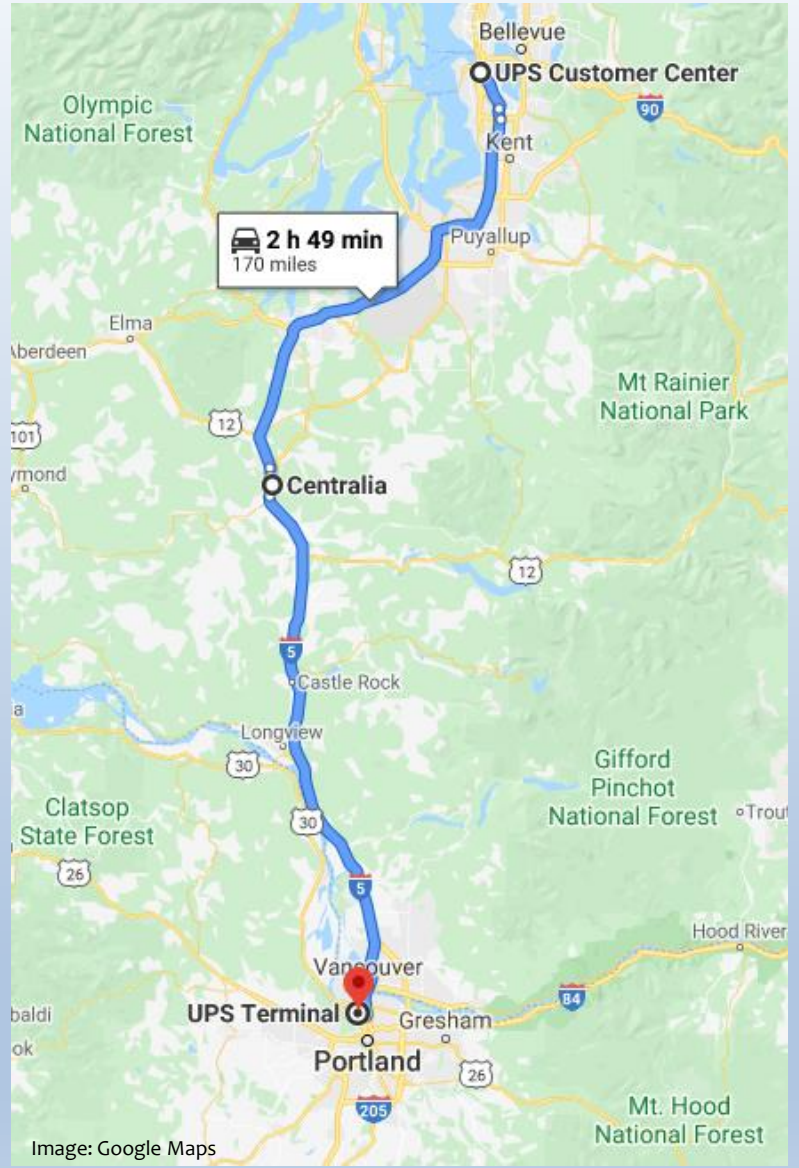
- Data from Seattle to Portland in range-extended electric tractor-trailer
- Power requirements for the traction motor system plus all accessory drives such as cooling pumps and fans, power steering, air compressor, HVAC, etc.

Energy Storage Required:

- 450 kW-hrs of energy will be consumed on each one-way between Seattle & Portland

Battery Selection:

- 660 kW-hrs capacity
- Capable of 1.5C charging rate at 1,000 kW
- NMC chemistry



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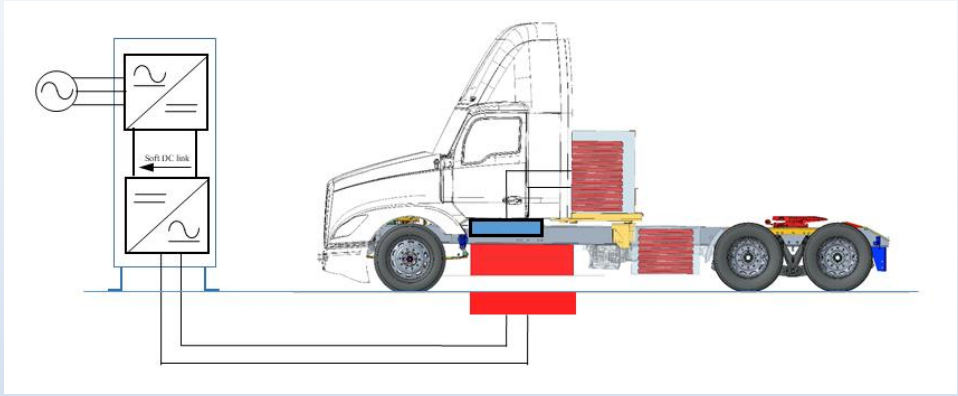
Progress

Magnetics & Electronics Design and Simulation:

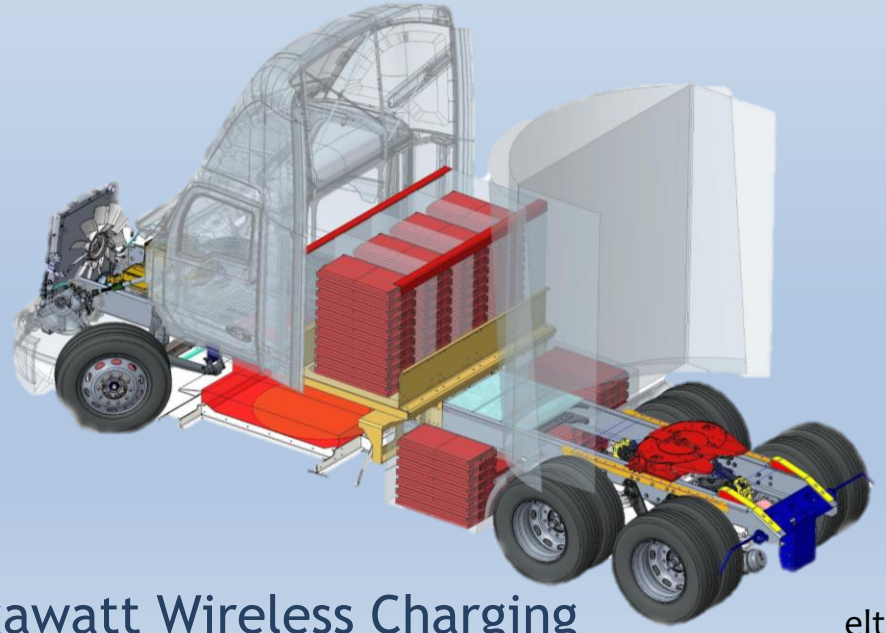
- Significant simulation and investigation
- Design meets vehicle parameters and charging requirement
- ANSYS simulation results yield path forward for a scaled prototype pad and shield
- Development and testing plans complete
- Initial weight and space calculations complete



Magnetic Field Plot Showing Leakage Meets ICNRP Regulations

Chassis Layout Design:

- Preliminary layout is complete
- Selected components all can fit on chassis
- Size and Weight requirements can be met
- Shielding requirements can be met
- Air gap requirement to fixed charger can be met



Future Research

- Explore the fleet impact and grid impact of large quantities of these trucks using chargers of this type.
- Ensure occupant and bystander safety during charging, and explore the trade-offs of field-shaping to reduce scatter vs mechanical shielding.
- Understand the thermal management needs of the battery system and the charging system across a spectrum of use cases.
- Explore the possibility of high-frequency interference from the charging system on vehicle electronic sub-systems, and means of mitigating the effects.