Texas Commission on Environmental Quality
New Technology Research & Development (NTRD) Program
Monthly Project Status Report

Contract Number: 582-11-13472-2019

Grantee: Transportation Power, Inc. (TransPower)

Report for the Monthly period: 02/11/12 – 03/09/12

Date Submitted: 03/12/12

Section I. Accomplishments

Provide a bulleted list of project accomplishments as well as a description of their importance to the project.

- The ElecTruck test-bed prototype truck was used to vet algorithms that are common between the port truck and yard tractor versions of the drive system, including inverter cooling pump logic and fan control.
- The precharge and ground fault detection circuits are being developed and packaged by a contracted electrical engineer to improve robustness.
- The first set of fabricated "suitcase" battery enclosure parts arrived and are being tested for ease of assembly, cell restraint, and the possibility of integrating cost effective high-voltage connectors.
    - Ease of assembly: The parts have keyed details that allow the structure to self-align, speeding up assembly while eliminating the need for expensive tooling.
    - Cell restraint: A certain amount of compressive force is required to maintain cell shape integrity over large variations in the state of the charge. Computer simulations have been corroborated with real world loading, which has confirmed that the "suitcase" superstructure is sufficiently rigid.
    - High-voltage connectors: Anderson connectors have been selected to supply right angle connectors that are both affordable and strong. The right angle connectors will allow TransPower to mount the suitcases very close together.
- Testing is almost complete on the prototype suitcase, which will allow TransPower to update prints and order the parts for the rest of the suitcases shortly. Figure 1 is a picture of the assembled prototype suitcase loaded with cells.

Figure 1: Prototype Battery "Suitcase" Loaded with Cells

- TransPower is in the process of fabricating parts for powertrain integration. An input shaft was ordered and is being machined by a local company to mate to the motor input splines. The two motor-to-transmission adapters (one for each truck) have been fabricated and are being machined for flatness and parallelism. The mounting strategy for the powertrain has been defined and the mounts are in production. Figure 2 shows various parts and pieces that will form a part of the powertrain mount.

Figure 2: Assorted Powertrain Mount Components

- TransPower has received the shifting hardware from MasterShift and updated the sensor and actuator portion of the drive system software to reflect the analog I/O required to shift. The MasterShift control box has also been added to the space claim, allowing TransPower to specify the cable lengths required to operate the shift hardware. A bench testing location has been dedicated to the assembly and testing of powertrain control components. This location will allow TransPower to develop and debug the shifting control logic and other powertrain control algorithms prior to integrating the powertrain into the yard tractor, saving a considerable amount of time. TransPower has purchased a water brake dynamometer which will be incorporated into the powertrain test bench and provide a load for the motor to spin. Figure 3 shows the new dynamometer partially assembled.

Figure 3: Partially Assembled Dynamometer

- All electric accessory components have been ordered and will be installed and cabled as they arrive. TransPower has developed a novel air conditioning compressor-to-motor interface to replace the typical pulley/belt system. TransPower will use a love-joy coupler to connect the motor directly to the compressor shaft, reducing cost, required space, component weight and build time. This interface will undergo accelerated wear testing in-house to ensure the coupler is robust and suited for the vehicle operation environment.

Indicate which part of the Grant Activities as defined in the grant agreement, the above accomplishments are related to:

- The first four accomplishments listed above relate to Task 2.1.1, "Final Component Selection and Procurement."
- The last two accomplishments above relate to both Task 2.1.1 "Final Component Selection and Procurement" and Task 2.2.1, "Procure Tractors and Components."

Section II: Problems/Solutions

Problem(s) Identified: Report anticipated or unanticipated problem(s) encountered and its effect on the progress of the project

a) TransPower has ordered the batteries for both tractors, but the delivery of the first set of batteries may not happen until as late as mid-May 2012. Last month TransPower was anticipating an arrival date of mid-April 2012. Battery deliveries are a critical path for assembly of the energy storage subsystem (ESS). The ESS is itself a critical path for vehicle-level testing of the yard truck.

b) TransPower has not yet received the components for the electrically-driven accessories subsystem. While these components should be arriving soon, TransPower was expecting to already be installing these components onto the first tractor.

Proposed Solution(s): Report any possible solution(s) to the problem(s) that were considered/encountered

a) TransPower has asked the battery supplier to do everything it can to expedite delivery of the first set of batteries. There is a possibility that the first batteries will arrive ahead of schedule, but no guarantee.

b) TransPower is considering hiring an additional technician to parallelize various assembly tasks in response to this delay.

Action(s) Conducted and Results: Describe the action(s) taken to resolve the problem(s) and its effect

a) TransPower has strategized on two fronts in order to minimize the effect of the battery delays on the truck completion date. Firstly, TransPower has modified the ESS assembly order so that as much of the assembly as is possible can be completed prior to the arrival of the batteries, including full assembly of all battery "suitcases." Secondly, TransPower intends to use the newly acquired dynamometer to facilitate validation and testing of the powertrain prior to truck integration. This will reduce the required amount of vehicle-level drive testing and allow the powertrain to be validated prior to the first battery delivery.

b) Actions to address this problem will be conducted during the next reporting period.

Section III. Goals and Issues for Succeeding Period:

Provide a brief description of the goal(s) you hope to realize in the coming period and identify any notable challenges that can be foreseen

- During the next period TransPower expects to fabricate most of the battery suitcases and finalize the suitcase mounting strategy.
- TransPower also expects to receive and install the electric accessories onto the tractor.
- Work will continue on the vehicle control system with a focus on integrating shifting logic into the drive system software.
- TransPower technicians will also complete the powertrain mounts.
- As TransPower transitions from the design phase to the integration phase, the biggest challenge in achieving these goals will be the finite amount of available technician time combined with a well populated to-do list. TransPower's focus for the next period will be efficiently utilizing the technicians' time.

Date: 3/12/2012

Authorized Project Representative's Signature

NOTE: *Please attach any additional information that you feel should be a part of your report or that may be required to meet the deliverable requirements for tasks completed during this reporting period.*