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Project Director LAMBERT, FRANK

Project Unit ECE

Sponsor SOUTHERN COALIT ADV TRANSP INC/ATLANTA, GA

Division Id 6178

Contract Number AGMT DTD 980223 Contract Entity GTRC

Prime Contract Number MDA972-94-2-003

Title RAPID CHARGING AND BATTERY MANAGEMENT FOR HEAVY DUTY ELECTRIC VEHICLES

Effective Completion Date 30-SEP-2001 (Performance) 30-SEP-2001 (Reports)

Closeout Action:	Y/N	Date Submitted
Final Invoice or Copy of Final Invoice	N	
Final Report of Inventions and/or Subcontracts	N	
Government Property Inventory and Related Certificate	Y	
Classified Material Certificate	N	
Release and Assignment	N	
Other	N	

Comments

Distribution Required:

Project Director/Principal Investigator	Y
Administrative Network/MAPS	Y
Grants & Contracts Accounting	Y
GTRI Accounting	N
Research Security Department	N
Reports Coordinator	Y
Research Property Team	Y
Georgia Tech Research Corporation	Y
Project File	Y
OSP/OOD	Y

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NEETRAC
62 Lake Mirror Road Building 3
Forest Park, Georgia 30297-1613 USA
TEL 404.675.1875 FAX 404.675.1820
URL http://www.neetrac.gatech.edu

TO: Dan Raudebaugh
SCAT

FROM: Frank Lambert
Georgia Tech / NEETRAC

DATE: September 14, 2000

SUBJECT: Atlanta Team Four FY97 Quarter 11 Report & Invoice
"Rapid Charging and Battery Management for Heavy Duty Vehicles"
Project #E21-R59 NEETRAC Project #97-374

SCAT Team: Atlanta Team 4

Team Leader: Georgia Tech / NEETRAC Frank C. Lambert 404-675-1855

Project Title: Rapid Charging and Battery Management for Heavy Duty Vehicles

Contributing Organizations:

Georgia Tech Research Institute (GTRI)
Electric Transit Vehicle Institute (ETVI)
Electric Power Research Institute (EPRI)
Advanced Lead Acid Battery Consortium (ALABC)
AeroVironment, Inc.
Georgia Power Company
Alabama Power Company
Birmingham - Jefferson County Transit Authority (Metro Area Express)
Advanced Vehicle Systems (AVS)
Trojan Battery Company
Ferro Magnetics Corporation

Project Description and Goals:

Design, build, and deliver two different high power chargers for two different heavy duty electric vehicles. A battery management system will be selected and installed on the vehicles to control the charge and discharge process and to interface with the chargers with the newly approved SAE J2293 Recommended Practice.

Project Status: Behind Schedule

The battery management systems have been installed on both vehicles and are operational. The Blue Bird bus is being evaluated for possible use on the Georgia Tech campus as an additional bus to their system. NEETRAC is working with Georgia Power and Georgia Tech to determine if the vehicle can be loaned and used in this way. The AVS bus is returning to the MAX transit facility in Birmingham, AL. To maintain good use of the vehicle, the bus will be charged temporarily with a Level 2 system until AVCON delivers the Level 3-charge connector.

The field trial phase of this project will continue over the next four quarters.

Technical Status:

3.0 CHARGER

Task 3.5 Install on Site

The Ferro Magnetics charger has been installed at the MAX transit facility in Birmingham, AL. The AVCON cable has been on order since May 18, 2000. Final turn-on of the charger will occur as soon as the cable is delivered and installed. AVCON has been unable to give us and estimated date of delivery.

4.0 VEHICLE

Task 4.5 Install on Vehicle

The AeroVironment BMS system has been installed on the Blue Bird school bus since November 1999. The installation of the Ferro Magnetics BMS on the AVS bus was completed in August 2000.

Task 4.6 Test on Vehicle

The battery management systems have been tested for proper communication with the vehicle systems and are working properly.

Task 4.7 Test Integrated System

Both vehicles have been driven and data recorded of the drive cycle.

5.0 TELEMETRY

Task 5.4 Install on Vehicle

The majority of the telemetry data will be recorded by the battery management systems on each vehicle. These systems and the additional monitors have been installed on the two vehicles.

Task 5.5 Test on Vehicle

After installation, the data acquisition system has been tested on the vehicle and communication verified.

Task 5.6 Test Integrated System

The vehicles have both been tested under run conditions for accurate data recording from the telemetry system.

Deviations (SOW, Schedule, Approach):
Georgia Power has been reluctant to place the vehicle in service with another operator other than NEETRAC due to the prototype nature of the vehicle. NEETRAC is working through them to develop the best approach to implementing a field trial of the Blue Bird bus on Georgia Tech's campus in a beneficial way to both parties.

AVS was able to secure labor and operating resources to complete the required modifications and installation of the Ferro Magnetics systems on the AVS bus supplied by MAX Transit. Alabama Power installed the new transformer and charger at the MAX Transit facility in downtown Birmingham. The bus will be in service as part of the normal EV operation the regular transit system. The bus will go into service at the end of September. Charging with the Ferro Magnetics system will be underway once the AVCON connector is delivered.

Payable Milestones Completed This Quarter:

	DARPA	Cash	In-Kind
Task 3.5 – Install on Site	$30,757	$6,000	$0
Task 4.5 – Install on Vehicle	$64,175	$32,500	$10,000
Task 4.6 – Test on Vehicle	$26,000	$0	$5,000
Task 4.7 – Test Integrated System	$26,147	$6,500	$7,200
Task 5.4 – Install on Vehicle	$16,428	$0	$10,852
Task 5.5 – Test on Vehicle	$5,000	$0	$5,000
Task 5.6 – Test Integrated System	$6,500	$0	$6,000
Totals	$175,007	$45,000	$44,052

Prior Completed Tasks:

Project Management

Task 0.1 Manage Project Q1
NEETRAC has completed management of the project for Quarter 1. This involved drafting the Consortium Agreement and initial review with Team members.

Task 0.2 Manage Project Q2
NEETRAC has completed management of the project for Quarter 2. This involved completion of the Consortium Agreement in February 1998.

Task 0.3 Manage Project Q3
NEETRAC has completed management of the project for Quarter 3. This involved revising the Consortium Agreement to replace Schott Power Systems with AeroVironment, Inc. and holding the project kickoff meeting for the Birmingham Team on May 12th at MAX Transit Headquarters.

Task 0.4 Manage Project Q4
NEETRAC has completed management of the project for Quarter 4. This included holding the project kickoff meeting for the Atlanta Team on July 2nd at Georgia Power Company.

Task 0.5 Manage Project Q5
NEETRAC has completed management of the project for Quarter 5. We have facilitated four conference calls with Team Members during this quarter and presented the project review at the DARPA meeting.

Task 0.6 Manage Project Q6
NEETRAC has completed management of the project for Quarter 6. We have facilitated four conference calls with Team Members during this quarter.

Task 0.7 Manage Project Q7
NEETRAC has completed management of the project for Quarter 7. We have facilitated two conference calls with Team Members and hosted one meeting of the Alabama team. We presented the project review at the DARPA meeting in Indianapolis.

Task 0.8 Manage Project Q8
NEETRAC has completed management of the project for Quarter 8. We have facilitated four conference calls with Team Members and distributed two additional status report emails.

Specifications

Task 1.1 Develop Communications Specification

Atlanta Team Four has completed the communications specification for the project. SAE J-1850 has been selected for the vehicle to charger communications protocol.

Task 1.2 Develop Power Transfer Specification

Atlanta Team Four has completed the power transfer specification for the project. SAE J-2293 has been selected to control the power transfer from the charger to the vehicle.

Task 1.3 Develop Vehicle Specification

Atlanta Team Four has completed the vehicle specification for the project. SAE J-1772 and J-2293 have been selected to insure the vehicles are capable of charging at any standard charging location.

Task 1.4 Develop Pulsing Specification

Atlanta Team Four has completed the pulsing specification for the project. SAE J-2293 has been selected for the positive pulsing control. The negative discharge pulses will be produced on-board the vehicle to comply with the J-2293 interface.

Task 1.5 Develop Charger Specification

Atlanta Team Four has completed the charger specification for the project. SAE J-1772 and J-2293 have been selected to insure the chargers are capable of charging any standard vehicle.

Task 1.6 Develop Telemetry Specification

The telemetry specification has been completed detailing the data values to be measured and the appropriate time intervals.

Develop Pulsing Algorithms

Task 2.1 Write Pulsing Code

GTRI has completed the charging algorithm pulsing code. They are currently in the testing phase of the project.

Task 2.2 Test Pulsing Code

GTRI and AeroVironment, Inc. have completed the pulse code testing of their charger systems. See the included reports for final results.

Task 2.3 Test Integrated System

NEETRAC assisted GTRI with the testing of their pulse charging system and the testing of the AeroVironment system's use of SAE J2293 pulsing.

Build Chargers

Task 3.1 Complete Engineering Design and Deliver Schematic
The charger schematic has been completed.

Task 3.2 Complete Charger Bill of Material
The charger bill of material has been completed.

Task 3.3 Build Prototype Unit
The AeroVironment 120 kW unit and (2) 60 kW units have been received.

Task 3.4 Test Prototype Unit
AeroVironment, Inc. and Ferro Magnetics Corporation have completed the internal prototype testing of the charger units and have delivered them to NEETRAC.

Task 3.6 Test Integrated System
NEETRAC has tested each charging system within its laboratory in Atlanta. The Ferro Magnetics charger has been evaluated with the charger, battery management system and the Trojan battery packs. The AeroVironment system has been fully integrated onto the Bluebird bus and is in final testing.

Modify Vehicles

Task 4.2 Design Bus BMS and Deliver Schematic
The vehicle schematic has been completed.

Task 4.3 Complete Vehicle Bill of Material
The vehicle bill of material has been completed.

Task 4.4 Acquire Material
The vehicle material has been acquired.

Install Telemetry

Task 5.1 Complete Telemetry Schematic
The charger telemetry schematic has been completed.

Task 5.2 Complete Telemetry Bill of Material
The telemetry bill of material has been completed.

Task 5.3 Acquire Telemetry Material
The telemetry material has been acquired.