

2012 DOE Vehicle Technologies Program Review Presentation Advanced Vehicle Electrification

PI : Darren Gosbee

Presenter: Dion Van Leeve

Navistar

May 17th, 2012



Project ID # ARRAVT069

This presentation does not contain any proprietary, confidential, or otherwise restricted information

Overview

Timeline

- Start - Oct 1st, 2009
- Finish - Oct 31st, 2014
- 44% Complete through Dec, 2011

Budget

- Dept of Energy cost share
\$39,200,000
- Navistar cost share
\$39,858,466
- DoE funding received
through Dec 2011,
\$7,202,694

Barriers

- Immature supply chain
- Original / foreign platform reliability issues
- Aligning vehicle requirements vs customer cost/range expectations
- EVSE compatibility with various suppliers due to spec interpretations

Partner

- DOE (NREL) analysis of fleet data
- Suppliers
- Initial customers
- ELC (Electrification Leadership Council)

Objective and Relevance

The overall objective of this project is to manufacture and distribute a zero tailpipe emission light-duty commercial electric vehicles (EV) in the United States. Navistar shall deploy at least 950 commercial medium duty EVs in the U.S. market.

- Specific objectives include;
 - Demonstrate EV technology for commercial applications
 - Demonstrate reliability in diverse locations
 - Address customers needs to achieve mass market penetration
- This project is creating and sustaining American jobs in support of the ARRA initiatives.
- Estimates are that each vehicle will reduce carbon emission by at least 10 tons per annum, compared to ICE vehicle. This equates to 1250 gallons of fuel per annum
- EV Project has a positive impact on technology development, barriers are being improved

Approach - Milestones

Month/Year	Milestone or Go/No-Go Decision
May-2010 / Complete	Go/No-Go decision: Complete engineering review and sign off of initial SKD (semi knockdown) units for OK to ship to initial customer, MY2010 Completed 5/12/2010. Completed shipment of first sold units on 5/18/2010.
Oct-2010 / Complete	Milestone: Complete transition to CKD (complete knockdown) units, with increased US manufacturing content. Due to component availability and pre-ordered product, this milestone slipped to 5/2011.
Aug-2011 / Complete	Milestone: Complete launch of Model Year 2012. Enhanced; heating, air-conditioning, motor, charger, and battery pack
Sep-2011 / Complete	Milestone: Chartered the development of next generation EV 2 for integration into another existing platform
Mar-2012 / Planned	Milestone: Program approval of next generation EV2. Critical systems concepts approved
Jun-2013 / Planned	Milestone; Job 1, program launch, of next generation EV2 integrated into existing platform.

Approach - Tasks

- Transfer existing technologies and product from overseas to a domestic manufacturing location
- High voltage architecture was revised to ensure compliance with US Grant performance targets
- Complete homologation of systems and sub-systems to ensure compliance with DOT (Department of Transport) requirements
- Charter and staff product development teams to upgrade and launch EV generation 1, and improve key systems for development and launch of EV generation 2
- Develop alignments with Gen 1 customer base, and utilize feedback to improve and enhance Gen 2
- Organize industry, governmental, and educational institutions stakeholders into Electrification Leadership Council to promote adoption and infrastructure of EVs

Technical Accomplishments

- Prior Accomplishments
 - Vehicle meets FMVSS requirements
 - 80 kW battery pack integrated (to achieve 100 mile range objective)
 - On board charger integrated
 - EPA and CARB certified for on road use
 - Launched initial product May, 2010
- 2011 Accomplishments
 - Generation 1 EV
 - FRP battery pack enclosure
 - Locally sourced charger integrated allowing improved charging time and serviceability
 - Air conditioning option available
 - Enhanced windshield defrost / demist to allow for expanded geographic locations
 - Continued vehicle life durability testing

Technical Accomplishments

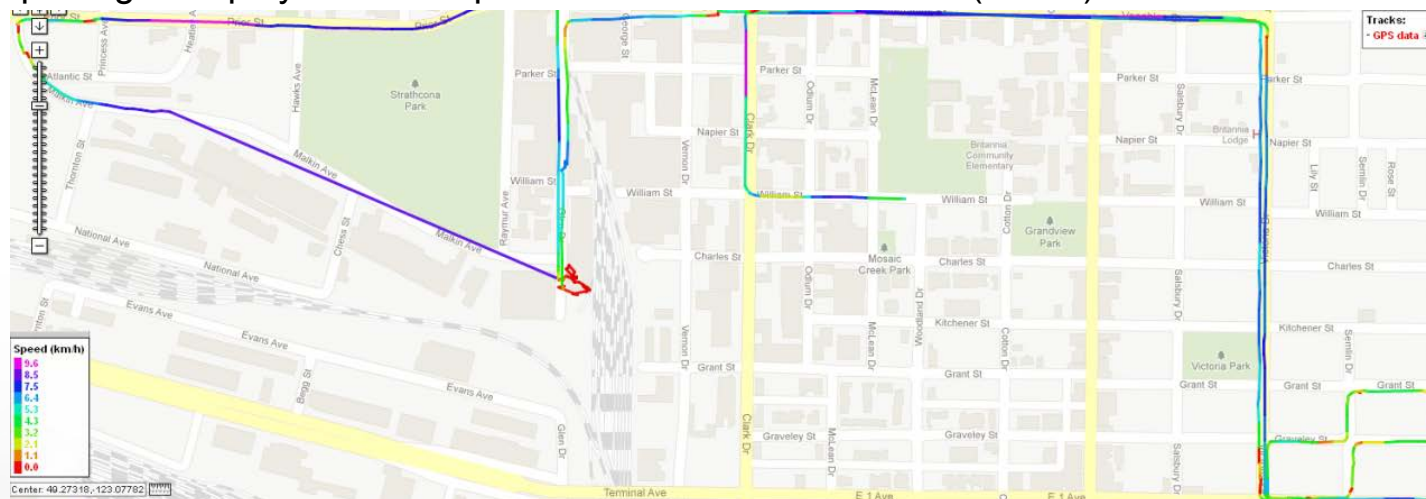
- 2011 Accomplishments (cont)
 - Generation 1 (cont)
 - EMC susceptibility further improved during redesign of Battery enclosure and Charger Management Systems
 - Implemented J1772 architecture into charger
 - Vehicle and systems Operating Temperature range increased to -20 to 50 C
 - Park pawl robustness improved
 - Staffed EV Generation 2 program with product development team

Technical Accomplishments

- EV Generation 2
 - 100 mile range with increased GVW and Payload
 - Modular battery pack configurations to allow for reduced cost option
 - Increased maximum speed
 - Common platform to minimize product cost
 - Evaluated for driver ergonomics
 - Design protected for alternative product offerings

Collaboration

- Reporting of deployed vehicle performance data to the DOE (NREL)

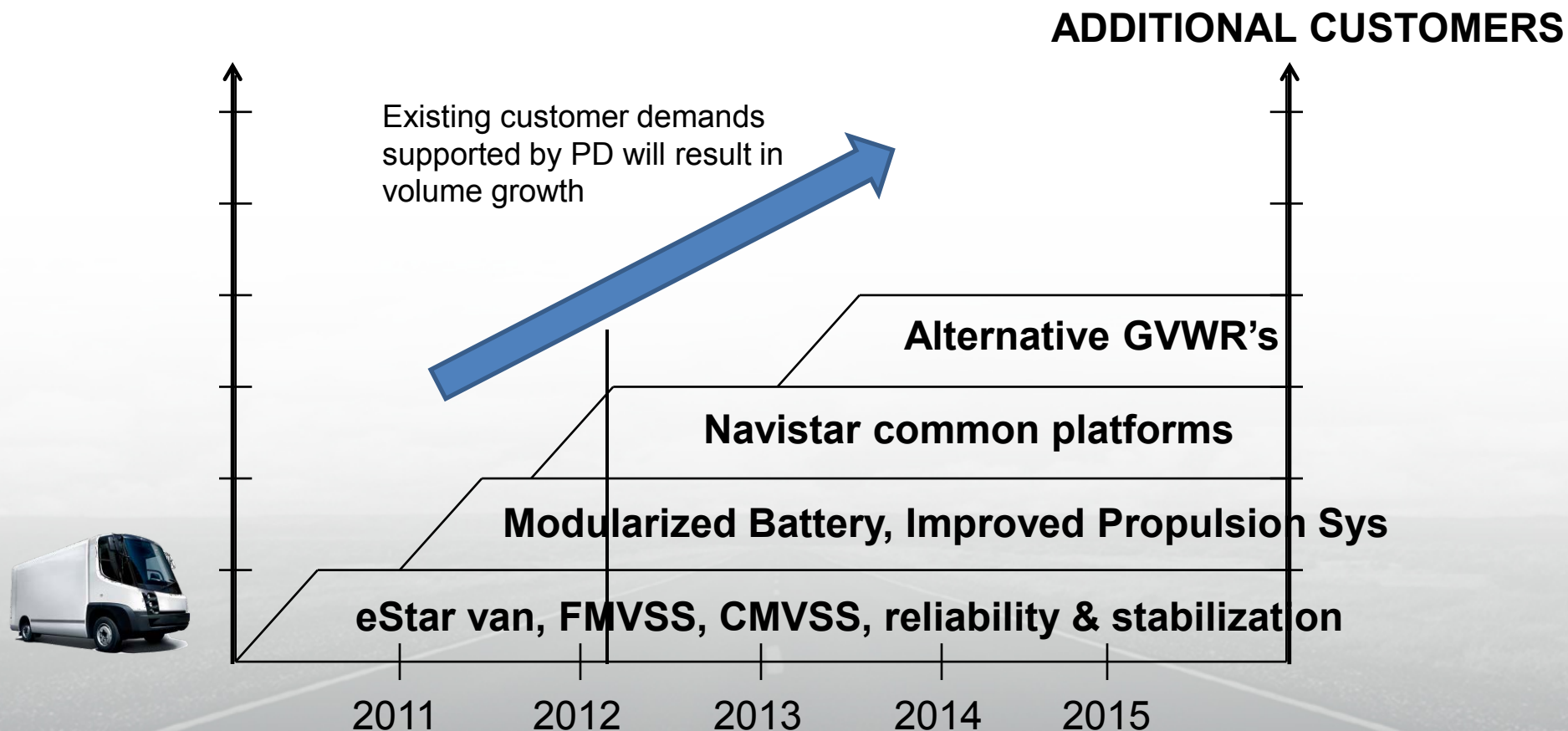


- Leveraging DOE partners
 - High voltage battery pack manufacturer
 - EVSE options for customers
- Strategic alignment with body builder for integrated truck / body
- Initial customer(s) key to continuous enhancement of gen1 and defining requirements for gen 2
- Developing relationships via the Electrified Leadership Council;
 - Utility
 - Local suppliers / User Industry
 - Local and state governments

Future Work

- Continuous localization and sourcing
- Launch generation 2 summer 2013
- 2013 and out
 - Continue cost reduction initiatives
 - Integrate electrified drive train into alternative platforms
- Achieve General Services Administration (GSA) certification for Generation 1 product to increase vehicle sales

Future Work



Product, market development AND cost reduction required to grow the EV business

Summary



- US homologation generation 1 completed
- Product launched May 2010
- MY2012, enhanced version of generation 1 launched Sep 2011
- Technical challenges remain
 - Cost reduction of energy storage system
 - Vehicle range matched to customer wants
 - Availability of charging stations for utilization by commercial vehicles.
 - Electric grid support for large fleets (long term)