2011 DOE Vehicle Technologies Program Annual Merit Review

Electric Drive Component Manufacturing: Magna E-Car Systems of America, Inc.

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Magna E-Car Systems of America, Inc.

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Project ID: ARRAVT027

Overview

Timeline

- Start Date: July 1, 2010
- End Date: June 30, 2013
- 25% Complete

Budget

- Total Project Funding
  - DOE $40,000,000
  - Magna E-Car - $47,402,116
- DOE Funding
  - FY2010-$7.1M
  - FY2011-$23.7M

Barriers

- Unexpected delays in program timing
  - OEM customer design changes and delays
  - Installation of manufacturing equipment and tooling
- Increased cost and timing for low-volume components

Partners

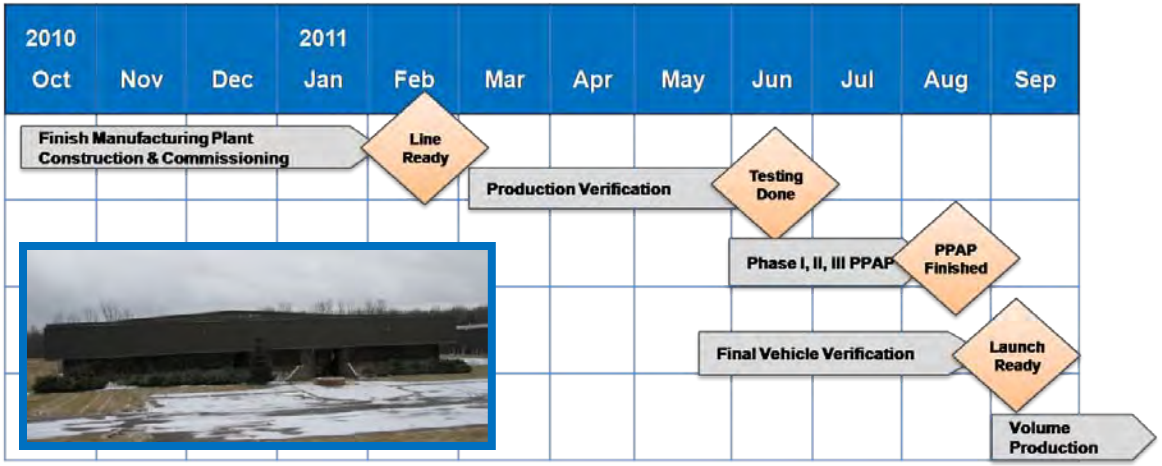
- Magna E-Car USA, LP
- Magna Powertrain USA, Inc.
- VEHMA International of America, Inc.

Relevance

Project Objectives

- Increase production capacity and validate production capability of advanced automotive electric drive component manufacturing plants in the U.S.
  - Completion of the activities required to manufacture and supply electric drive systems to existing OEM customer projects supporting long-term economic growth
  - Creation and validation of production capability of advanced automotive electric drive vehicle components for electric vehicle production programs in the U.S. spurring economic activity
  - Preparation of a newly acquired facility to house the manufacturing activities that are supported by this project creating new engineering and manufacturing jobs
- 2011 Objectives
  - Continue production software development for:
    - VCU –motor control; vehicle communication with charger, battery, DC-to-DC and TCM
    - TCM –torque management software
  - Continue the industrialization of the manufacturing facility
  - Perform Validation Prototype (VP) build for the OEM customer and supplier readiness reviews

Approach



- Go/No Go Decision Point
  - Completed when Magna E-Car was awarded a production program with lead OEM for calendar year 2011 Start of Production
- Facility Utilization and Production Preparation
  - NEPA and Certificate of Occupancy Approved January 2011
- Overall Milestone Status
  - All programs continue to follow component-level Program Management Plan timing with minimal delays

Milestones

Milestone	Component	Start Date	End Date	% Complete
Procurement of Production Assembly Equipment –Procure and build of required production equipment in support of production	VCU	10/2010	03/2011	55
	MCU and Motor	07/2009	04/2011	75
M1 Engineering Validation Build –Initial build of first level design validation components using production-intent designs for engineering development	BCCM	03/2011	04/2011	0
Verification Prototype (VP) Build Part Procurement –SCM function including the kick-off and procurement of all tools and components needed to assemble VP-level components for engineering validation	VCU	10/2010	03/2011	60
	MCU and Motor	05/2010	02/2011	100
Final Data Judgment (FDJ) –Complete all validation testing, and freeze engineering designs to allow kick-off and procurement of production	VCU, MCU and Motor	01/2011	01/2011	100
Installation of Line at Production Facility –Install and test purchased production assembly equipment in the Magna E-Car production facility	VCU	10/2010	03/2011	15
	MCU and Motor	10/2010	04/2011	35
Verification Prototype –Production-intent builds to satisfy specific test requirements and ensure vehicle compatibility and design completeness	VCU	03/2011	03/2011	0
	MCU and Motor	02/2011	03/2011	0
VP Validation Testing –VP component- and vehicle-level testing is completed using VP-level parts to validate conformance to all objectives of production tooled components	VCU	04/2011	08/2011	0
	MCU and Motor	03/2011	06/2011	35
Production Part Approval Process (PPAP) –Phase I, II, III PPAP	VCU	08/2011	09/2011	0
	MCU and Motor	08/2011	10/2011	0
Final Engineering Completion (FEC) and Launch Readiness (LR) –All issues have been resolved and final approval to proceed to tooling trial is given	VCU, MCU and Motor	10/2011	10/2011	0
Mass Production (MP1) –Start of production at Magna E-Car production facility	BMU, VTM, VCU, MCU, Motor, BCCM	2011		0

Technical Accomplishments and Progress

Power Plant: Motor and Motor Control Unit (MCU)

- Engineering designs released
- Design Validation (DV) testing:
  - Several prototypes built
  - Motor passed all critical DV test

- Supply Chain Management
  - Production suppliers kicked off for Verification Prototype (VP) build
  - Conducted Advanced Product Quality Planning (APQP) and supplier readiness reviews

- Production
  - Kicked off production tooling
  - Completed assembly equipment build

Technical Accomplishments and Progress

Vehicle Control Unit (VCU)

- Engineering designs released
- Testing
  - Design Validation (DV) testing: First–level production design
  - OEM durability testing completed: First durability vehicle test cycle
- Supply Chain Management
  - Production suppliers kicked off for Verification Prototype (VP) build
  - Conducted Advanced Product Quality Planning (APQP) and supplier readiness reviews
- Production
  - Kicked off production tooling
  - Released assembly equipment orders for procurement

Battery Charger Converter Module (BCCM)

- Built and began testing eight prototypes
- Completed the Engineering Development (ED) test plan
  - Limited ED testing completed
- Initiated next generation design based on issues discovered on original design
  - Revised MOSFET cooling strategy to increase thermal stability

Technical Accomplishments and Progress

Manufacturing Facilities

- Component Manufacturing –Grand Blanc Township, Michigan
  - Completed production floor and office upgrades
  - Certificate of Occupancy received January 2011
  - Approximately 12 new hires to support engineering, quality and manufacturing activities were added to the project
- End-of-Line Assembly –Muncie, Indiana
  - Completed fabrication of the assembly and end-of-line equipment
  - Prepared facility for receipt of manufacturing and assembly equipment
  - Integrated the battery emulation system to the dynamic test system

Testing Facilities

- Vehicle Integration, Materials Testing & Validation Facility – Auburn Hills, Michigan
  - Equipment acquisition and calibration complete (90%)
  - Received pack and cell validation and cycling equipment

Collaborations / Partnerships

Magna E-Car Systems of America, Inc.

- Primary Recipient

Magna E-Car USA, LP

- Engineering, development and testing of VCU, MCU and Motor
- Assembly and manufacturing of VCU, MCU and Motor

Magna Powertrain USA, Inc.

- Development and manufacturing of gearbox
- Assembly and integration of the electric powertrain assembly

VEHMA International of America, Inc.

- Development and manufacturing of the cradle for the powertrain assembly

Future Work

Vehicle Integration

- Software validation for functional safety and calibration released
- Completion of all Verification Prototype (VP) deliverables
- Continue production software development

MCU and Motor

- Complete PPAP (Production Prototype Approval Process) and DVP (Design Validation Plan)
- Continue industrialization of the manufacturing facility
- Begin Process Validation (PV) testing
- Final engineering completion, launch readiness and start of mass production

BCCM

- Release and finalize second-level production designs
- Continue prototype build and engineering validation

Summary

- Program continues to follow projected timeline, milestones and budget with minimal delays
  - Customer design changes major contributor of delay
- Facilities upgraded and prepared for manufacturing
  - Manufacturing, assembly and testing equipment procured and continues installation and testing
- Components designed, prototypes built and undergoing various levels of development testing and validation
  - Increased cost and timing for low volume component manufacturing is primary barrier
- Validation and industrialization to continue at both manufacturing and end-of-line assembly facilities
  - Mass production to begin in 2011
  - Creation of additional engineering and manufacturing jobs expected
  - Continue commercialization development plans with OEM customers spurring sustainable economic growth