

UNIVERSITY HONORS PROGRAM

SENIOR PROJECT-PROSPECTUS

Name: Kevin Hansom

College: Engineering

Department: Mechanical

Faculty Mentor: Dr. David K. Irick

Project Title:

Challenge X - Crossover to Sustainable Mobility

Project Description (attach not more than one additional page, if necessary):

For this project, we will be converting a 2005 Chevy Equinox from a 3.4L V-6 powered all-wheel-drive SUV into an equally capable Hybrid Electric Vehicle (HEV), powered by a 1.3L Fiat Engine in conjunction with a large electric motor. Once completed, our vehicle should perform comparably with the gasoline-only version, while remaining much more environmentally friendly and providing far superior fuel efficiency.

More specifically, I will be working on power systems integration. The added power demands of the large electric motor require the installation of an externally manufactured 288V battery pack. I will be responsible for modifying the vehicle chassis to accommodate the battery, integrating the battery into the current electrical system, and fabricating the cooling system required for full time operation of the unit.

Once completed, the vehicle should function just as any other vehicle on the road today. However, given the current global energy situation, the exploration of alternative power sources and the development of more efficient means of transportation are critically important.

This project should be completed by the end of the Spring 2006 semester, with the design competition taking place in July of 2006.

Seniors Honors Project Kevin Hansom University of Tennessee

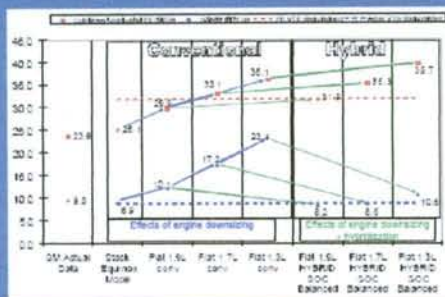
ChallengeX – Cross-Over to Sustainability



Challenge X at the University of Tennessee

- ♦ Senior capstone design
 - ♦ Ground-up design and construction of a hybrid vehicle
- ♦ Sponsored Competition
 - ♦ General Motors
 - ♦ Argonne National Laboratory
 - ♦ Department of Energy
- ♦ Subdivided into teams / tasks
- ♦ Testing / Competition in June 2006
 - ♦ 17 schools compete
 - ♦ Different categories of awards / judging

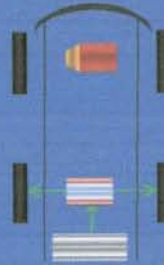
Effects of Hybridization of a Vehicle



Integrated Vehicle design : Modes of Operation

Zero Emissions Vehicle Mode

- Engine idle stop operation
- ZEV
- No Charging during ZEV mode

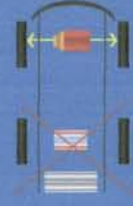


EM will provide the sole traction power for the vehicle on a limited basis such as:

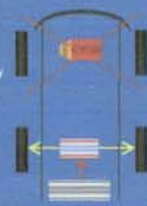
- Low vehicle speeds
- &
- Low driver demand

Integrated Vehicle design : Modes of Operation

Limp-Home Mode



System redundancy & segregation provides the ability for limited vehicle operation should either the IC engine or the High-voltage systems fail



Integrated Vehicle design : Modes of Operation

Series Regenerative Braking

When braking, kinetic energy of vehicle is converted back into electrical energy by the EM.

Advantages:
Less brake wear
Less KE wasted as ME



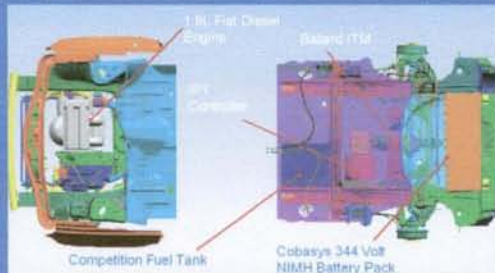
Vehicle Technical Specifications

VTS Motivation

- Increase Fuel Economy
- Maintain Performance and Utility
- Reduce Emissions
- Noise Considerations
- Competition Goals and Requirements

Discussion	Test Type	Manufacturer's Rating	VTS (Team's Performance)
1.4M Btu/min	1.2.5	4.5	4.5
10.75 Mph	1.2.5	4.5	4.5
Vehicle Mass	1.2.5	4.5	4.5
MPG Combined EPA	1.2.5	4.5	4.5
Altitude Range	1.2.5	4.5	4.5
Passenger Capacity	1.2.5	4.5	4.5
Charging Cycle/Day	1.2.5	4.5	4.5
Trailing Load/Day	1.2.5	4.5	4.5
Charging Capacity	1.2.5	4.5	4.5
Starting Time	1.2.5	4.5	4.5
Max. Current	1.2.5	4.5	4.5

Packaging Evaluation and Component Layout



Packaging Continued

Trouble Areas for THRU-the-Road

- Battery Pack Compartment Modification
- Pack interference with sub-frame
- Cooling system in/out connections



Unique Program Aspects

- Hands-On Experience
 - Cutting Edge Technology
 - Batteries
 - PSAT Software
 - Matlab + Simulink
 - All design and construction self-directed
- Bridge to employment with industry leaders

Project Completion Outlook

- ChallengeX Competition – June 2006
 - Arizona
 - All Team members go (expense-free)
 - Culmination of project / senior design work
- Car Shipping Deadline – May 1, 2006
 - Minor modification allowed at testing site
- Preliminary Tech Inspection – March 1, 2006
 - Done at each University by GM / ChallengeX
 - All vehicles must be running / driveable

Questions?

- The End! Thanks for your attention!