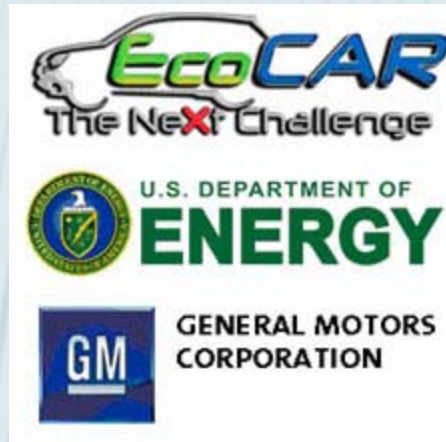


EcoCAR Challenge – Team 2



Team Members:

*Tarik Wright, Seitu Brathwaite,
Katrellle Jones, Derrick Rumbolt*

PROJECT OUTLINE

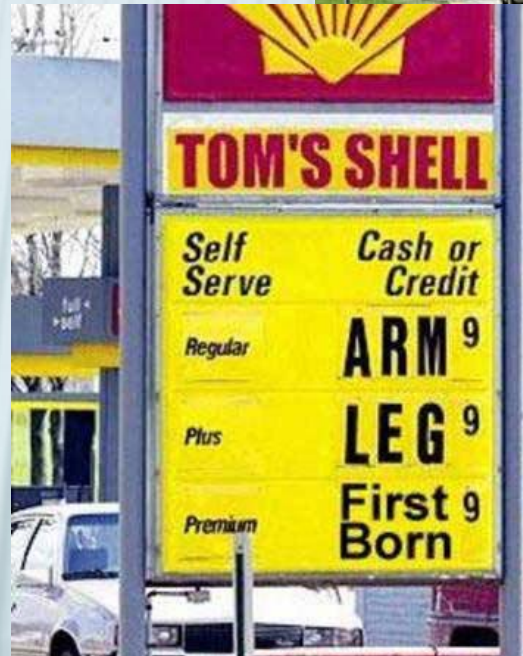
- × Background
- × Problem Statement
- × Design Requirements
- × Solution Implementation
- × Performance Testing & Evaluation
- × Conclusion
- × Questions



GENERAL MOTORS
CORPORATION

BACKGROUND

- ✘ Foreign Energy Dependency
- ✘ New environmental policies (global warming)
- ✘ Rising prices of petroleum/crude oil
- ✘ Carbon Emission effect on the environment
- ✘ Federal government laws mandating increased fuel economy



Vehicle exhaust emissions

PROBLEM STATEMENT

- × Eco-Car Next Challenge Year 1
- × Design Simulink Model of control strategy for Hybrid vehicle
- × Simulink model must be Software-in-the Loop tested



DESIGN CONSTRAINTS

Performance:

- ✘ Battery State of Charge should never fall below 60% nor go above 90%

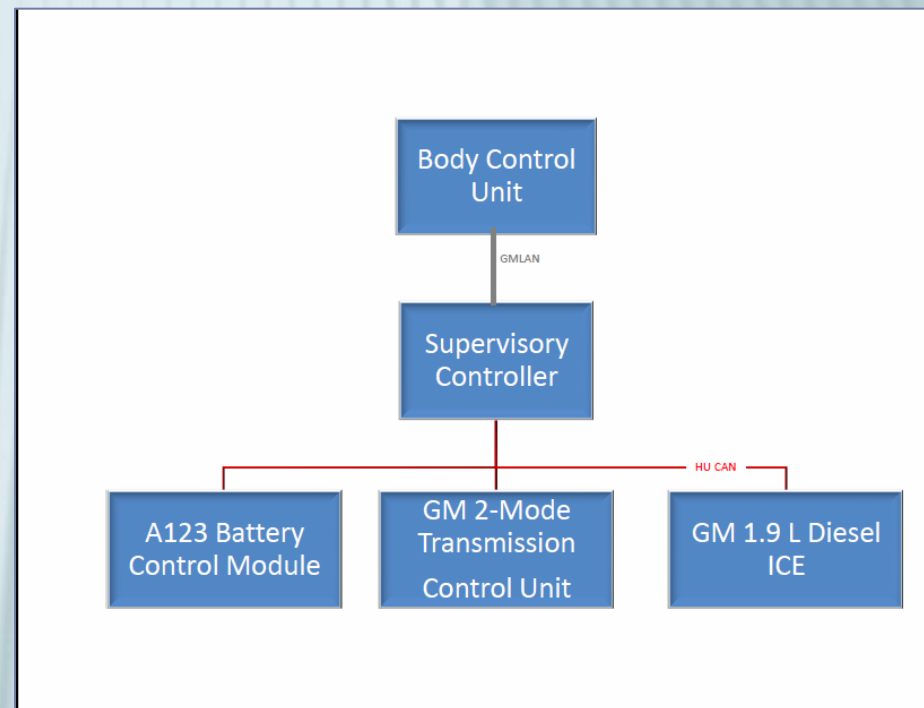
Compliance:

- ✘ Design must satisfy ISO standards (See ISO 11898 Section 1-5) for high-speed applications within CAN
- ✘ Design must satisfy ISO standards(See ISO 11519 Section 1-3) for low speed applications within CAN

SOLUTION IMPLEMENTATION

- ✘ Controller connected to subsystems via “HU” CAN
- ✘ Controller would connect to stock GMLAN
- ✘ All other stock systems remain unchanged
- ✘ Controller function as receiver and transmitter of CAN messages

Control Architecture



SOLUTION IMPLEMENTATION

× Driver

- Upper subsystem
- Drive schedules

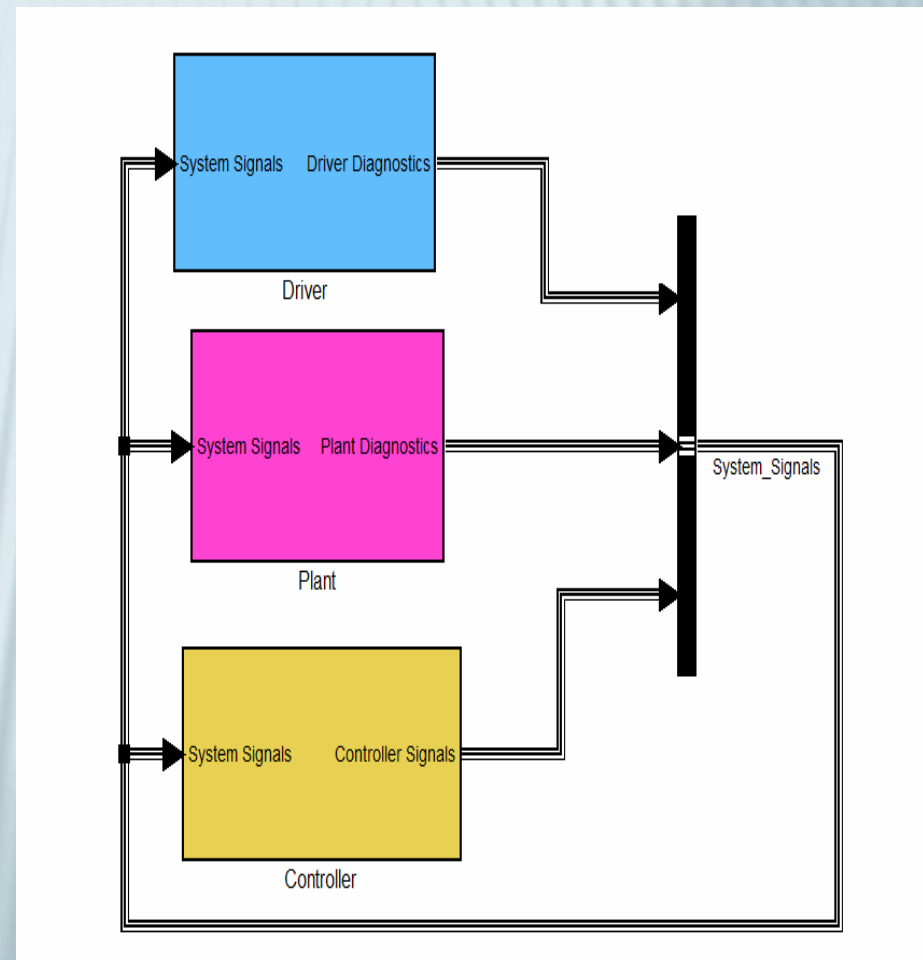
× Plant

- Middle subsystem
- Diesel Engine
- Electric Motor
- Battery

× Vehicle-Controller

- Lower subsystem
- Control Logic

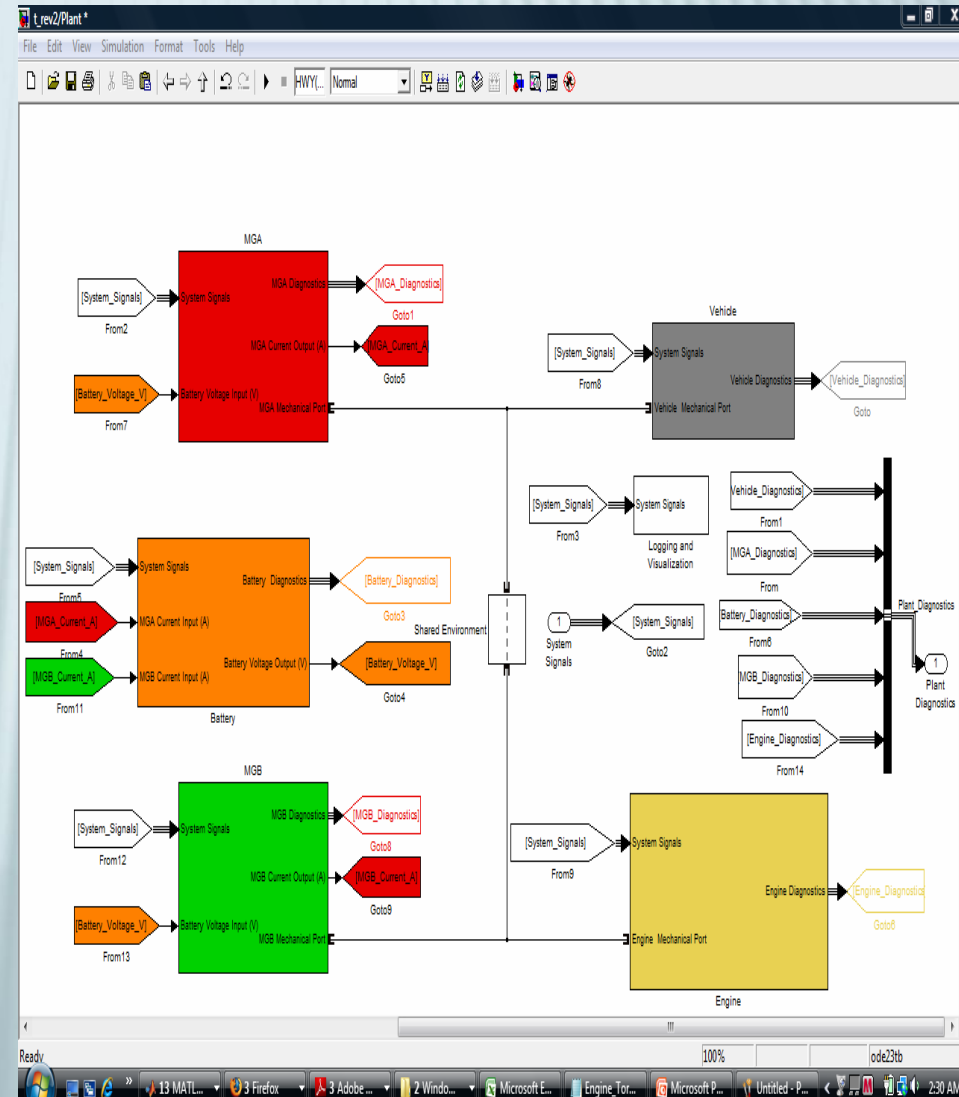
High-Level Model



SOLUTION IMPLEMENTATION

Plant Subsystem

- ✘ Software models were created to approximate the behavior of real components
- ✘ 2-Mode Transmission was represented by 2 electric motors MGA and MGB(Acceleration & Battery Regeneration)



SOLUTION IMPLEMENTATION

Controller Logic

A123 Battery:

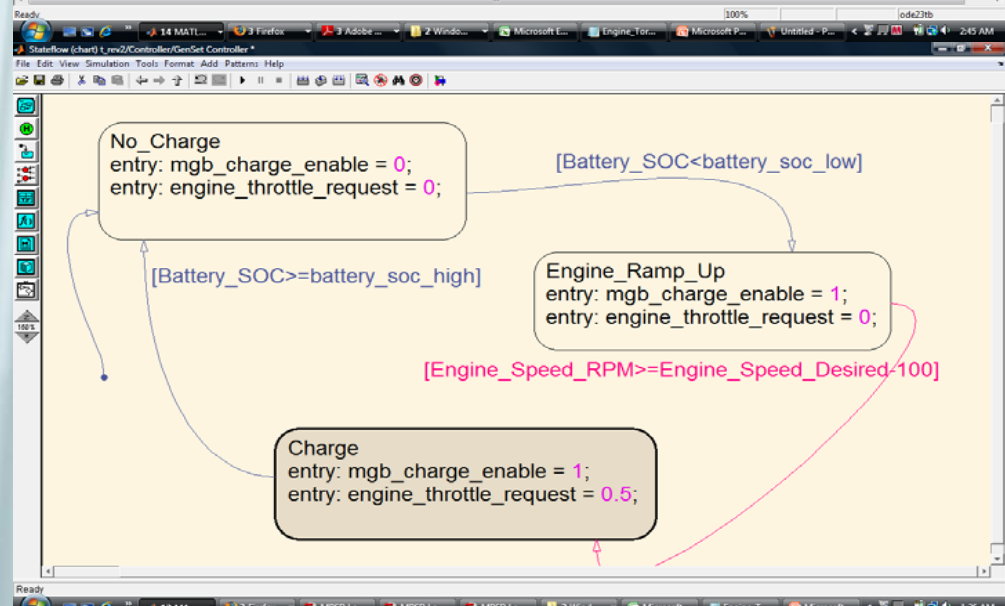
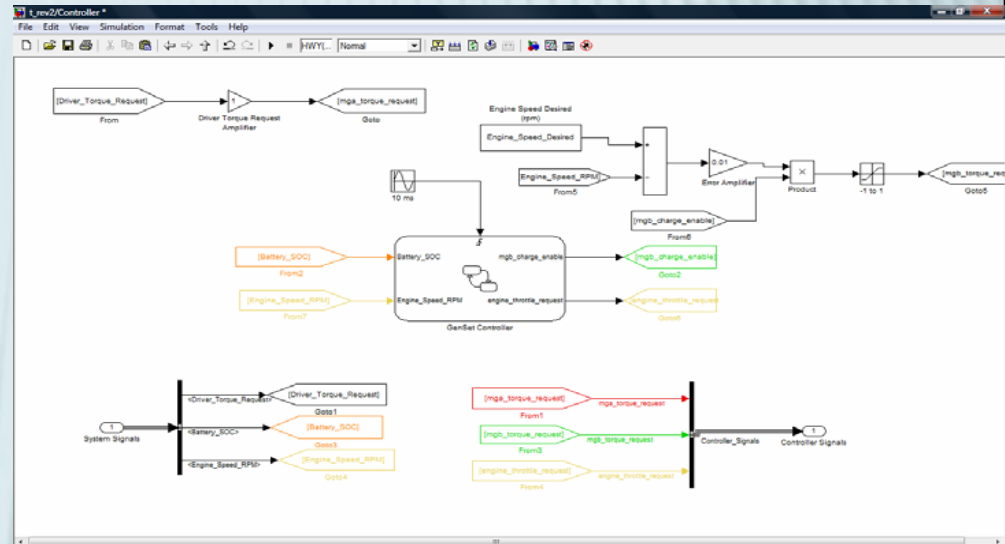
- ✘ Battery longevity is of utmost concern
- ✘ State of Charge must be limited between 60% and 90% of battery capacity

2-Mode Transmission:

- ✘ Motor 1(MGA) used for propulsion upon startup
- ✘ Motor 2(MGB) used for regeneration when battery charge falls below 60%
- ✘ Motor 2 stops when battery charge climbs to 90%

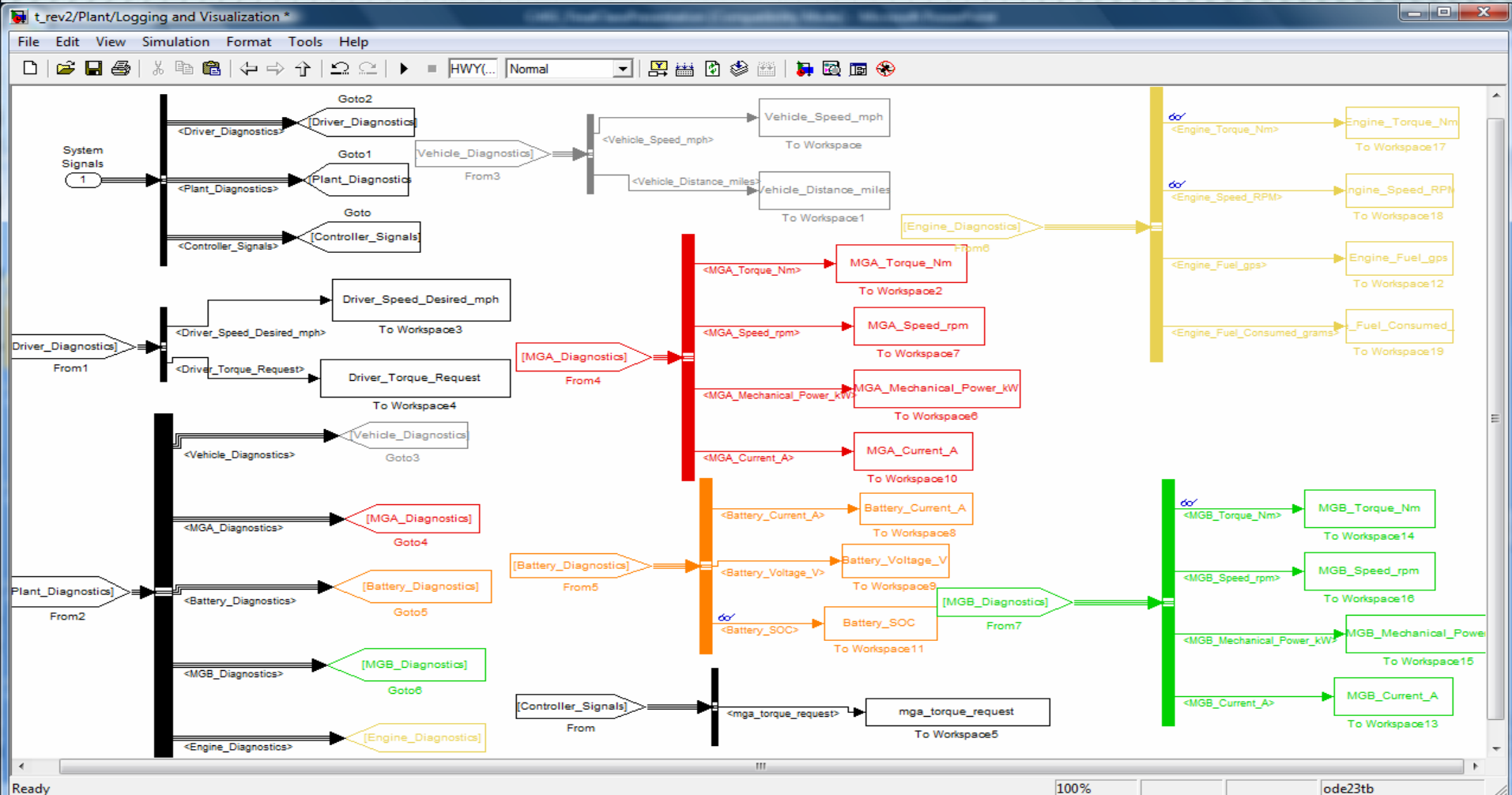
1.3L Diesel Engine:

- ✘ Is turned on once engine approaches 1800 RPM



SOLUTION IMPLEMENTATION

Logging & Visualization Subsystem



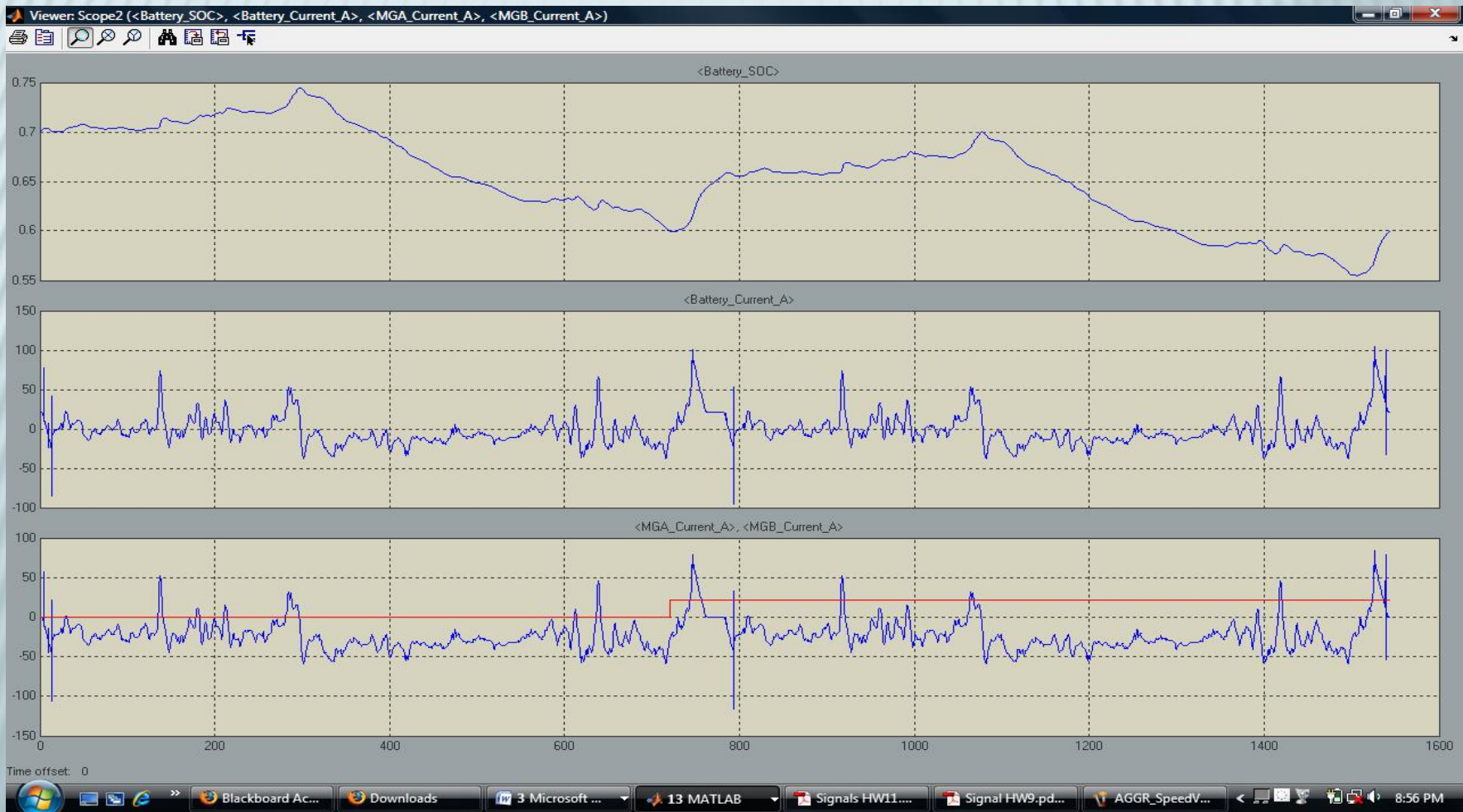
PERFORMANCE TESTING & EVALUATION

EPA Highway Drive-cycle



PERFORMANCE TESTING & EVALUATION

EPA Highway Drive-cycle



CONCLUSION

- × The Team has designed and tested a functioning control system for a Hybrid Vehicle.
- × We would like to say thank you to:

Sponsors

General Motors, Department of Energy, dSPACE Inc.,
Mathworks

Faculty and Advisors

Dr. Charles Kim, Dr. Grant Warner, Dr. James Hammond &
Dr. Ganley

Colleagues

The entire Senior Design Class

QUESTIONS?