Advanced Vehicle Testing Activity Data Collection Overview

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Presentation Outline

• Introduction to the Advanced Vehicle Testing Activity
• Testing and On-Road Data Collection Sequence
• Vehicle Performance Testing
• Fleet Data Collection
• On-Road Data Collection
• Component Testing
• Reporting
Introduction

• INL manages the Advanced Vehicle Testing Activity for the United States Department of Energy

• Test vehicles with high petroleum reduction potential
  – Electric Vehicles (Full size, urban, and neighborhood)
  – Plug-In Hybrid Electric
  – Hybrid Electric & Idle-Stop
  – Alternative Fuel (CNG, H₂)
  – Advanced Internal Combustion

• Test and report on
  – Vehicle performance
  – Fuel and electricity consumption
  – On-Road Operation
  – Ownership cost & maintenance
  – Battery performance and aging
Testing & Data Collection Sequence

1. Purchase Vehicle (4 of each make/model)
2. Install On-Board Data Logger
   - 4,000 Miles for Break-In
3. Track Performance and Coast Down Testing
4. Dynamometer Testing
5. Data Collection During Fleet Operation

EV end-of-test: 60,000 Miles
PHEV end-of-test: 195,000 Miles
HEV, ICE end-of-test: 255,000 Miles

Try to capture failure modes
Vehicle Performance Tests

• Closed Track Performance Tests
  – 0-60 mph, ¼ mile, 1 mile acceleration
  – Coast Down for road-load determination
  – Braking
  – Battery transients during tests
  – Testing performed by ETEC Labs

• Chassis Dynamometer Tests
  – Drive cycle based fuel economy or energy consumption/range
    • UDDS, HWFET, US06, SC03 (US EPA Cycles) at 20°F, 72°F, 95°F
  – Steady-state speed fuel economy/energy consumption, gradeability
  – Testing performed by Argonne National Laboratory
Fleet Data - Fuel & Electricity

- Fuel dispensed for each vehicle is logged by fleet operator by date and odometer reading
- Electricity metered by Blink EVSE, collected from Blink database, with unique access cards for each vehicle
Fleet Data – Maintenance and Costs

- Maintenance is recorded and compiled
- Reports detail every maintenance item
- Operating costs based on purchase price, fuel costs, maintenance costs, insurance, and state registration
On Road Data Collection

• Data is collected, second-by-second for each drive by a mixture of OBD-2 and ‘Normal’ CAN messages.
  - Speed
  - Engine speed
  - Fuel consumption
  - Battery current
  - Battery voltage
  - Battery temperature
  - Air conditioning usage
  - Coolant temperature
  - Ambient temperature
  - Catalyst temperature
  - Brake on/off
  - Accelerator pedal position

• Charging data is also collected for Plug-In Electric Vehicles.

• Other interesting data is collected, as available, depending on the vehicle
  - i.e. electric motor torque, electric motor speed, transmission gear, brake pressure, etc
Component Testing - Battery

• Batteries are baseline tested in the laboratory after break in (4,000 Miles)

• Interim tests occur at 6, 18, 30 months from baseline

• Final lab test at the end of mileage accumulation

• Tests based on United States Advanced Battery Consortium (USABC) standard test manuals
  - Constant current capacity test
  - Pulse power characterization
Reporting

- Reports all link to database
  - Baseline Performance Testing
  - Fleet Testing Fuel Economy
  - Maintenance History
  - On-Road Performance Results
  - Battery Report
  - Fact Sheet
  - Other reports for focused analysis
Summary

• Vehicles are performance tested when new
• Sub-components of interest are lab tested on intervals
• Vehicle on-board data gathered for duration of fleet deployment
• All data in databases
• Reports generated from multiple databases
• Signal validation and data quality assurance processes produce reliable results