

PHEV Parcel Delivery Truck Model – Development and Preliminary Results



Hybrid Truck Users Forum

October 28, 2009

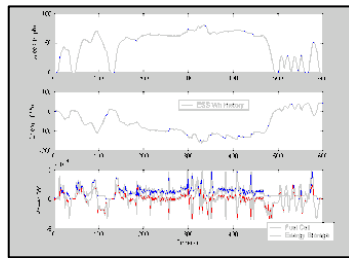
**Robb Barnitt
NREL**

Project Goals



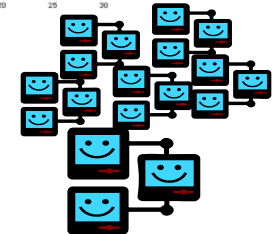
Project Design

Laboratory Testing



Modeling and Simulation

Validation



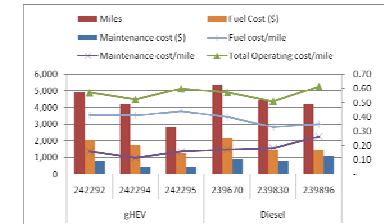
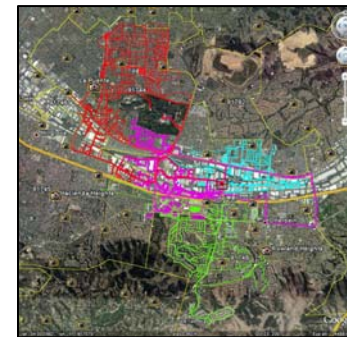
	Start	Event Rectangles & Sample	End/Status
Iteration 1	•	•	•
Iteration 2	•	•	•
Iteration 3	•	•	•

Calibration

Stakeholders

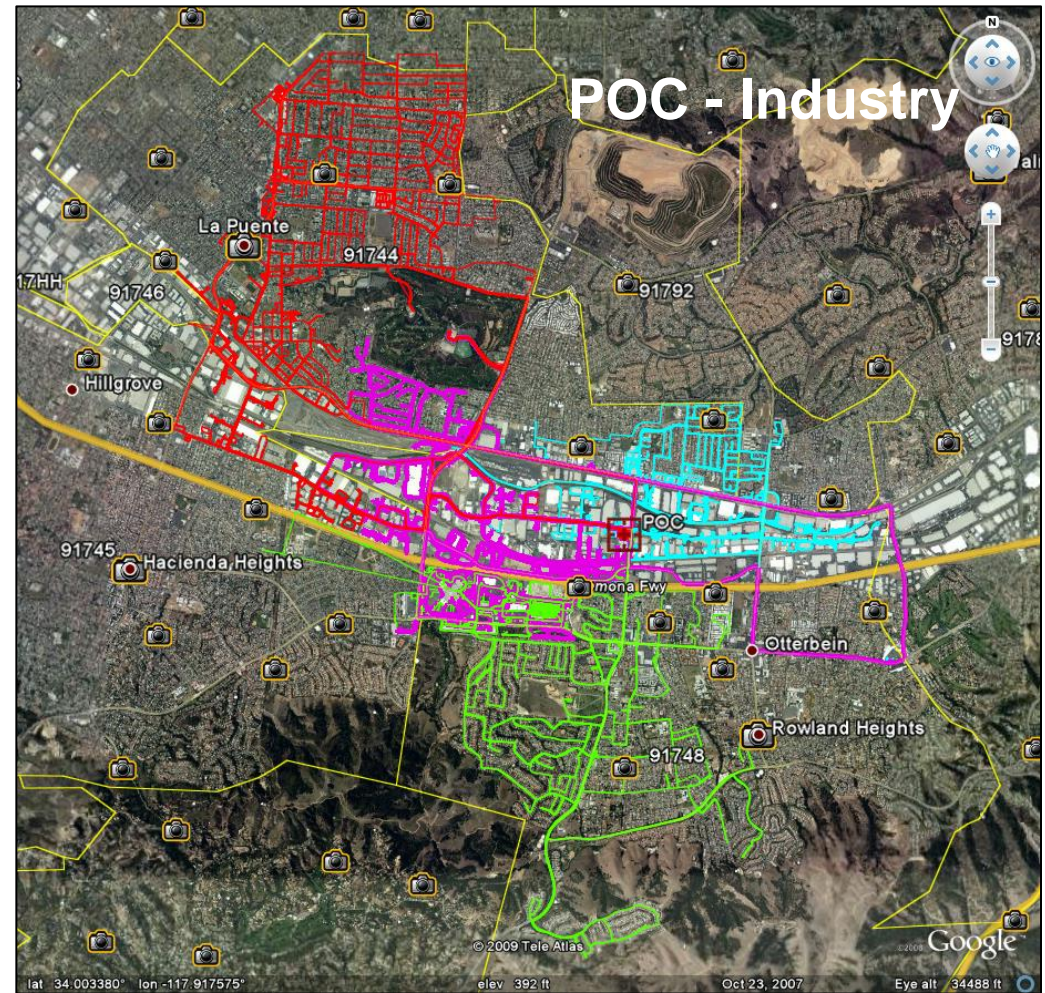
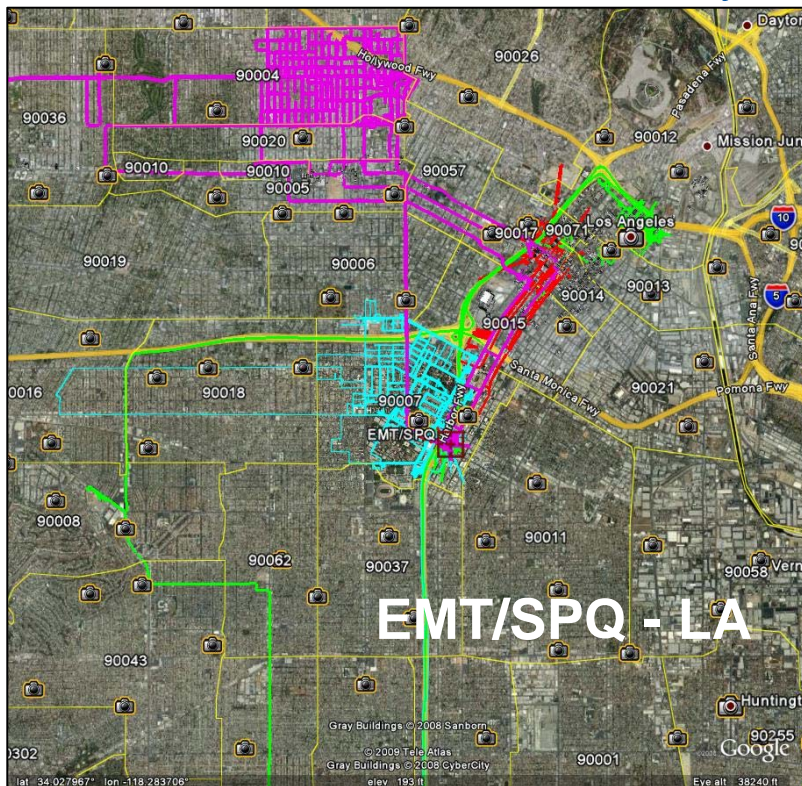


In-use Evaluation



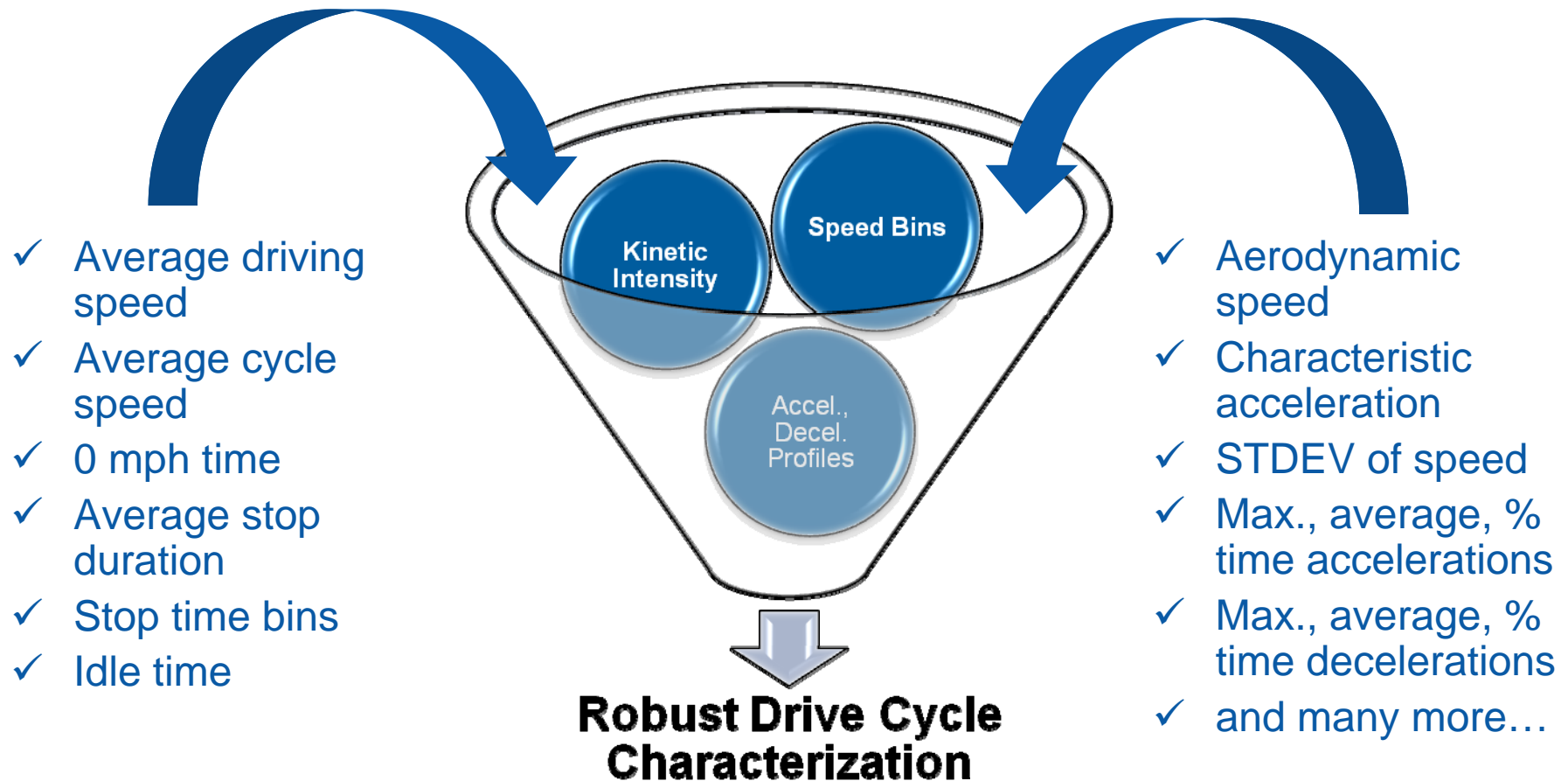
Route Visualization

- Latitude/longitude/speed data filtered, visualized using Google Earth to more completely understand vehicle usage
- Key considerations:
 - Screen out off-days
 - Day-to-day consistency
 - Route “zone” exclusivity

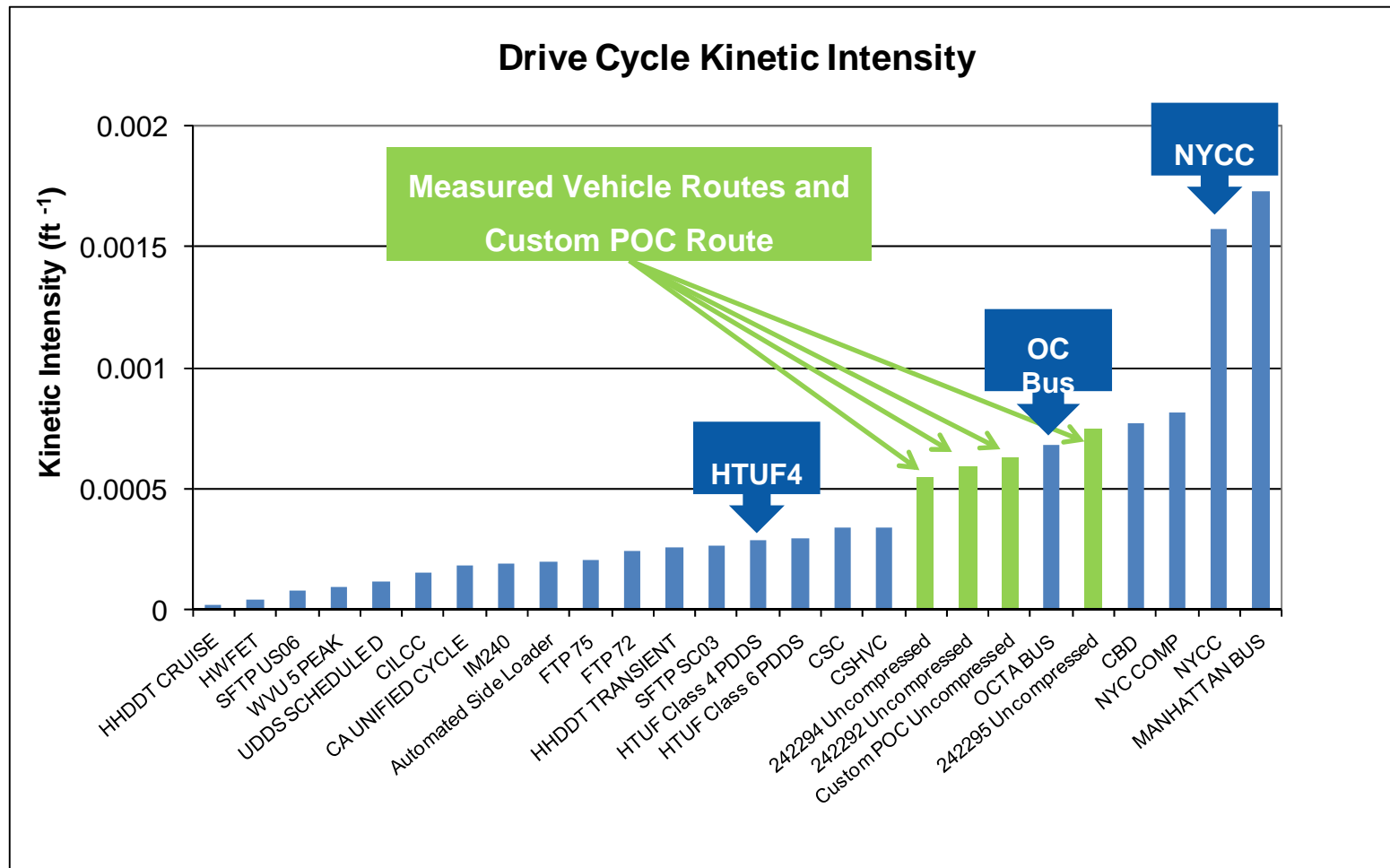


Drive Cycle Analysis

- Drive cycle comparisons based on average speed and stops/mile lack resolution and precision
- NREL performed comparative analysis of all 62 days of data over 55 drive cycle characteristics



ReFUEL Test Cycle Selection



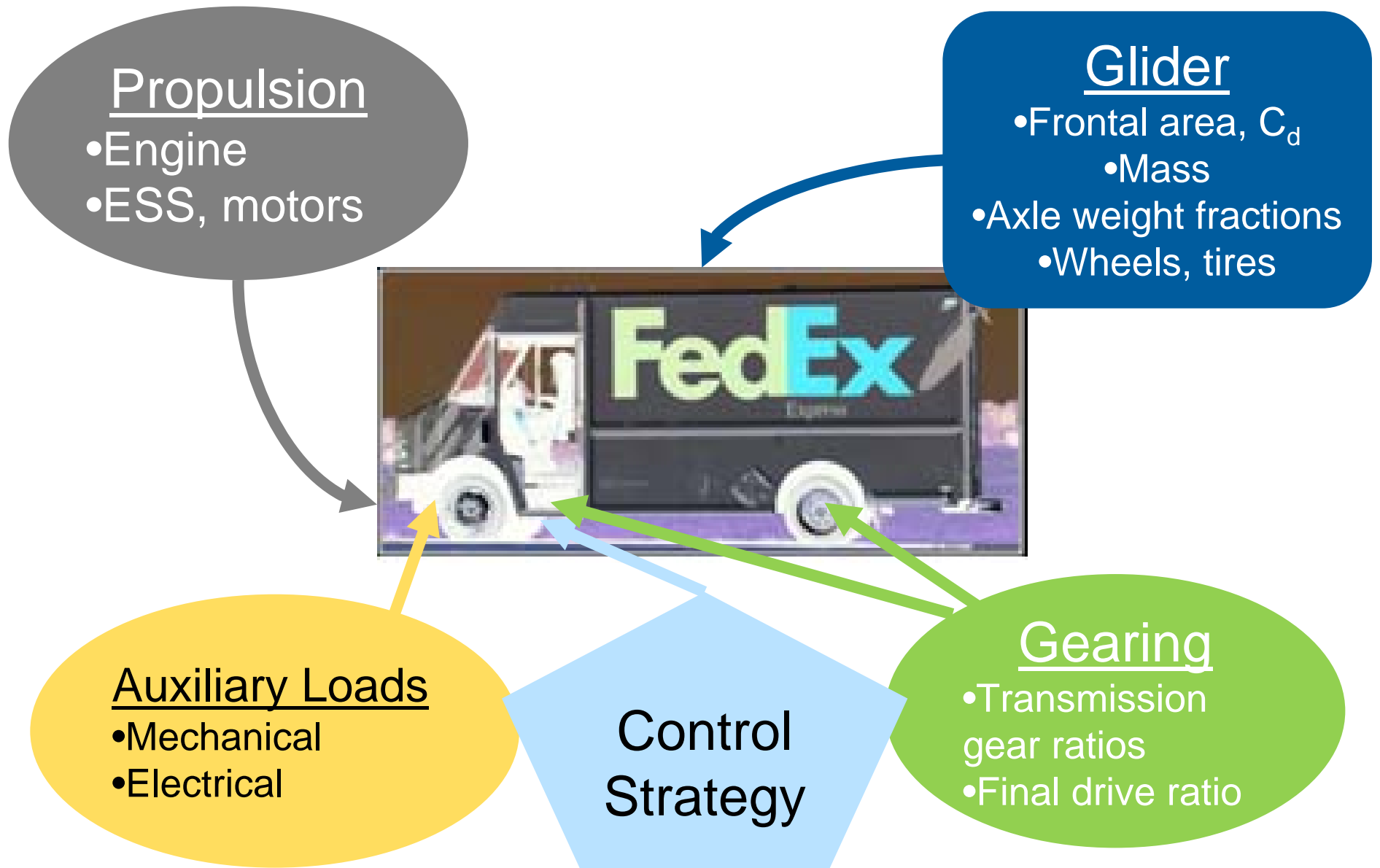
- HTUF4 and NYCC represent “boundary cycles”
- OC Bus cycle most closely matches Custom POC data

Preliminary FE (ReFUEL)

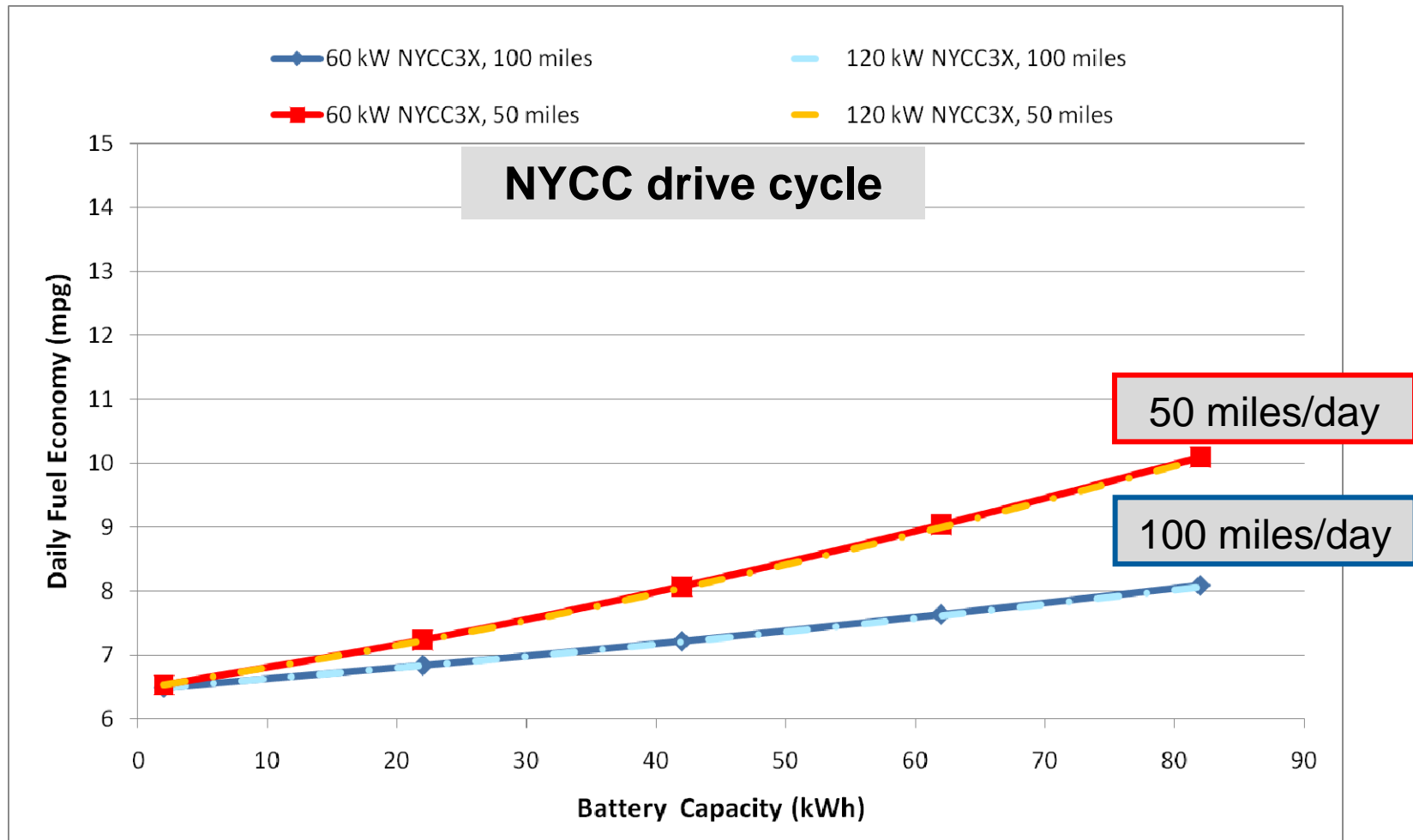


Drive Cycle	gHEV FE (mpg)
HTUF4	10.5
Orange County Bus	8.6
NYCC	6.8

Parcel Delivery Model Development

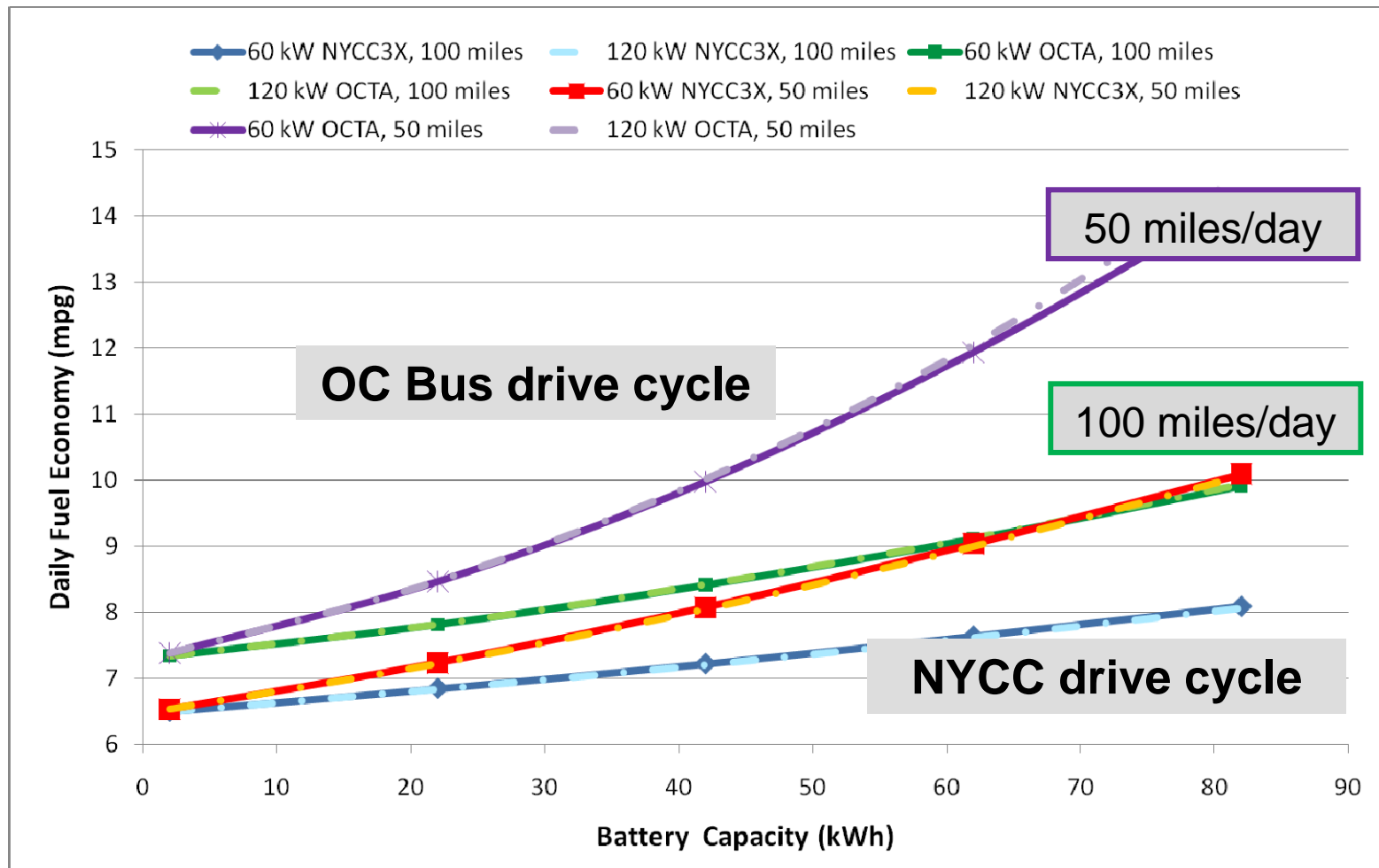


Preliminary Simulation Results



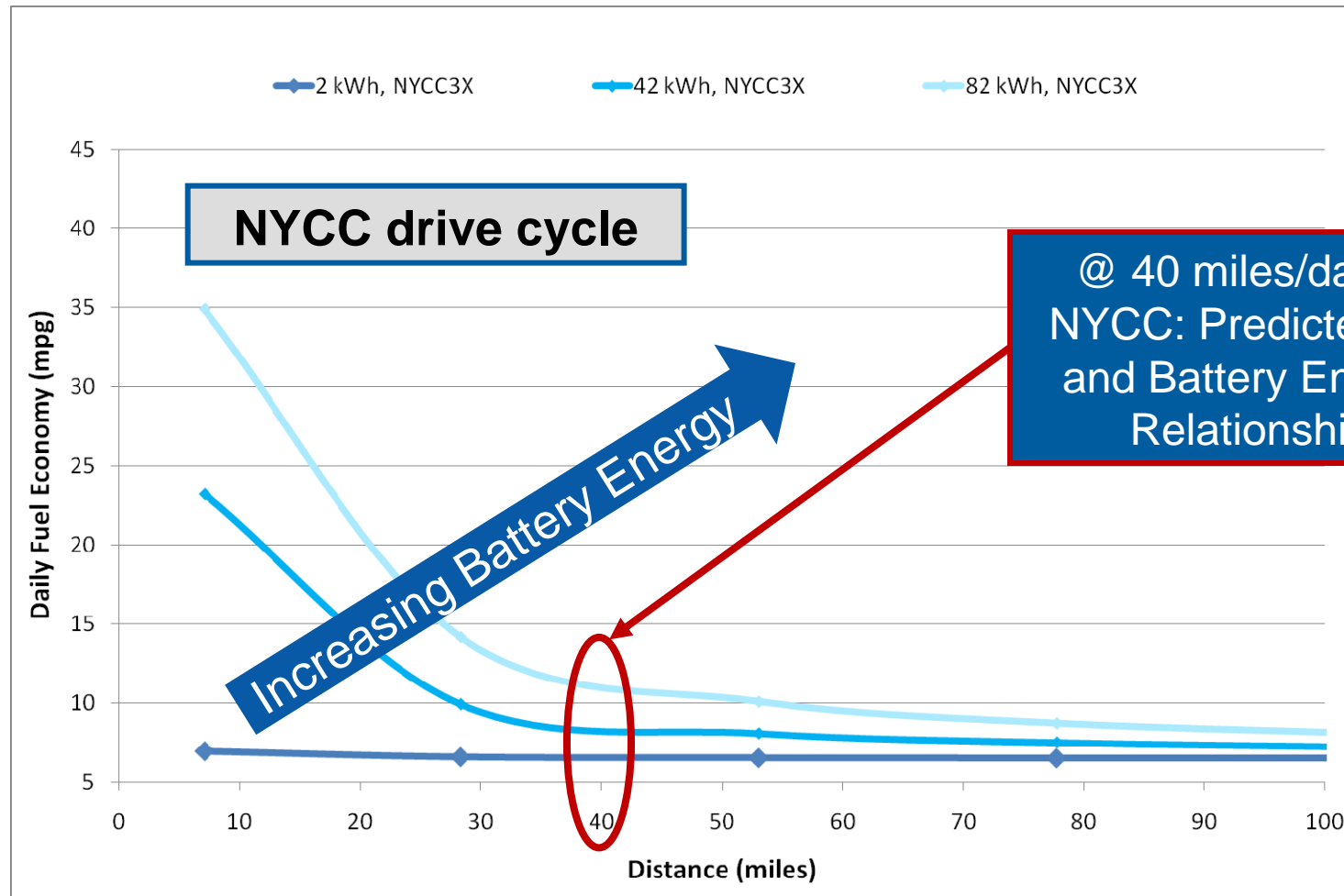
- 60 kW is plenty for vehicle and route
- Daily distance traveled matters!

Preliminary Simulation Results



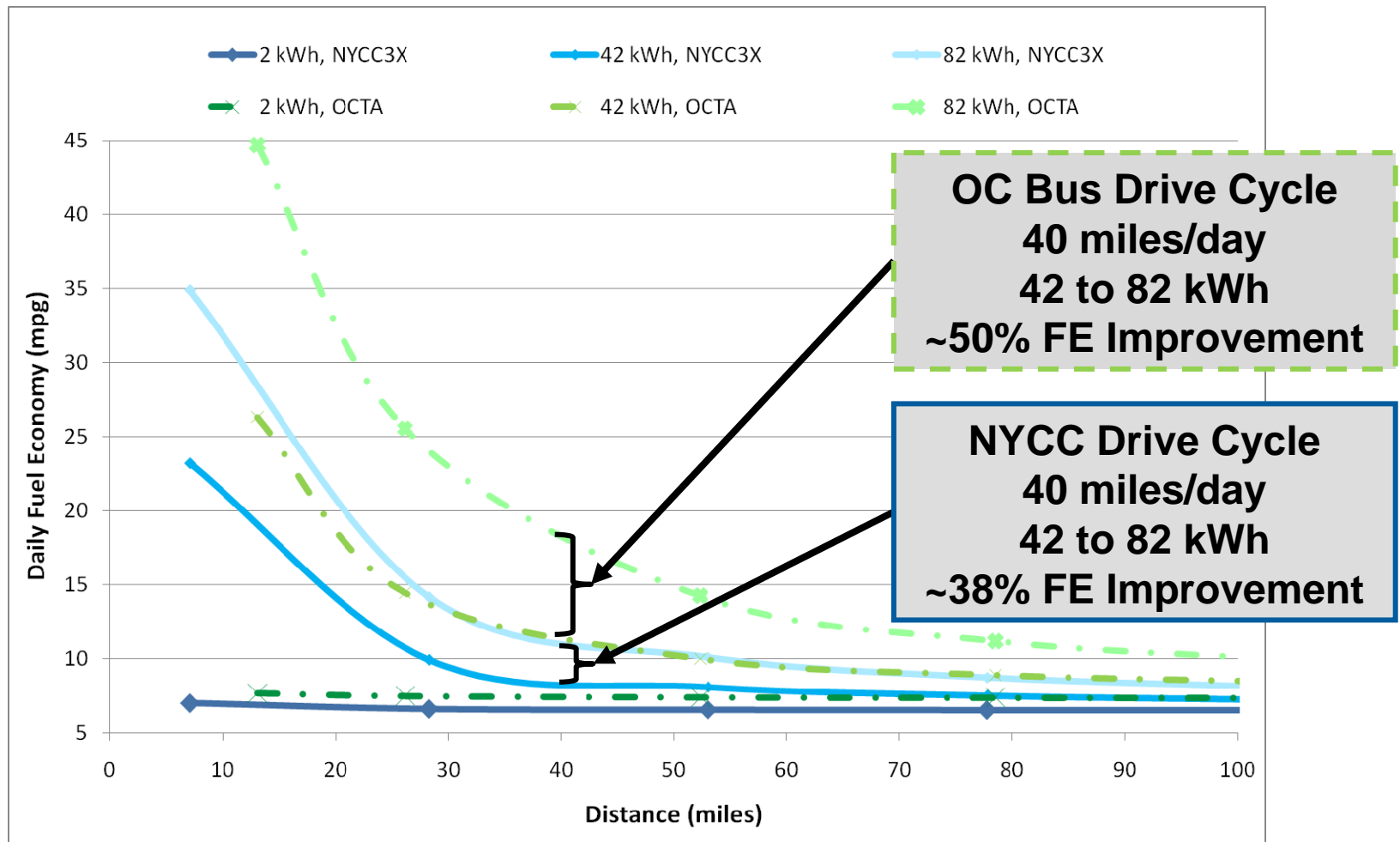
- Duty cycle matters!
- Daily distance traveled matters!

Preliminary Simulation Results



- Daily distance traveled matters!
- Diminishing returns: larger battery capacity with dVMT

Preliminary Simulation Results



- Duty cycle and dVMT influence capacity decision
- dVMT and lifetime mileage drive ROI

Key Points

- GPS-based route logging, when properly analyzed, allows for effective comparison of existing standard drive cycles and real-world data based drive cycles
 - Allows for **selection of relevant drive cycles** for chassis dyno test programs and vehicle simulations, and better matching of vehicle groups in field evaluations
- Validated vehicle platform model allows for more precise exploration of design-performance tradeoffs
- Knowledge of **drive cycle, daily miles traveled** is critical in assessing **PHEV battery tradeoffs**
 - Increased capacity for improved daily fuel economy
 - Diminishing returns with daily distance traveled
 - Vehicle lifetime mileage also drives ROI

Future Work

1. Vocational and route power and energy requirements
 - Traction
 - Work site
2. AER and blended CD strategies
3. Engine usage changes and emissions impacts
4. Economics
5. Next two platforms.....



Thanks to:

Jeff Cox – South Coast AQMD

Jasna Tomic - Calstart

Lee Slezak – US DOE Vehicle Technologies
Program

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