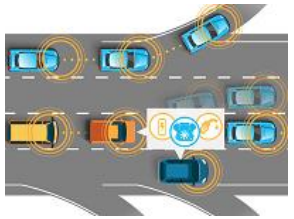
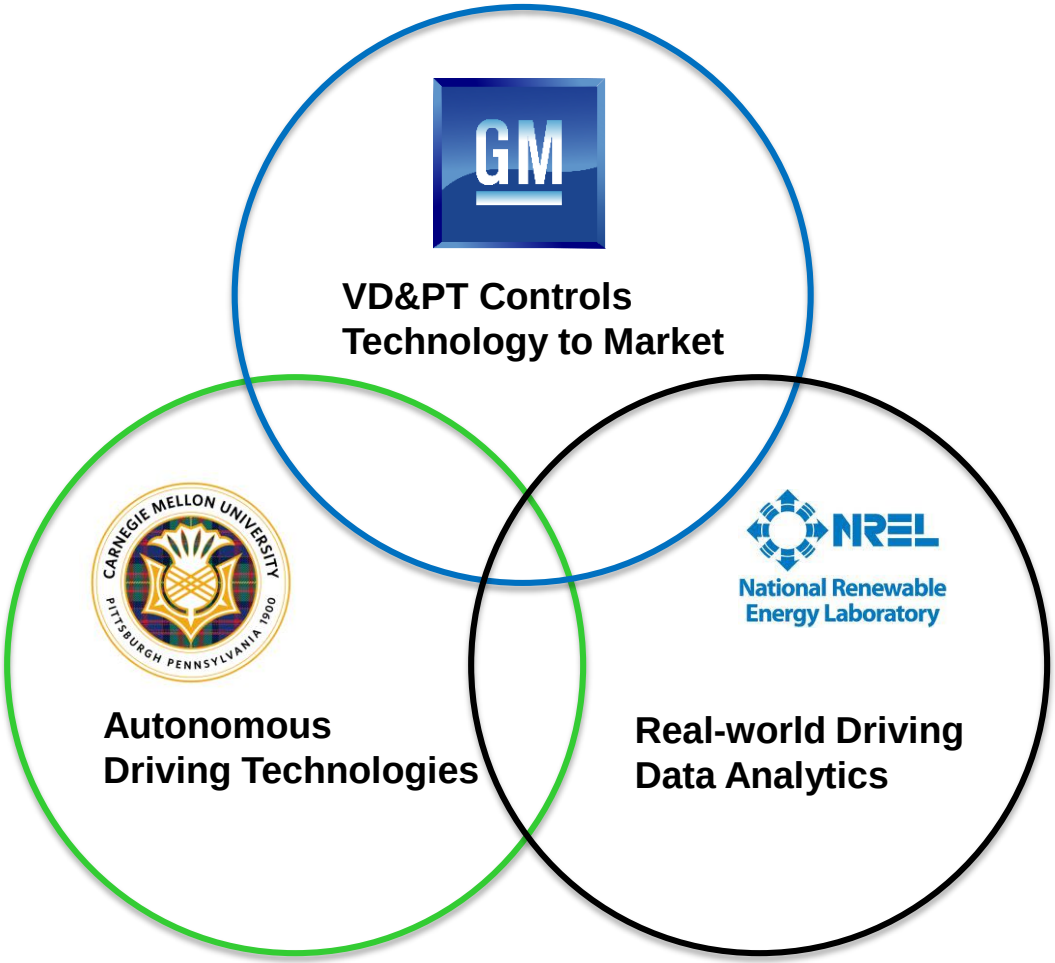
InfoRich VD&PT Controls

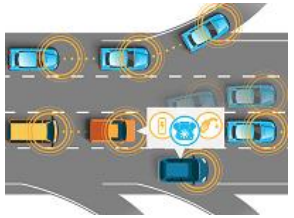
General Motors

Chen-Fang Chang, R&D Lab Group Manager



Team


GM
VD&PT Controls
Technology to Market
CARNEGIE MELLON UNIVERSITY
PITTSBURGH PENNSYLVANIA 1900
Autonomous
Driving Technologies
NREL
National Renewable
Energy Laboratory
Real-world Driving
Data Analytics



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Technology

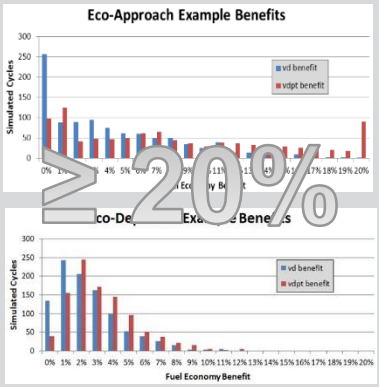
Technology Summary

- Develop novel vehicle dynamics and powertrain (VD&PT) control technologies that incorporate the **preview information** from connectivity and on-board sensors.
- Explore the energy saving potentials of connected and automated vehicles (CAVs) through **co-optimization** of the vehicle dynamics and powertrain operations.

Technology Impact

- Reduce fuel consumption by ≥20% under **real-world driving scenarios** against a 2017 baseline production vehicle (Cadillac CT6)
- Large deployment of CAVs with this technology will greatly reduce energy footprint and energy-related emissions from automobiles

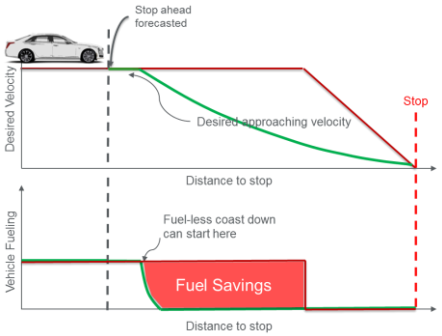
An integrated vehicle and powertrain solution!



Four Applications

Eco-Approach

- Maximize the kinetic energy recovery through the use of preview information by coordinating vehicle speed control and various powertrain fuel-saving features (DFCO*, AFM#, gear selection, stop/start, etc.)



Eco-Departure

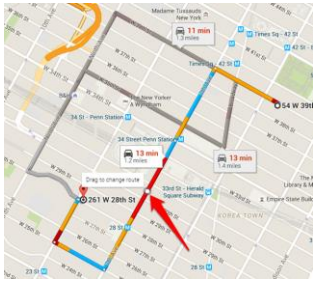
- Optimize vehicle departing acceleration profile and powertrain control calibration to maximize efficiency

Eco-Cruise

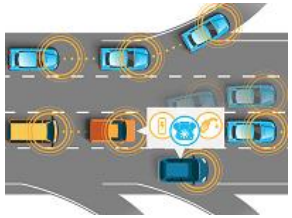
- Optimize powertrain operation to maximize efficiency based on look-ahead road grade and traffic conditions

Eco-Routing

- Select route that minimizes fuel consumption based on vehicle-specific powertrain characteristics without compromising travel time



*DFCO – Deceleration Fuel Cut Off
#AFM – Active Fuel Management

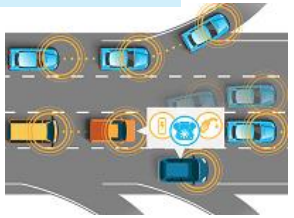


Technology-to-Market approach

T2M tasks will follow the suggested ARPA-E template:

- The GM NEXTCAR project team will use the T2M milestones for scheduled discussions with GM's Technology Innovation Team

WBS	Task Title	Quarters 1 2 3 4 5 6 7 8 9 10 11 12
5	Technology Transfer & Outreach	
5.1	Technology to Market Point of Contact	
5.2	Technology-to-Market (T2M)	
5.3	Commercialization Readiness	
5.4	Customer Engagement	
5.5	Operational Strategy	
5.6	Qualitative Cost-Performance Model	
5.7	Intellectual Property (IP)	
5.8	Identify Potential Resources	
5.9	Regulatory Issues	
5.10	Pitch Plan	



Key Challenges

Modeling & Simulation

- Joint simulation of vehicle, control, infrastructure, and traffic
- Quantifying control impacts on some test factors (e.g., CAV tech penetration rate)
- Real-world fuel economy assessment metrics
- Random behavior of vehicle drivers

Controls

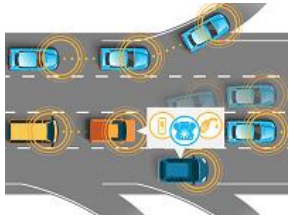
- Information fusion strategy that integrates V2X and on-board sensors
- Flexible control architecture that can accommodate different powertrain types, sensing capability, and levels of connectivity

Implementation & Demonstration

- Repeatability of field testing
- Safety measures for vehicle demonstration on public roads

Commercialization

- Off-cycle credit as OEM incentive for commercializing CAV technology
- Cadence of technology introduction based on CAV technology penetration rate and customer acceptance



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