



PRESENTATION TOPICS

1. US PHASE 2
 2. FOR PHASE 2 AND BEYOND
 - Including trailers
 - Certification approaches
 - Rules around the world
 - Harmonization, or lack of it
 - Future timeframes
 3. A BRIEF LOOK AT SWRI'S PHASE 2 PROJECT FOR NHTSA
 - Project scope
 - A few preliminary results
-

US Phase 2 Regulations

EPA and NHTSA are working towards a Phase 2 regulation

- New certification methods are possible
- GEM will be upgraded
- Trailers might be included
- New targets



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Including Trailers

For tractor-trailer trucks, trailers have a significant effect on vehicle fuel consumption

- Aerodynamics
- Tire rolling resistance
- A SmartWay trailer is 8 – 10% better than “conventional” at 65 MPH cruise

Fuel purchasers and trailer owners are often not matched

Tractor designers will choose different aerodynamic features, depending on trailer aero

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Certification Approaches

Today:

- Engine dyno test for engine certification
- GEM for vehicle certification

Future options:

- Powertrain in a test cell, with simulated vehicle power demand input
- Component testing
- Vehicle testing and simulation
 - On road
 - Chassis dyno
 - Simulation of feature performance

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Rules Around the World - China

Chassis dyno test on modified WTV

- Variants of a basic vehicle can be chassis dyno tested or simulated
- Overall vehicle fuel consumption is measured (liters/100km)

Weighting of urban, rural, and motorway segments is a function of vehicle type

Stage 1 in July 2014

Stage 2 in July 2015

Beijing is working on its own, more stringent requirements, based on the same approach

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Rules Around the World - Japan

Japan – Top Runner program

- Efficiency technology descriptions required since 2006
- Full implementation in 2015
- 9 – 15% improvement target over 2002 fuel economy
- Simulation model for certification
 - Cd, Crr, and vehicle weight specified by regulators
 - JE05 and “Interurban with grade” drive cycles, with a weighted average to determine compliance
- Effectively, a regulation on engine efficiency and transmission match
 - Everything else is held constant

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Rules Around the World - EU

VECTO simulation tool is under development

VECTO uses:

- Engine maps from dyno testing
- Cd from a constant speed on-road test
- Crr from ISO 18164 and 28580 tire tests
- Transmission ratios and efficiency by gear from manufacturer
- Auxiliary system power demand from test maps or regulator-provided standard values

Labeling requirement expected in 2016

Actual regulation TBD – fuel price is a huge incentive

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Rules Around the World – US & Canada

Engine certification for fuel consumption and GHG per unit work

- FTP cycle for most truck engines
- SET for long haul truck engines

Vehicle certification using GEM

- Most trucks have only a Crr requirement
- Long haul trucks include Cd, Crr, weight reduction features, idle reduction features, road speed governors
- Trailers are NOT yet included, on-off road exemption

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Rules Around the World – US & Canada

Phase 1 took effect in January 2014

- OEMs were allowed to certify in 2013 and bank credits, which most did

Final step of Phase 1 takes effect in 2017

- Engine requirements become 3% more stringent
- Vehicle requirements do not change

Phase 2 is under development

- Expected to take effect after 2019



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Harmonization, Anyone?

The harmonization situation for fuel efficiency is far worse than for emissions

Everyone is on very different, diverging paths

The wide range in regulatory approaches risks pushing different technology solutions in each market

There seems to be little government interest in harmonization

- If industry wants it, it will be very hard to get

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Future Timeframes

In the US, a National Academy of Science committee is already preparing to look at technologies for potential Phase 3 regulations

- Post 2022 outlook
- Public report due in late 2015

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SwRI Projects for US Phase 2 Regulations

For the EPA:

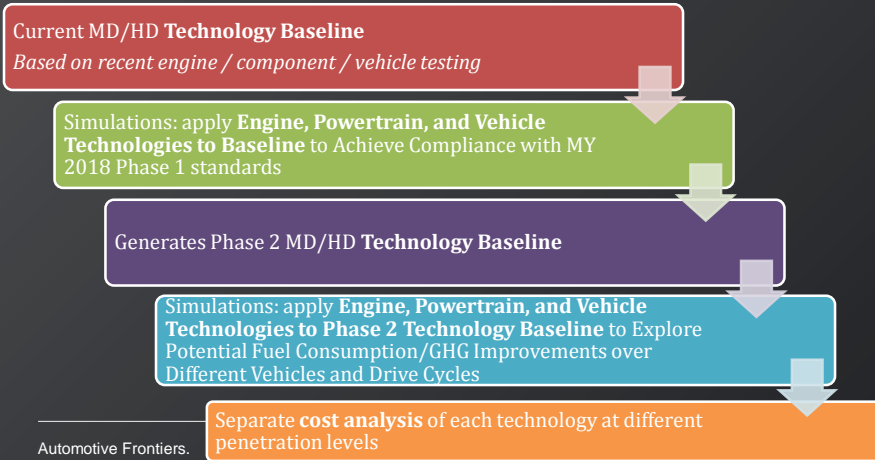
- Comparison of on-road, chassis dyno, and powertrain in a test cell certification methods
- Upgrade of GEM

SwRI Projects for US Phase 2 Regulations

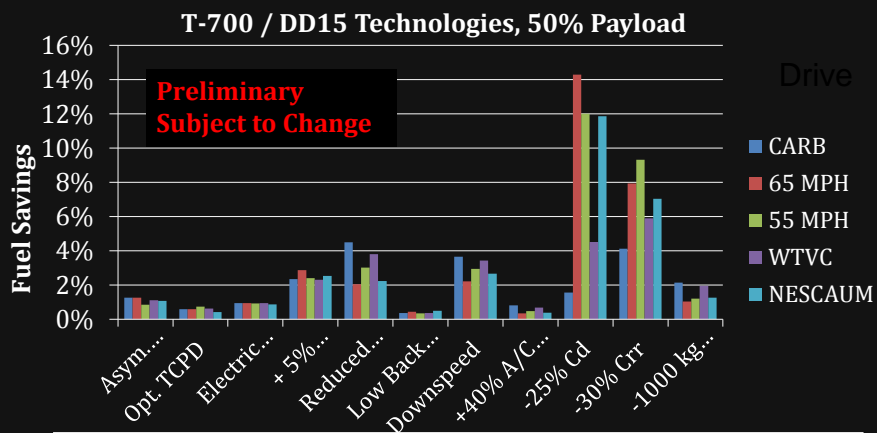
For NHTSA:

- Evaluate the effectiveness of potential HD vehicle technologies on fuel consumption and cost at various penetration levels
 - Technologies
 - » Engine technologies
 - » Powertrain technologies
 - » Tractor and vehicle technologies
 - » Trailer technologies
 - Vehicle classes
 - » HD pickups (Class 2b and 3)
 - » Class 8 Tractor / Trailers
 - » Vocational (Classes 2b through 8)

SwRI Projects for US Phase 2 Regulations



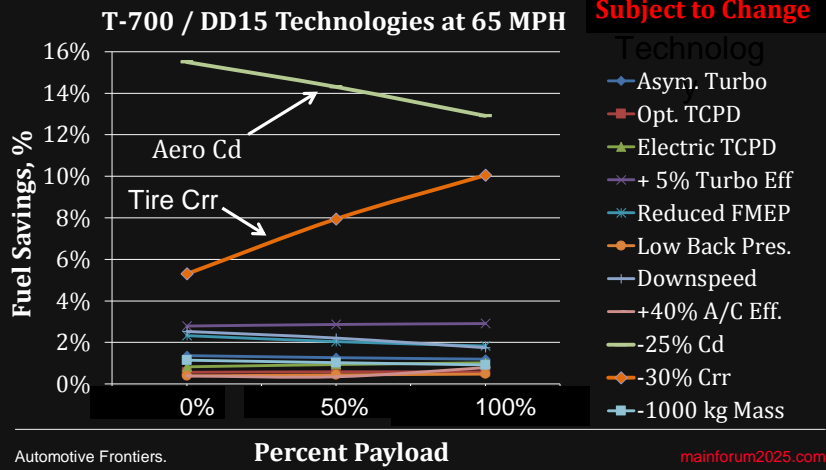
Sample Preliminary Results



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Sample Preliminary Results





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