

# DAIMLER

## OSU / Daimler Truck Research Lab

Derek Rotz

Oregon House Energy and Environment Committee

June 2<sup>nd</sup>, 2015



Mercedes-Benz



FUSO



WESTERN STAR

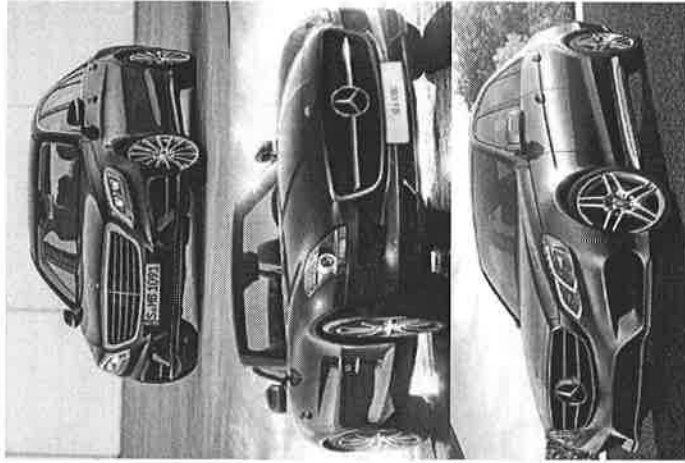


BHARATBENZ

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## Daimler AG

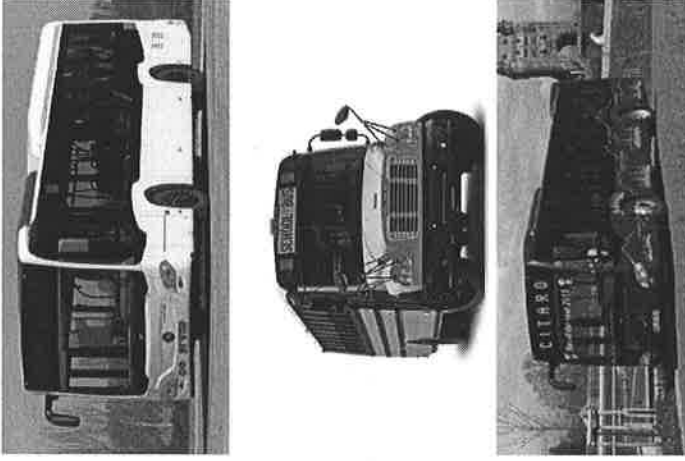
### Mercedes-Benz Cars



### Daimler Trucks &



### Daimler Buses



### Mercedes-Benz Vans



### Daimler Financial



# DAIMLER

## DAIMLER U.S. Sites, Revenue and Employees

DAIMLER locations across the USA

DTNA brands in the U.S.



**OR**  
Daimler Trucks HQ and  
Western Star Plant (4,549)  
Portland



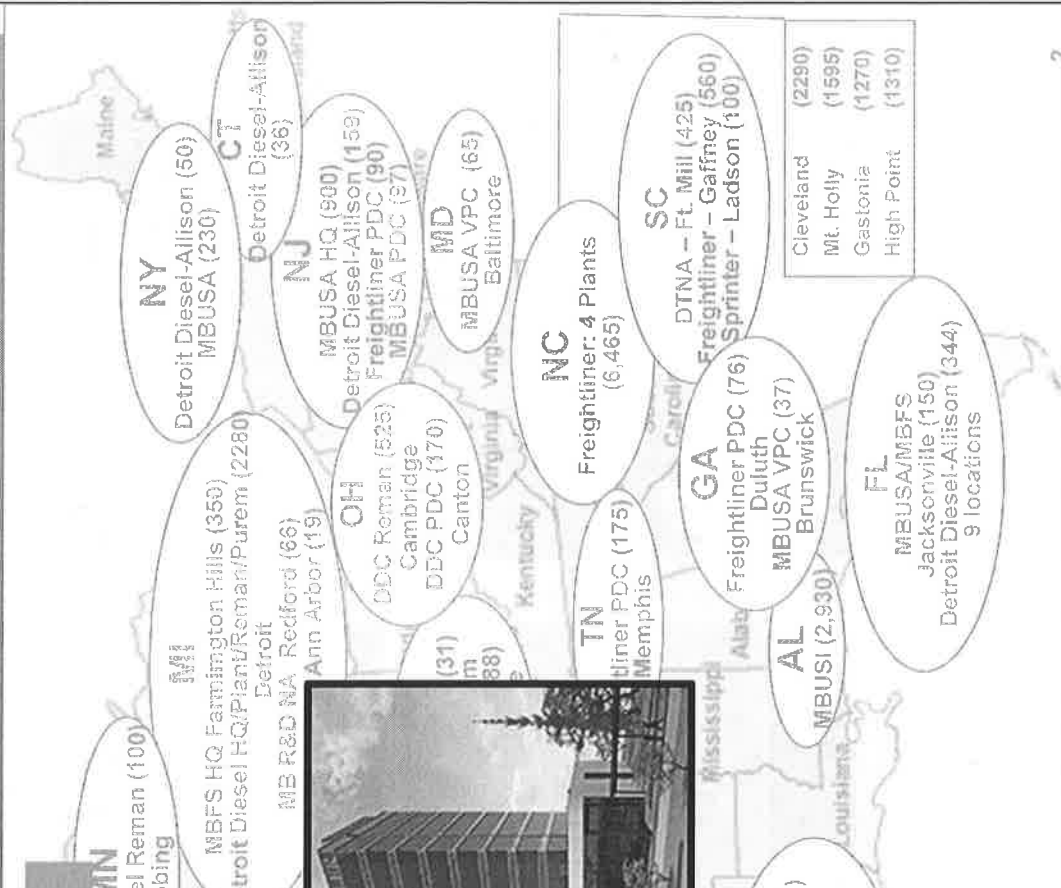
**NV**  
Freightliner PDC (40)  
Reno

**CA**  
M-B R&D NA (170)  
Palo Alto, Long Beach, Carlsbad  
M-B Driving Academy - Los Angeles  
MBUSA VPC - Los Angeles

**U.S. (2013)**

Revenue	\$39.4B
Employees	20,993

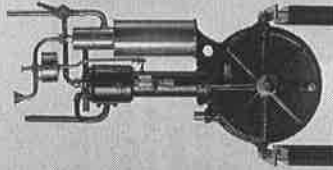
car2go: Austin - San Diego - Miami - Portland  
- Seattle - Washington, DC



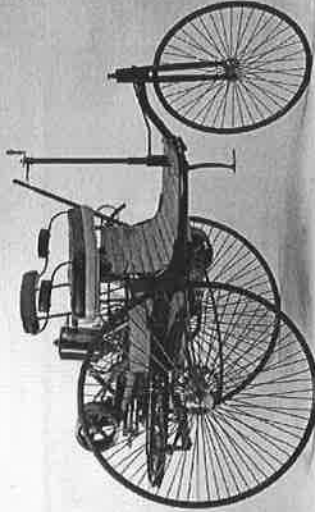
# DAIMLER

## Inventor of the Automobile and...

**1885** Gottlieb Daimler's invention of an upright single-cylinder four-stroke engine



**1886** Carl Benz's invention of a three-wheeled "Motorenwagen"



**1959** World's first safety body with robust passenger cell and integrated crumple zones for passenger car



**1978** World premiere of anti-lock braking system (ABS) for passenger cars  
First ABS for commercial vehicles in 1981



**1987** First acceleration skid control (ASR) system for commercial vehicles



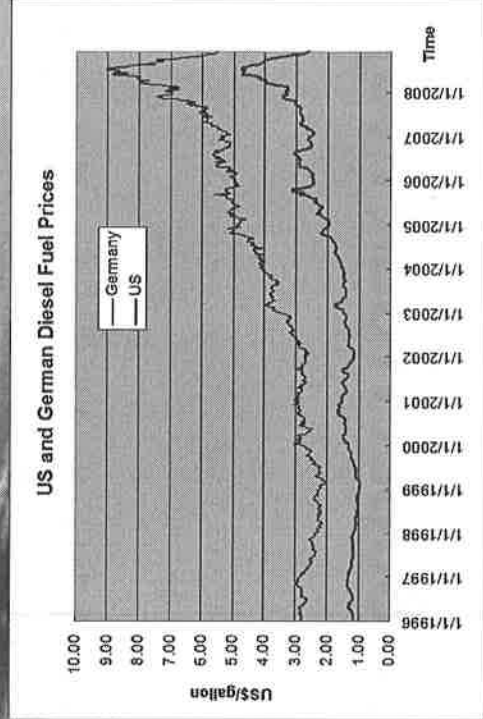
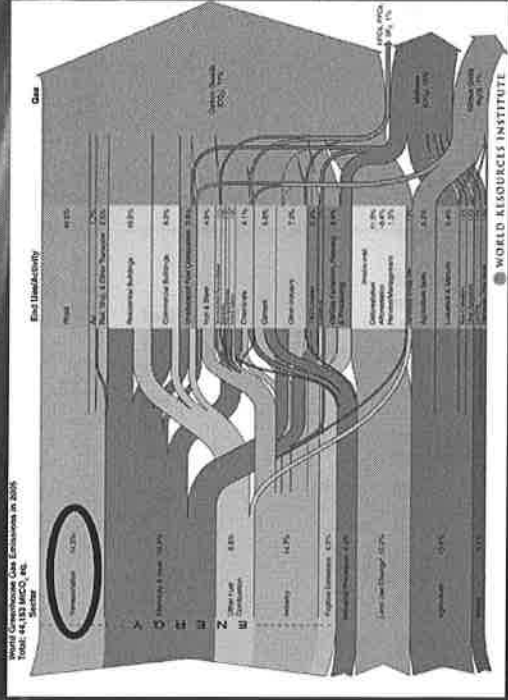
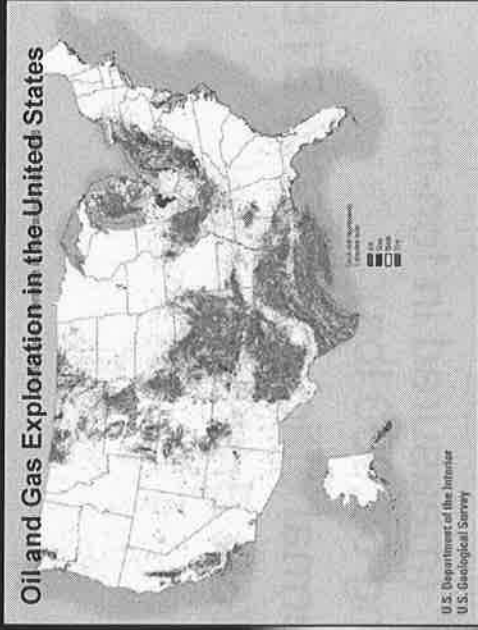
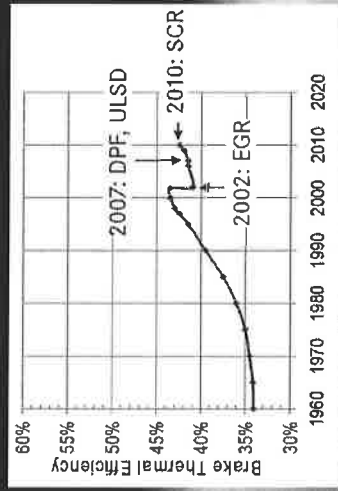
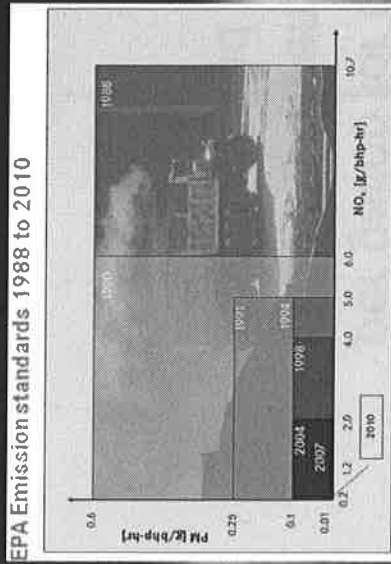
**2000** First Lane Keeping Assist system for trucks



Daimler Trucks North America ("DTNA") continues to maintain a strong commitment to the safety and fuel efficiency of our vehicles which support both economic productivity and to protect the human and natural environment. This is demonstrated by our history of being first to market with many safety technology systems including antilock brake systems in 1987, obstacle detection systems in 1996, driver airbags in 1998, stability control systems in 2002, lane departure warning systems in 2006, seat belt pre-tensioners and side airbag systems for rollover protection in 2007, and adaptive cruise control and collision avoidance systems in 2007.

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# Changed priorities - Transition from emission regulations to CO<sub>2</sub> footprint & fuel economy



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## **Department of Energy SuperTruck Project Goals**



### **Project Target**

Develop and demonstrate vehicle and advanced engine technology for Heavy-Duty Class 8 Trucks as follows:

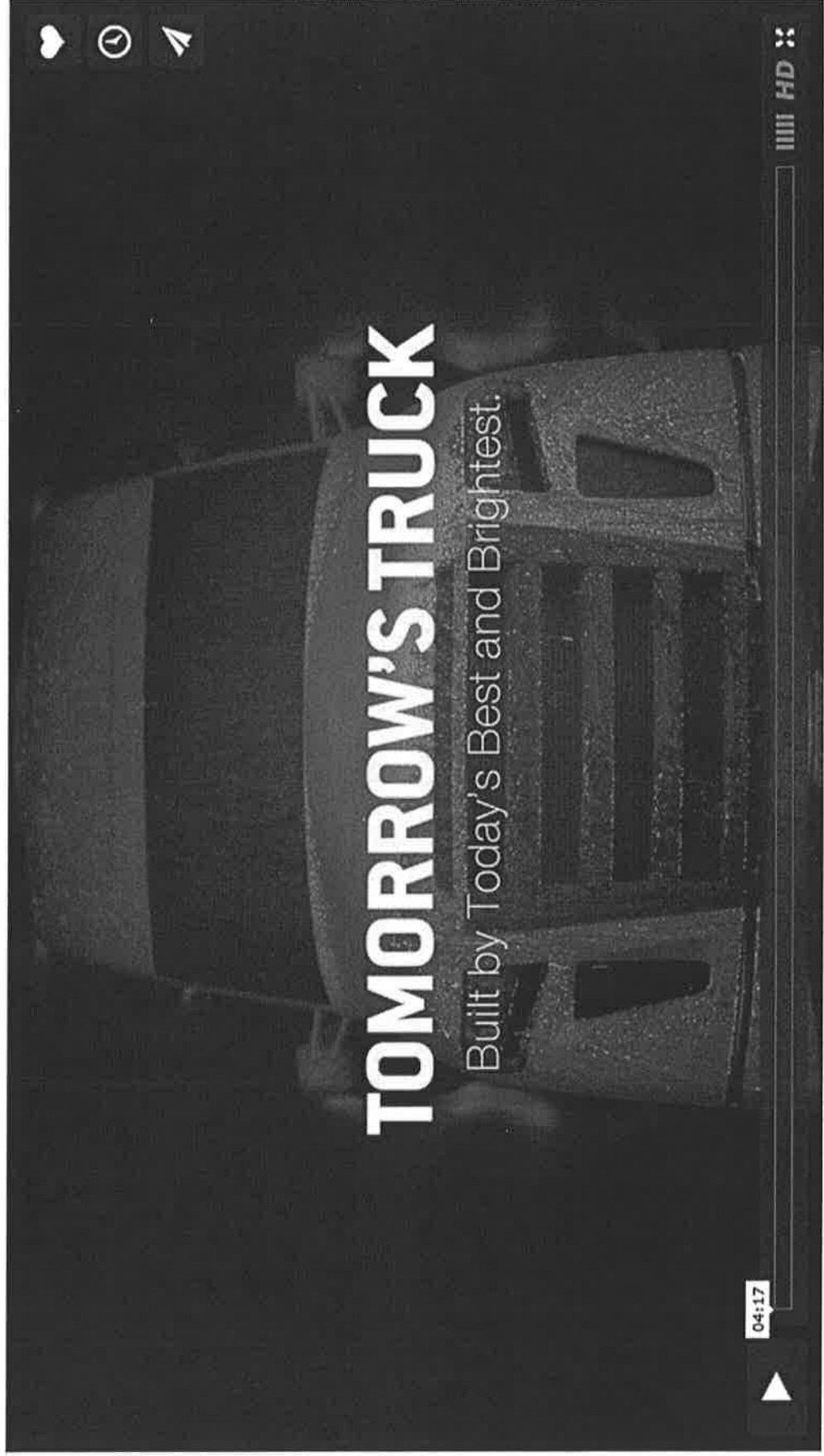
- 50% improvement in “freight efficiency” (measured in ton-miles per gallon for a Class 8 vehicle weighing 65,000 lbs)
- 20% improvement in “engine brake thermal efficiency” (50% BTE)
- Modeling and analysis for pathway to 55% Brake Thermal Efficiency

### **Funding**

- Federal awards: \$39.6M (with \$40M DT matching) over 5 years (2010-2015)
- Stimulus money awards based in part on number of jobs created or retained
- Pairing with partners or subcontractors encouraged

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## SuperTruck Video



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# Daimler Trucks has the Leading SuperTruck Results

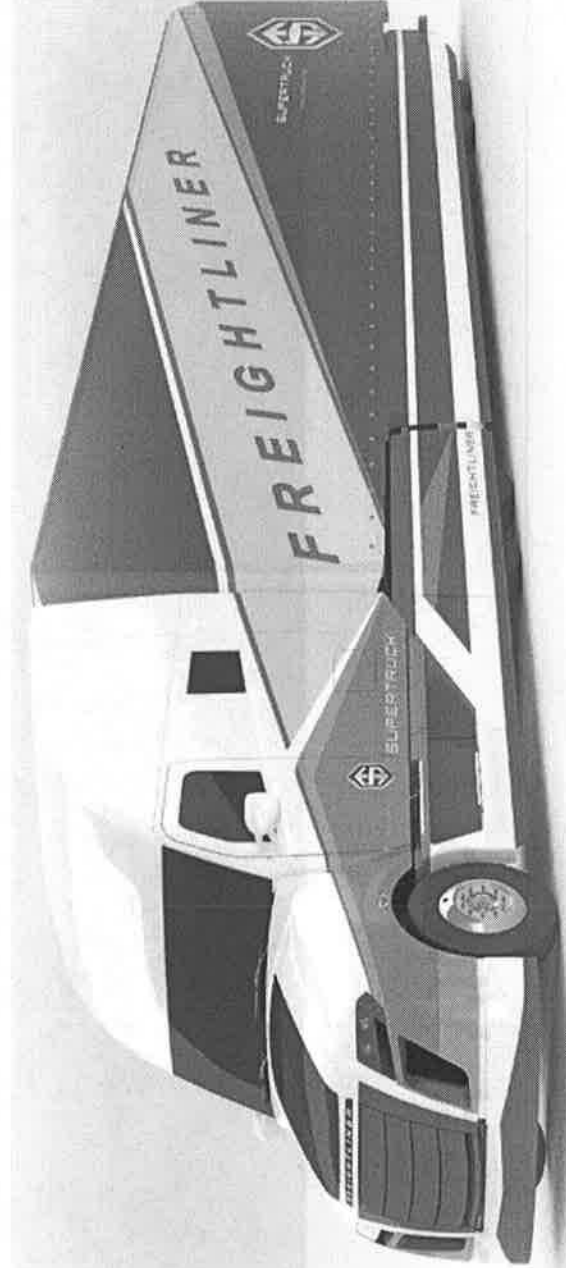
**115%**

Freight efficiency improvement

**12.2**  
**mpg**

**50.2%**

Brake thermal efficiency





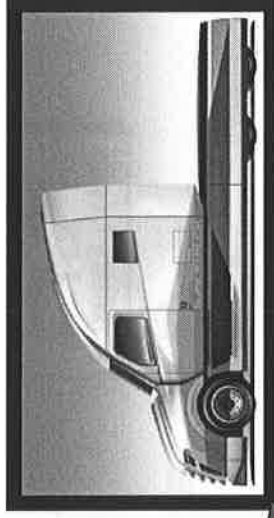
## Road to 50% Improvement

### A-Sample (Performance Test, April 2014)

- Aero hood, bumper, active grille
- Stock DD11 Engine, DT12 DD Trans. + eCoast
- Waste Heat Recovery (electrical expander & vehicle cooling)
- 6x2 Axle Config, 2.28:1 RAR + oil baffle
- GHC Hybrid B-sample (120kw eMotor, 360v, 2.4 kw-hr Li-Ion Bat)
- eHVAC (HV compressor, remote condensor, electrical fan)
- eMotor engine start
- Cab insulation package
- Clutched air compressor / electronic air control
- AccuSteer (closed center steering gear + a
- Low rolling resistance wide based single tire
- Thermal mgt. (variable speed fan, water pu
- Trailer aero., lightweighting and solar



A-Sample



Final Demonstrator

### Final Demonstrator (FE Test, Oct 2014 –

Jan 15)

#### A-Sample Technologies, plus...

- Full Tractor Aero
  - cab/sleeper, underbody, drive wheel fairing, mirror cam, steer wheel, full side extender
- 50% BTE DD11 Engine + WHR
- Predictive hybrid controller
- Predictive engine controller
- New final drive active oil management with FE gear oil
- Lightweight Aluminum Frame and cross members
- Ultra Lightweight Air Suspension
- Advanced Loadshift 6x2
- Solar reflective paint
- Enhanced Trailer aerodynamics



Tinker Trucks

# Energy Losses in Engine/Vehicle

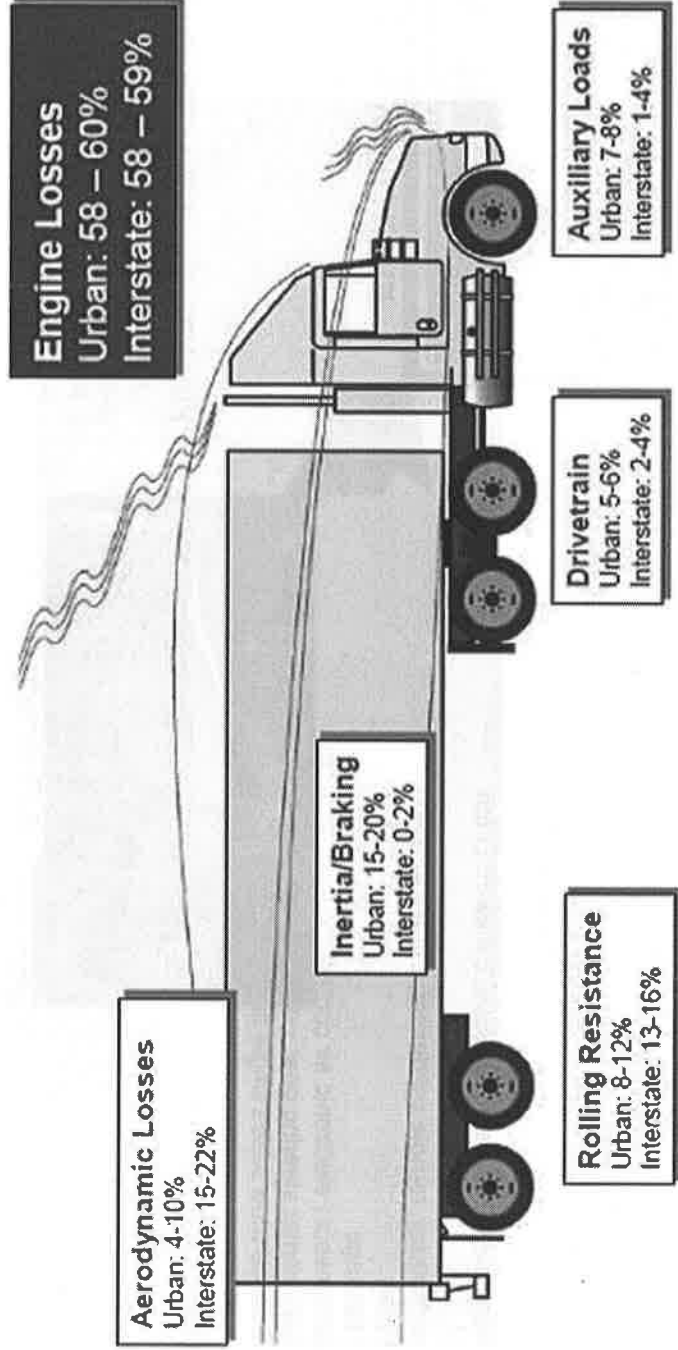


FIGURE 2-7. Energy “loss” range of vehicle attributes as impacted by duty cycle, on a level road.

Source: Technologies and Approaches to Reducing the Fuel Consumption of Medium and Heavy Duty Vehicles. National Research Council of the National Academies, 2010

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## Truck Research Lab

Oregon State University / Daimler Trucks North America

3-year pilot program proposed (Sept 2015 - June 2018)

- 2 Graduate fellowships
- Multiple undergraduate capstone programs (senior projects)

Research focus on fuel efficiency of Class 8 Trucks

### Daimler Commitments

- Definition research topics
- Gift of class 8 tractor (*incl. title transfer*)
- Access to relevant engineering data  
CAD
- Summer internships to graduate student

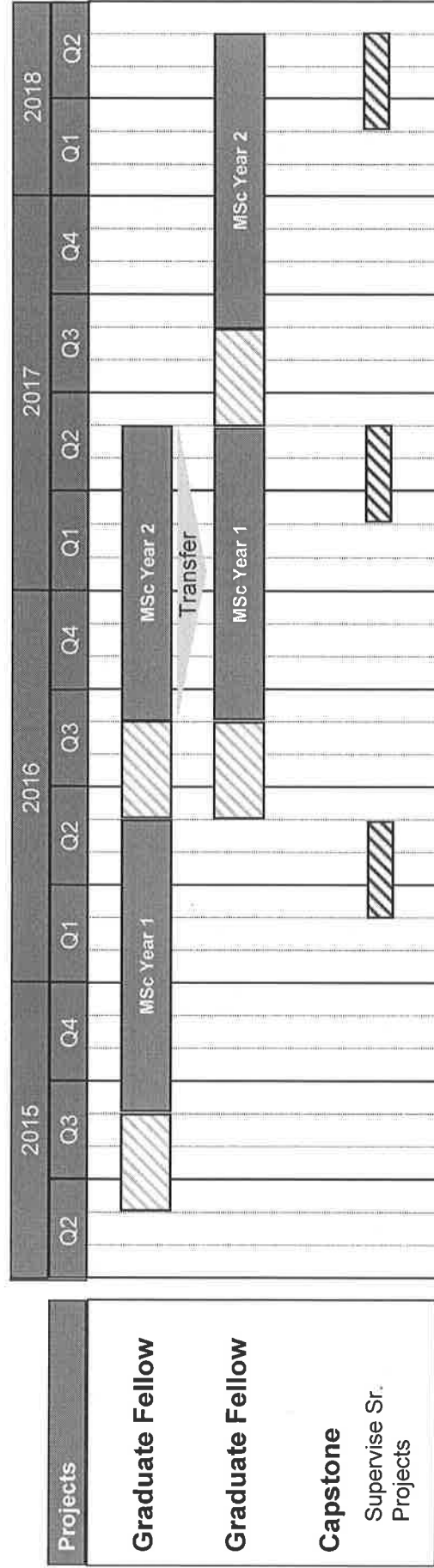
### OSU Commitments

- Provision of facilities for tractor and CAD systems (e.g. NX)
- Provision of tools and materials for parts fabrication
- Faculty oversees graduate students and facilities
- Coordinate and oversee undergraduate capstone programs

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# Three Year Daimler Oregon State University Proposal



**Legend**

- Truck Lab Setup and Research (Location: OSU)
- Summer Internship (Location: Daimler)
- Undergraduate senior project supervision (Location: OSU)