Medium to Heavy-Duty Trucks

Jointly Announced September 25, 2015

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An Opportunity to Increase Efficiency by 50%, Cut Oil Imports, Reduce Emissions & Meet Freight-Hauling Demands

U.S. M&H Truck Consortium
[Ongoing Competitive Solicitation; Selectee to be Announced, Summer 2016]

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July 1, 2016

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Heavy (Class 8) Truck Energy Balance

Tractor-Trailer Base Configuration

Average Payload	11,800 kg (26,000 lbs.)
Total Mass	27,220 kg (60,000 lbs.)
Fuel Use	14.7 gallons/1,000 ton-miles
Fuel Economy	5.8 mpg

Fuel Input	343 kW	*Engine Losses*	193 kW
		Idling Fuel Use	3.6 kW
Engine Output	146 kW	*Accessory Loads*	15 kW
		Drivetrain Losses	10 kW
Tractive Power	121 kW	*Aerodynamic Losses*	61 kW
		Rolling Resistance	44 kW
		Inertia/Braking Losses	16 kW

Configuration for Hi-Efficiency Goals

Average Payload	11,800 kg (26,000 lbs.)
Total Mass	25,220 kg (55,600 lbs.)
Fuel Use	9.0 gallons/1,000 ton-miles
Fuel Economy	9.4 mpg [+ 60% Gain]

Fuel Input	211 kW	*Engine Losses*	105 kW
		Idling Fuel Use	0.8 kW
Engine Output	105 kW	*Accessory Loads*	8 kW
		Drivetrain Losses	5 kW
Tractive Power	92 kW	*Aerodynamic Losses*	53 kW
		Rolling Resistance	32 kW
		Inertia/Braking Losses	7 kW

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Medium-Duty Truck Energy Balance

Medium-Duty Base Configuration

Average Payload	3,970 kg (8,750 lbs.)
Total Mass	10,1000 kg (22,250 lbs.)
Fuel Use	34.3 gallons/1,000 ton-miles
Fuel Economy	7.3 mpg

Fuel Input	91.9 kW	*Engine Losses*	54.4 kW
		Idling Fuel Use	4.2 kW
Engine Output	33.3 kW	*Accessory Loads*	6.8 kW
		Drivetrain Losses	2.4 kW
Tractive Power	24.1 kW	*Aerodynamic Losses*	10.2 kW
		Rolling Resistance	6.6 kW
		Inertia/Braking Losses	7.3 kW

Configuration for Hi-Efficiency Goals

Average Payload	3,970 kg (8,750 lbs.)
Total Mass	10,100 kg (22,250 lbs.)
Fuel Use	22.7 gallons/1,000 ton-miles
Fuel Economy	11.1 mpg [+ 50% Gain]

Fuel Input	62.4 kW	*Engine Losses*	36.9 kW
		Idling Fuel Use	1.0 kW
Engine Output	24.5 kW	*Accessory Loads*	5.4 kW
		Drivetrain Losses	1.7 kW
Tractive Power	17.4 kW	*Aerodynamic Losses*	9.7 kW
		Rolling Resistance	6.2 kW
		Inertia/Braking Losses	1.5 kW

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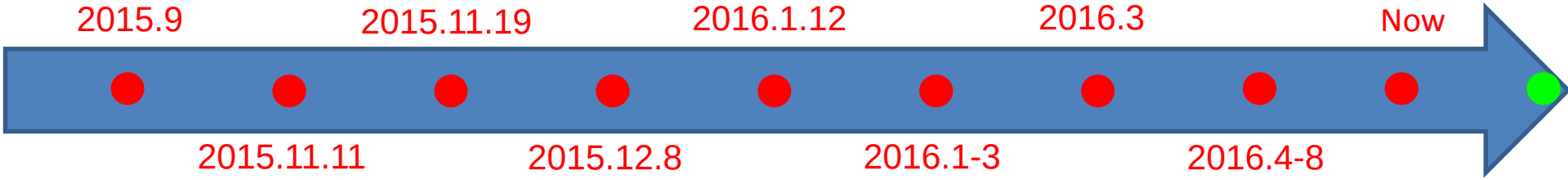
Topic Areas for Joint Research



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Topic Areas for Joint Research

- **Advanced Internal Combustion Engine/Powertrain System Technologies:**
  - Adv. High-Efficiency and Clean Combustion Strategies
  - Combustion Control and Optimization Technology
  - Advanced Air Management System
  - High-Conversion Efficiency NOx After-treatment and Particulate Filters
  - Alternative Fuel Combustion
  - Engine Thermal Management
  - Waste Heat Recovery
  - Engine Friction Reduction
  - Drive-line and Transmission Efficiency Improvements
- **Energy Management Technologies (for System Level Efficiency Improvement)**
  - Electrification of Engine-driven Auxiliaries/Accessories
  - Reduction of Accessory Loads and Auxiliary Power Predictive Engine Accessory and Drive-line Controls
  - Wind/weather and GPS-based Cruise Control and Intelligent Routing
  - Fleet-level Operational Efficiency Improvements
- **Hybrid Electric Powertrain Technologies**
  - Drive Unit Optimization
  - Energy Storage Systems
  - Regenerative Braking
  - Application-specific Powertrain Hybridization for Targeted Duty Cycles
  - System Architecture Analysis
  - Dedicated Engine for Hybrid System
- **Other Key Truck Technologies**
  - Aerodynamic Drag Reduction
  - Vehicle Weight Reduction
  - Tire Rolling Resistance
- **Applied Research, Test, and Evaluation**
  - Apply Selected Technologies (from above) on a Truck
  - Test and Evaluate Technology Performance
  - Modify/Utilize Existing “Off-the-Shelf” or Prototype Truck (From the U.S. side)
  - Or, Build a Full Prototype Truck (From the U.S. side)

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Medium and Heavy Trucks Estimated Schedule

U.S. (Sept. 2016) & Chinese Consortia Formed	Fall 2016
U.S. & Chinese Consortia Meet for Joint Planning	Fall 2016
Joint Work Plans Completed; Signing Ceremony	January 2017
IP Framework Agreement Concluded	Spring 2017
Project Plans & Funding Finalized [10-Point Plans]	Spring 2017
Collaborative Research Begins	Spring 2017
Joint Meetings of Consortia	Annually

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CERC Web-Links

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U.S.: http://www.us-china-cerc.org
China: http://www.cerc.org.cn/