

Topic: N133-148

Electro-Mechanical Associates

Adaptive Diesel Engine Control Via Variable Valve Timing

Established in 1988, Electro-Mechanical Associates (EMA) specializes in research programs on spark and compression ignition engines providing innovative, development, and testing of prototype engine technologies. During normal operation, military vehicles and generators often do not operate at peak efficiency. During design analysis, the EMA retrofit kit under development reduced fuel consumption up to 15% at moderate loads with larger improvements at light loads and demonstrated potential increases in engine power over 5%. This patented technology builds upon variable valve timing that is currently utilized in gasoline engines but has yet to be applied to diesel/compression ignition engines. Current development is focused on the Marine Corps Medium Tactical Vehicle Replacement (MTVR) program. Expansion into other Program Offices that operate on diesel /JP-8 /JP-5 fuel including electric power generation is anticipated.

Technology Category Alignment:

Energy & Power Technologies

Mobility

Contact:

George Schwartz

gschwartz@electro-mechanical.net

(734) 995-2455

<http://www.electro-mechanical.net>

SYSCOM: MARCOR

Contract: M67854-15-C-0201

 Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=M67854-15-C-0201

Department of the Navy SBIR/STTR Transition Program

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MCSC-PRR-1348

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WHO

SYSCOM: MARCOR

Sponsoring Program: Medium Tactical Vehicle Program

Transition Target: Medium Tactical Vehicle Replacement (MTVR), particularly vehicles using the Caterpillar C-12 engine

TPOC:

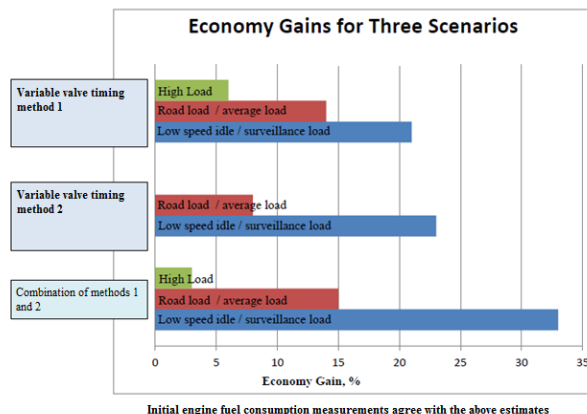
sbir.admin@usmc.mil

Other transition opportunities: * Compression ignition engines that operate for long durations at medium to light load (i.e. surveillance mode).

* Pushrod engines are the easiest to implement.

* Overhead cam engines require additional development work.

* Generators will benefit from this technology as well; many military generators are over-sized for the required task and therefore operate at very light load most of the time.



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WHAT

Operational Need and Improvement: The objective is to reduce fuel consumption of the MTVR engine during mission operations by 15-25% over current fuel consumption rates while increasing the power output of the engine by 5-10% over current engine rated capability. These goals will be reached thru modification of the Caterpillar C12 engine enabling independent control of diesel engine components allowing the engine to operate at maximum efficiency across a wider spectrum of engine loads.

Specifications Required: MTVR mission requirements focus on two different engine load levels.

1. High Power, up to 425 BHP, to climb slopes, accelerate under full payload, or traverse soft soils.
2. Low Capacity, 10-20 BHP, to support generation of electricity and HVAC functions.

Technology Developed: An add-on kit with two device alternatives

1. First device will allow a high compression ratio for cold start and low compression when warm. (Diesel compression ratios have been dropping over the years for a reduction in friction.)
2. Second device will disable some cylinders to improve idle and light load fuel economy. Innovations will reduce fuel consumption at a variety of loads, RSTA missions.

Warfighter Value: In order to save fuel, the vehicle operator needs additional control over the diesel combustion cycle which is often limited by fixed mechanical linkages.

Operation and maintenance expenses can be reduced by allowing greater control over the combustion cycle in response to engine demands. These multiple operating points may be achieved thru cylinder shut down or other means made possible by higher levels of combustion cycle control.

Result: Reduced fuel consumption and increased power at multiple engine operating points.

WHEN

Contract Number: M67854-15-C-0201 **Ending on:** December 23, 2016

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Durability test rig testing	Med	500 hours operated at a variety of operating speeds and temperatures	4	1st QTR FY17
Firing engine testing	Med	Successful dynamometer tests at a variety of speeds and loads	5	1st QTR FY17
Cold start testing - during Phase II Option	Med	No degradation of cold start capability	6	1st QTR FY18

HOW

Projected Business Model:

Provide retrofit kits. Early stage production is to be done by Electro-Mechanical Associates, up to approximately 50 units per month. Larger production volumes will be done by a 3rd party manufacturer.

Company Objectives:

Develop and sell this fuel reduction technology first to the military then to the commercial sector

Potential Commercial Applications:

Many heavy duty trucks idle for long periods (all night long as well as during load pickup and drop off). Operation at light to moderate loads is a common occurrence. These operating modes will benefit substantially from Electro-Mechanical Associates's, technology.

Contact: George Schwartz, Vice President

gschwartz@electro-mechanical.net

734-995-2455