

4.7 Intelligent Power and Thermal Management

Bottom Line Up Front	
Challenge	
<p>Critical to meeting the demand for C4ISR capabilities on tactical vehicles is intelligent power and thermal management. The objective of this focus area is to develop an integrated system that manages power utilization on vehicle platforms in order to improve fuel efficiencies and manage heat properties in the cab and other areas on the platform to maintain equipment and crew comfort. Effective power/thermal management systems will improve electrical system efficiency and improve heat rejection by linking power/thermal management strategies into a single onboard architecture. The likelihood of the demand for more capable suites of C4ISR, and electronic warfare devices and applications aboard USMC tactical vehicles will continue to increase resulting in power and heat loads that exceed platform capabilities. Advanced power/thermal management tools are a critical step in the development of efficient and reliable vehicle platforms.</p>	
Potential Solutions	
PEO LS / ONR / MCSC / US Army (RDECOM-TARDEC)	<p>MPC Vehicle Performance Generation Tool Integrated Vehicle Thermal Management Modular Vehicle Platform</p>
TARDEC	<p>Thermal Management Systems Development Program Cooling System Evaluation Tool Onboard Vehicle Management, Microgrid, and Hybridization Auxiliary Power Power and Thermal Management Technologies for the Vehicle Electronics Architecture Systems Integration Laboratory Efficient Powertrain Systems Integration</p>
JNLWP	<p>Compact, Low Mass, and Very Low Maintenance Thermal Management System for High Power Directed Energy Systems</p>
SBIR	<p>Innovative Simulation and Analysis Tool for Vehicle Thermal Management Application of Spot Cooling Technologies for the Thermal Management at the Source</p>

Potential Solutions

PEO LS is engaged with ONR, MCSC, US Army (RDECOM-TARDEC), as well as various Industry partners and other agencies to address the Marine Corps' power/thermal management challenges. Some of these efforts include:

MPC Vehicle Performance Generation Tool. A suite of interactive systems engineering tools to support decision makers in defining vehicle specifications. The requirements optimization process allows multiple vehicle subsystems to be varied concurrently while assessing differing vehicle performance attributes, such as powertrain performance, thermal management, vehicle dynamics, human factors and transportability.

Integrated Vehicle Thermal Management. This is a commercially focused effort at the National Renewable Energy laboratory that looks at combining thermal management systems in vehicles with partial or completely electric power trains.

Modular Vehicle Platform. A key aspect of the ONR 30 MVP effort will be developing or exploiting integrated power and thermal management technologies in order to synchronize power and thermal management across automotive, hotel, and modular payload.

TARDEC Efforts

Thermal Management Systems Development Program. This is a \$16 million program scheduled to complete by FY18 with several TRL6 technologies. Its purpose is to develop the ability to communicate and control remote loads from a central computer and to provide an opportunity to optimize electrical power usage system-wide. Algorithms to balance power draw from multiple sources, including batteries, alternators, ultracapacitors and fuel cells, and have produced overall system efficiency improvements in the range of 20% in simulations.

Cooling System Evaluation Tool. M&S and test and evaluation efforts seek to understand the component- and system-level impacts of advanced heat-rejecting materials and cooling.

Onboard Vehicle Management, Microgrid, and Hybridization. Provide an on-vehicle demonstration of the next step beyond current planned modernizations to show additional ways to increase fuel efficiency, mobility, and commonality. Provides a means to enable operational energy on-vehicle.

Auxiliary Power. TARDEC has several efforts looking at auxiliary power for silent watch operations in tactical vehicles. These technologies included JP-8 based fuel cells, ultra high power energy storage, and OBVP solutions.

Power and Thermal Management Technologies for the Vehicle Electronics Architecture Systems Integration Laboratory (VEA SIL). Provides an open architecture VEA SIL capable of testing any piece of hardware to verify its compatibility with an open architecture and is VICTORY compliant. The SIL will have the ability to configure multiple vehicle electronics implementations quickly in order to provide valuable data to PM offices and Original Equipment Manufacturers (OEMs). It will centralize the Army's approach to integrating electronics on ground vehicles, saving cost and reducing redundant efforts across multiple programs.

Joint Non-Lethal Weapons Program Efforts

Compact, Low Mass, and Very Low Maintenance Thermal Management System for High Power Directed Energy Systems. The successful demonstration of the proposed research and development will significantly improve performance and reliability of current and next generation high-capacity, high-rate thermal management system technologies and systems for both military and commercial applications. Additionally, the proposed concept may also be used in space nuclear power and energy conversion related applications.

SBIR Efforts

- **Innovative Simulation and Analysis Tool for Vehicle Thermal Management**
- **Application of Spot Cooling Technologies for the Thermal Management at the Source**