Advanced Aerodynamics and Cooling System Solutions for Higher Fuel Efficiency and Decreased Emissions

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Abstract  Auxiliary load systems, fuel and lubrication systems, and cooling systems are an integral part of any truck, and contribute to the overall design and energy use/management. Research and development appropriate to this topic include advanced aerodynamics, heat exchanger technologies, heat pipe/two-phase flow systems, advanced pumps and compressors, and other advanced thermal and fluid management concepts to improve electric powertrain cooling, enhance drivetrain performance, reduce energy usage, improve system energy management, and reduce component and system weight, volume, and aerodynamic drag in hybrid power trains and hybrid vehicle systems. The current study presents a cooling system and vehicle aerodynamics integration through the substitution of more efficient hardware and better integration with existing vehicle systems. Several aerodynamic add-on devices are tested for drag reduction. Practical vehicle designs are developed and software simulations are conducted to determine improvements in aerodynamic efficiency. Coastdown testing is conducted to determine the drag reduction achieved with aerodynamic modifications. Weight reduction and energy consumption improvements projected for a practical aerodynamic refuse vehicle are calculated. Improved aerodynamics and cooling system designs are integrated into the current vehicle technology and tested to quantify the benefits.