NATIONAL RENEWABLE ENERGY LABORATORY

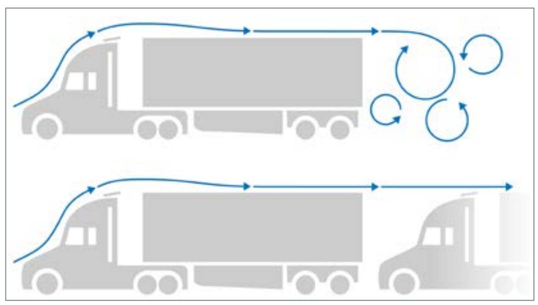
Assessing the Fuel-Saving Potential of Semiautomated Truck Platooning

Highlights in Research and Development

An NREL study found that platooning of long-haul trucks reduces fuel consumption at all tested highway speeds.

Vehicle automation is a promising fuel-saving strategy; semiautomated platooning systems for heavy-duty vehicles represent a likely first step toward public acceptance. Platooning reduces aerodynamic drag by grouping vehicles and safely decreasing the distance between them via electronic coupling, which allows multiple vehicles to accelerate or brake simultaneously.

NREL conducted track testing of platooned trucks with 53-ft trailers at the 8.5-mile Uvalde track in San Antonio, Texas. Photo courtesy of Peloton, NREL 31236



Platooning reduces aerodynamic drag by decreasing the driving distance between vehicles. Illustration by Al Hicks, NREL

Researchers at the National Renewable Energy Laboratory (NREL) are evaluating the fuel-saving potential of semiautomated platooning of long-haul trucks with commonly used modern aerodynamics. The platooning system used in the study was developed by Peloton Technology, Inc. This system incorporates vehicle-to-vehicle communications, radar-based forward object detection, and active braking systems. These are combined with sophisticated vehicle control algorithms to link pairs of trucks. The distances tested equate to a 0.2- to 0.8-second gap between vehicles traveling at 65 mph, which could not be achieved safely without an automated system. Typically, a safe gap for a tractor-trailer traveling at 65 mph is 6–7 seconds.

NREL conducted track testing of three trucks—two platooned trucks and one control truck—at varying speeds (55–70 mph), platooning distances (20–75 feet), and gross vehicle weights (65,000–80,000 pounds). Platooning reduced fuel consumption at all test speeds, platooning distances, and payload weights. The lead truck demonstrated fuel savings up to 5.3%; the trailing truck saved up to 9.7%; and together, the platooned pair saved up to 6.4%.

Because platooning is a relatively low-cost technology that can be used on existing vehicles, the demonstrated "team" savings of 6.4% on a pair of vehicles may be an attractive return on investment for fleets. NREL researchers see an opportunity for further savings through system optimization.

A number of variable conditions—including aerodynamic effects, payload weight, the distance between the lead and the trailing truck, and ambient temperatures—influence savings. More research is needed to maximize savings. For example, the loss of "ram air" for cooling the trailing vehicle's engine can cause the engine fan to actuate more often and consume energy. Optimum following distance to achieve the best fuel economy depends on payload, speed, temperature, and the aerodynamics of the truck pair.

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References: Lammert, M.; Duran, A.; Diez, J.; Burton, K.; Nicholson A. (2015). "Effect of Platooning on Fuel Consumption of Class 8 Vehicles Over a Range of Speeds, Following Distances, and Mass." Prepared for the SAE Commercial Vehicle Engineering Conference, October 7–9, 2014. NREL/CP-5400-62348. Golden, CO: National Renewable Energy Laboratory. *http://www.nrel.gov/docs/fy15osti/62348.pdf*

Key Research Results

Achievement

An NREL study, conducted in partnership with Peloton Technology, Inc. and Intertek Testing Services, quantifies the fuel-saving potential of semiautomated platooning in Class 8 long-haul trucks.

Key Result

Platooning results in significant fuel savings for the lead truck (up to 5.3%) and the trailing truck (up to 9.7%). Varied conditions—ambient temperature, distance between lead and trailing truck, and payload weight—influence the savings.

Potential Impact

The demonstrated fuel savings provide an attractive example for long-haul fleet managers who are interested in reducing fuel costs and improving energy efficiency. More than 1 million tractor-trailers operate in the United States today; each drives more than 100,000 miles per year, so fuel savings could be substantial.

NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

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