Truck's Cargo Cooling Bay: Aero-design for Solo and Platooning Conditions

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Vision and Motivation

The way we use transport, but more importantly, the way we think transport is changing fast. From a luxurious benefit, it quickly became a mass consumer good, and now, is transforming into a service at our disposal. The past thought us that larger streets, more cars and more trucks escalates rapidly into a congested traffic system. What if we instead re-adapt our network of infrastructure to our needs? In this context, an optimized good transportation system plays a crucial role. By the use of simulations and data collection, now more than ever, we have the possibility to pave the path toward the sustainable future we are all craving. The present project wants to bring a contribution to this vision. What we propose is an aerodynamic analysis to design the cooling bay for the EINRIDE autonomous truck (see link on reference [b]) under different flow conditions.

The Cooling Cargo Bay and Platooning

The cooling bay is a vital component for the conservation of food during their transportation. An efficient cooling cargo system can drastically decrease the energy consumption of an electric vehicle and therefore increase its mileage. Platooning, on the other hand, is the linking of two or more trucks in a convoy, and it is in fact a viable way to reduce power consumption, operating on the aerodynamic properties of the trucks formation. In previous on-road studies, platooning has shown a possible power consumption reduction of 6-10% but much of the flow physics and the full potential of this technique remain unknown. What happen to the followers when platooning is engaged? Is the flow field optimal for the cooling bay system? Can the geometry of the cooling system be adapted to different configurations? These questions will be the starting point for the thesis project proposed here.

Objectives and Division of the Work

This thesis work consists of two main parts. The first one deals with computational fluid dynamic (CFD) simulations of a two trucks platooning convoy. The objective is to gain knowledge of the flow physics surrounding the formation, and the main focus will be oriented to the cooling bay air flow. As mentioned, this part is of first importance for trucks transporting frozen or refrigerated goods. For this reason, the second part of the work will deal with the design of a new air intake for the cargo cooling bay, potentially adaptable to different flow conditions. Wind tunnel tests and heat transfer calculations will eventually integrate and complement the CFD results obtained in the first part.