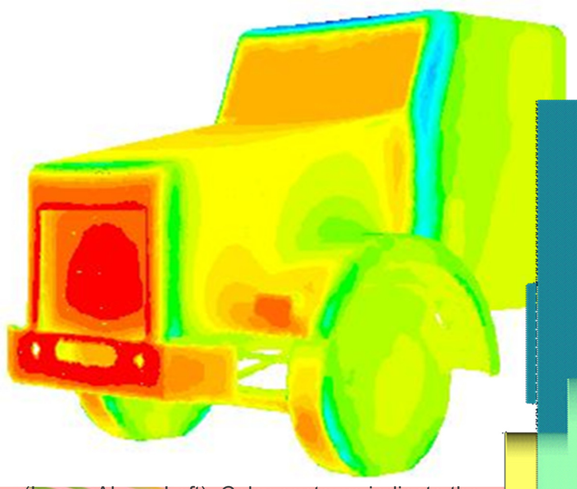
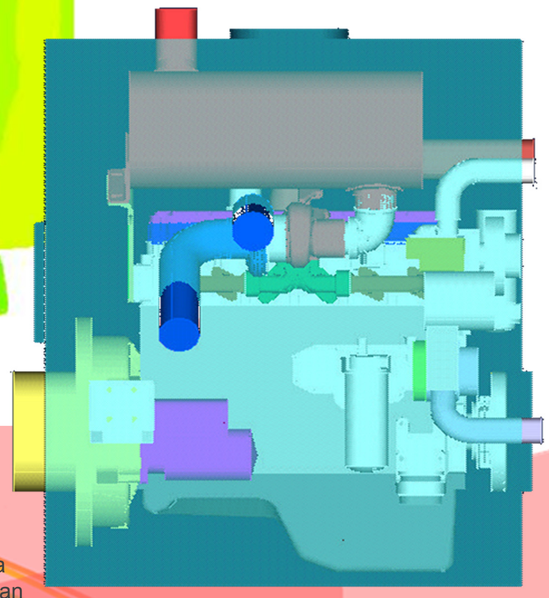
Nuclear Engineering Simulations





(Image Above Left) Color contours indicate the pressure force acting on the vehicle surface, as predicted by a detailed Computational Fluid Dynamics model.

(Image Right) Image showing the geometry of a typical Computational Fluid Dynamics model for an underhood analysis.

Nuclear Powered Tractor Trailer Trucks?

These trucks may not be nuclear powered, but Argonne's expertise in modeling fluid dynamics and heat transfer in large facilities is being applied to the analysis of new vehicle and engine designs that reduce emissions and use significantly less fuel.

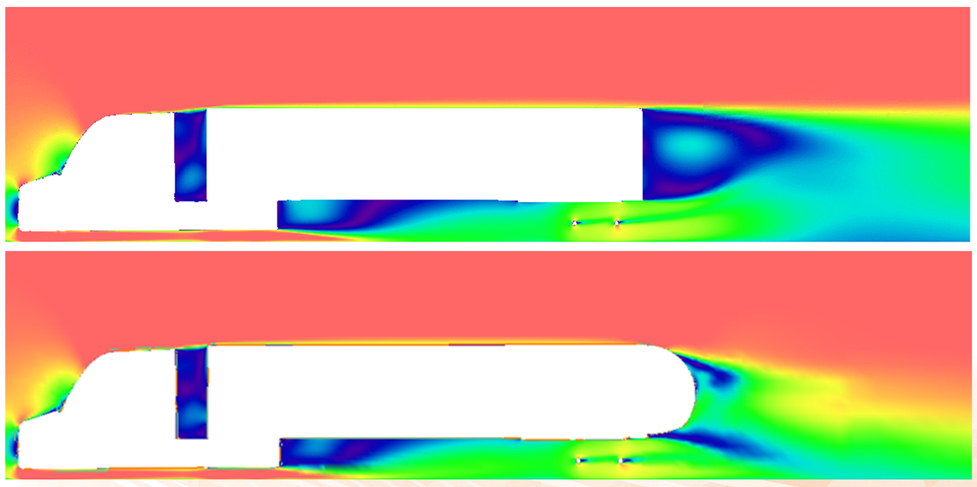
Cool Designs for Hot Spaces

Computational Fluid Dynamics simulations of airflows through an engine compartment have been coupled with conventional models of engine performance to better predict the temperatures of engine components. Better temperature predictions allow design engineers to provide adequate cooling so that engine components last longer and enable the optimized design of engine compartments for quieter, cleaner, and more efficient operation.

(Image Above) Results of a CFD simulation of airflow over a tractor trailer truck travelling at 70 mph with a 12 mph cross wind.

Current Designs are a Drag…

At highway speeds overcoming aerodynamic drag can consume as much as 65% of the total usable energy produced by a typical heavy vehicle engine. The use of advanced Computer Aided Engineering tools in the development of new tractor trailer truck designs allows engineers to optimized the shape of the these vehicles so that less fuel is consumed in overcoming drag. For example, simply rounding the rear of the trailer could reduce drag forces by as much as 7% -- that translates to about 3% less fuel used at highway speeds! A fully optimized design might use 25% less fuel than a conventional vehicle.



(Images Left) Results of CFD simulations of airflow over two tractor trailer designs tractor trailer truck geometries. The upper geometry is a simplified conventional tractor trailer geometry. An ogive boat tail has been added to the lower geometry, resulting in a significant reduction in the size of the wake behind the trailer and a significant reduction in drag losses associated with the wake. Blue regions indicate areas where flow separation occurs and identify regions where additional optimization could provide additional drag reductions.

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