High-Performance Computing Research

To remain cost-competitive in the global transportation industry, U.S. auto, truck and off-road vehicle manufacturers and their-suppliers are accelerating the design process through expanded use of Computer-Aided Engineering (CAE) tools. Argonne's expertise in large-scale modeling, high-performance massively parallel computing systems, computational fluid dynamics, computational mechanics, and high-fidelity visualization technology is being adapted to next-generation vehicle design.

For more information, contact David Weber at (630) 578-4241.

Modeling Underhood Thermal Performance

As technology advances, automakers need a better understanding of underhood heat loads, especially as they relate to emissions and fuel efficiency. Manufacturers of heavy duty vehicles and off-road machines have similar concerns. Ineffective underhood thermal management can lead to higher emissions, reduced fuel efficiency, and damage to sensitive electronic components. Argonne researchers are working with industry partners on computer models that simulate complex fluid flows and heat transfer in autos, trucks, and off-road machines. Automotive researchers can validate their computer modeling results on actual or emulated vehicles using Argonne's comprehensive hardware-in-the loop (HIL) expertise at Argonne's Advanced Powertrain Research Facility.

For more information, contact Tanju Sofu at (630) 252-9673.

Visualizing Heavy-Duty Truck Aerodynamics

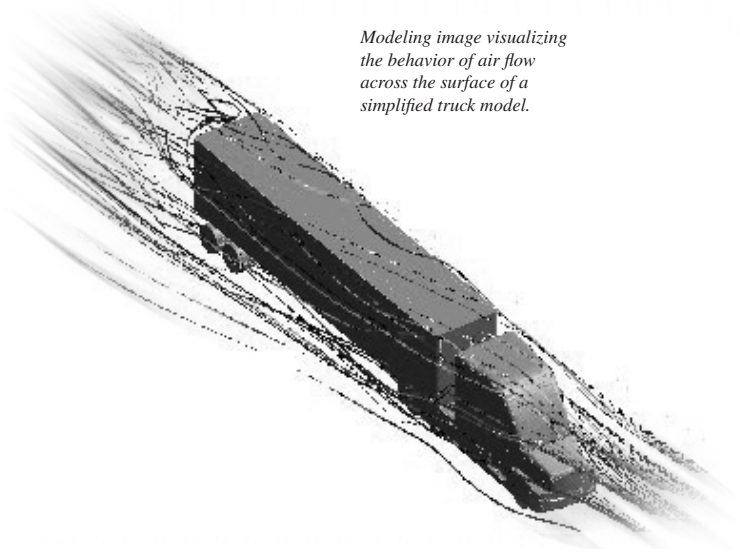
Tougher emissions standards and industry demands for more powerful engines and new vehicle equipment continue to increase the heat rejection requirements of large trucks. But changes in physical configuration and weight can affect how a truck handles wind resistance and how much energy it loses to the effects of aerodynamic drag. The field of computational fluid dynamics (CFD) offers researchers the ability to visualize and predict how changes in vehicle design affect a truck's aerodynamic performance on the road. Argonne scientists use a variety of commercial CFD tools to develop guidelines for the use of CFD analysis in evaluating tractor-trailer designs. Results show that modeling can predict drag coefficients within 1 percent of the actual values measured, and that surface pressure distributions can be predicted with reasonable accuracy.

For more information, contact David Pointer at (630)-252-1052.

Simulating Crash Behavior

Argonne's high-performance computing facilities are also used for simulating vehicle crash behavior. One of the great strengths of high-performance computing environments is their ability to simulate and produce highfidelity visualization and animation of operatives and reactions in complex sequences of events. Compare this to the traditional approach of determining a vehicle's ability to withstand an impact—crashing it into a wall and studying the results—which is both expensive and time-consuming. Argonne researchers are developing computational crashworthiness software, which runs on a cluster of high-performance computers using massively parallel processing, that can be seamlessly integrated with a wide variety of high-fidelity visualization tools and technology. The use of high-performance computing tools minimizes the construction of expensive prototypes and the experimental verification of product designs.

For more information, contact Ron Kulak at (630) 578-4245.



Modeling image visualizing the behavior of air flow across the surface of a simplified truck model.

GREEN TRANSPORTATION TECHNOLOGIES