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C A S C

HIGH PERFORMANCE COMPUTING IMPROVES AUTOMOTIVE PRODUCTS, BUILDS COMPETITIVE EDGE FOR U.S. AUTO INDUSTRY

High performance computing has played a critical role in reviving the U.S. automotive industry, affecting virtually every facet of its work, from enhancing product quality and reliability, to streamlining designs, improving vehicular safety and boosting fuel efficiency, while reducing production cost and shortening development time and even larger role is emerging.

Much of the high tech pre-commercial research and development responsible for this revival has been made possible by federal HPCC funding to the academic supercomputing community and national labs, with positive repercussions throughout the entire economy, stimulating jobs, exports and profits.

There is no turning back. Problems that once took days or weeks to resolve, can now be handled in minutes or hours. Modifications that once took several months to implement can be realized in a matter of weeks. Only a few costly full size hand-built crash models are required because computer simulations can do much of the work.

All of the crash simulation software now used by U.S. automakers, for example, is based on software first developed at national laboratories and academic supercomputing centers. Over the past 10 years, crash simulation has become the largest user of computer resources in the automotive industry. The following are examples of recent or current work with similar implications for the automotive industry:

IMPROVING AUTO SAFETY -- Engineers at several Ohio universities are using the expertise and resources of the Ohio Supercomputer Center (OSC) to improve auto safety. One such project has already resulted in new hood and fender designs in the Ford Taurus. Trauma to the head is a frequent injury to pedestrians involved in automobile accidents, occurring when the head strikes the car hood. Using computational visualization techniques,researchers found that by incorporating simple, low-cost design modifications into existing car models the severity of such injuries could be reduced significantly.

Others are using OSC facilities to study the dynamics of an automobile crash, with the goal of developing door designs and paddings that mitigate injury causing forces.

AUTOMOBILE DESIGN -- In the early 1990's, researchers for General Dynamics, working with the San Diego Supercomputer Center (SDSC), created a new manufacturing process to make molded auto panels from injected polymers. The panels were designed for the Chevy Lumina, and the process developed for manufacturing polymer parts is now used throughout the automotive industry.

Other research at SDSC, aimed at improving highway paving methods, is yielding information that can help auto manufacturers to design better tires, heavier loadings, improved truck suspension systems and axle configurations.

University of Toledo engineers currently are working on projects at the Ohio Center to minimize fatigue stress cracks in automobile shafts and to improve the operation of the crankshaft and rod bearings -- all critical factors in automotive design.

HEAVY EQUIPMENT -- Caterpillar, Inc., working in partnership with the National Center for Supercomputing Applications (NCSA) is using virtual reality technology to test and improve the efficiency of heavy earth moving equipment. Design changes that once took between six and nine months to test and implement with computer-aided design blueprints and full scale wooden models, can now be made, at great savings, in less than one month. As a result, the company will introduce improved models of wheel loaders and back hoe loaders by 1996.

BETTER COMBUSTION -- Researchers from the University of Texas at Austin are using the expertise and resources of the University's High Performance Computing Facility to study the effects of automobile pre-ignition -- more commonly known as engine knock -- in internal combustion engines, with the aim of improving combustion technology. Supercomputer modeling and computational fluid dynamics are used to examining internal chemically reacting flows, piston movements, and flame action in combustion chambers.

The research is conducted by the University's Foundation for Combustion Sciences and Automotive Research Lab, funded by General Motors. More complete understanding of the combustion process can improve engine designs, increase fuel efficiency and reduce air pollution from auto emissions.

In order to remain globally competitive, the automotive companies will continue to rely on supercomputing technology. There is a 10- to 15-year development cycle from major idea to commercial success. Few companies, large or small, will risk that long-term investment. But they will use proven concepts from pre-commercial research to improve products and maintain their competitive edge. They will look to the academic supercomputing community for expertise in solving complex problems that they are best equipped to handle, and for developing the future generations of high performance computers that will ensure ongoing success.