Lenovo® recommends Windows® 7 Professional.

North American Eagle™
SUPERSONIC LAND SPEED CHALLENGER

LENOVO® THINKSTATION® IS THE ENGINEERING PLATFORM FOR NORTH AMERICAN EAGLE, POISED TO BREAK THE WORLD LAND SPEED RECORD USING CATIA VIRTUAL DESIGN SOFTWARE.

DASSAULT SYSTEMES

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"The challenges of innovative design that are encountered when trying to create the world's fastest vehicle cannot be overcome without the use of a powerful workstation like the Lenovo ThinkStation. Using CATIA V5 software on the ThinkStation D20, we got results in minutes, similar to what you would get on a supercomputer in 1993. ThinkStation is the perfect design hub for running high-powered software like Dassault Systèmes CATIA to redesign parts, evaluate large and complex assemblies, run analysis and assess multiple designs quickly, resulting in an optimal design while saving huge amounts of engineering time."

— Ed Shadle, Driver, North American Eagle (NAE)

Most people play golf when they retire. But not Ed Shadle, the project manager and owner of a company trying to build the world's fastest land speed vehicle. When Ed retired from IBM® in 1996 he established North American Eagle (NAE) and set his sights on breaking the world land speed record, which is currently held by the British at 763mph. The engineering team at NAE retrofitted the fuselage of a Starfighter jet plane by adding state-of-the-art patented wheels and braking systems to create the Eagle.

To design and build the vehicle, as well as engineer the programs and processes critical to its successful pursuit of the record, Shadle and his team rely on the Lenovo ThinkStation as the engineering design and data acquisition hub. Although the team's hardware and software requirements keep growing as they close in on the record, the ThinkStation remains a key tool in the chase, says Shadle.

The Eagle engineers utilize a rapid prototyping process, developed on the Lenovo ThinkStation system, with software from Geomagic Studio, Verisurf, Dassault Systèmes (CATIA) and Adobe®, running on Microsoft Vista® 64. Without the ThinkStation workstations processing power, critical Computational Fluid Dynamics (CFD) analysis would not be possible. The Eagle engineers, scientists and aerodynamic experts are able to access the ThinkStation and work as a 'virtual' team from their homes, an unimaginable scenario only a few years ago. The ThinkStation D20 essentially eliminates the need for constant access to a mainframe computer.

PUSHING THE EDGE OF INNOVATION

The challenge ahead for Ed Shadle, co-owner Keith Zhangi and their team is four-fold. First, the vehicle and its dynamic interactions with the ground at speeds of Mach 1 must be stable. Second, the design of the wheels is highly critical for stability. Third, the braking system must work in tandem with a high-speed parachute, which deploys at 850mph. Finally the steering and suspension design of the vehicle has to be strong and stable for elevated speeds.

REAL-TIME ENGINEERING ANALYSIS

Using three high-speed Olympus cameras, the performance of the Eagle was captured on film at speeds of 33,000 frames/second. During a test run, data also was collected from a network of sensors on board the Eagle. The NAE engineering team then reviewed the data and the film footage frame by frame using Adobe® Production Premium software on the ThinkStation and analyzed the performance of the suspension system, wheels, parachute deployment and air flow around the Eagle. This analysis enabled precise redesigns to the suspension system and the wheel components, to enhance the Eagle's overall stability at high speeds.

Lenovo ThinkStation Flyer

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"LENOVO® AND DASSAULT SYSTÈMES ARE PROUD TO BE WORKING TOGETHER TO PROVIDE NORTH AMERICAN EAGLE WITH THE DESIGN POWER OF CATIA AND THE THINKSTATION TO MEET THE EXTENSIVE DEMANDS OF CREATING THE WORLD'S FASTEST CAR."

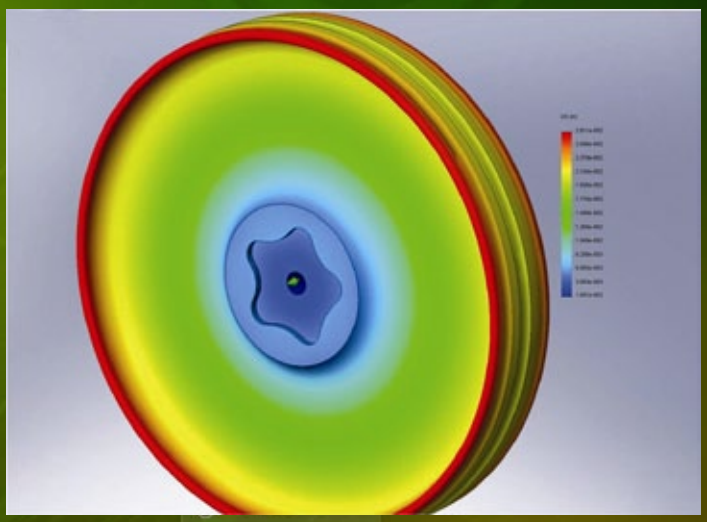
– Barbara Tabb, Director, WW Alliance Program Operations, Dassault Systèmes

DESIGNING THE WORLD'S FASTEST AUTOMOBILE WHEELS

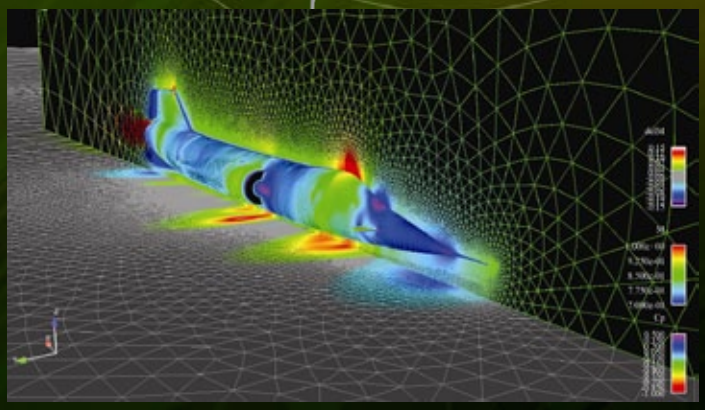
Team NAE has built the fastest automobile wheels on earth. The vehicle's aluminum wheels took one year to develop using CATIA V5 and Finite Element Analysis (FEA) software running on the powerful multi-core ThinkStation. Using advanced high-speed bearings and special lubrication developed by Kluber Lubrication, the wheels are safe up to 950mph.

PERMANENT MAGNETIC BRAKE SYSTEM DEVELOPMENT

Creating a brake system to slow the Eagle from 800mph to a smooth stop is truly a design challenge. Many unknowns and surprises occur at such intense speeds. In fact, the original mechanical disc brakes, wheels and related assemblies burned up completely in one test run after the brakes reached a temperature of 1400ºF. And the challenge of performance at such high temperature is second only to maintaining the stability of the vehicle while slowing it down. To redesign the brakes, NAE engineers evaluated many designs using Dassult Systèmes CATIA software on the ThinkStation D20 and agreed on a non-contacting magnetic brake design that was patented by Lev X Technology. This approach leveraged the powerful eddy currents that developed in the aluminum wheels at high speeds to decelerate the Eagle without requiring physical disc brake contact and thus eliminating the heat of friction. The newly designed wheel and brake assembly can withstand temperatures up to 1800ºF.



Aluminum wheels designed with CATIA software on Lenovo ThinkStation hardware



This digital rendering of the NAE is used to run CFD analysis whereby different nose cone, canard and wheel fairing designs are evaluated.

Discover how you can break records using Dassault Systèmes CATIA technology at **www.plmV5.com/landspeed**

SUPERSONIC SHOCK WAVE MITIGATION

At Mach 0.7 (70% of the speed of sound) strong Transonic Shock waves begin to form and continue to increase in strength to Mach 1 and beyond. These shock waves can cause changes to the vehicle aerodynamic forces leading to destabilizing lift and lateral movement. But CFD analysis can predict the effects of those shock waves to the Eagle. Using the software from Geomagic Studio, Verisurf and CATIA on the ThinkStation D20, a massive digital model of the Eagle, consisting of 30 million points was created and analyzed. A refined model was submitted to run CFD analysis on a Cray supercomputer, enabling the NAE engineers to make the design changes to improve stability at high speeds. The ThinkStation D20 performed the critical computations and rendered the results of the huge model flawlessly and in record time—a crucial requirement to meet the NAE project deadlines.

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