

Cleveland Golf

Customer Profile: Jeffrey Brunski

Jeff Brunski is a Performance Research Engineer at Cleveland Golf in Huntington Beach CA, a leading manufacturer of equipment in the \$7.5 billion golfing equipment industry. Jeff and his team are responsible for improving golf club performance through research and virtual analysis. Traditionally, Jeff's team needed about a month to move from a design concept to a prototype that could be tested and evaluated to determine how new or modified design features impacted performance.



Challenge

Cleveland Golf has its sights set on becoming the #1 golf equipment manufacturer in the world. The company needed to evaluate many design possibilities thoroughly and quickly in order to produce best-in-class clubs for golfers of every skill level. In order to do this, they needed Jeff and his team to create, build, and test many prototypes each month to optimize golf club designs quickly. Considering the lead time and costs required for tooling to build prototypes, traditional "build & test" design methodologies could not meet this requirement.

Solution

Patran, Nastran, and Dytran finite element analysis software.

Benefit

Jeff's Performance Research team can now create and test a virtual prototype for new or modified golf club designs within a day – a 3000% improvement in design cycle time.

Case Study

Cleveland Golf launches new golf club designs on an annual basis in a highly competitive, performance-driven market. With competition gaining ground on them, Cleveland's management challenged Jeff to find ways to truly optimize their golf club performance – and that meant evaluating literally hundreds of design variations.



CG14 Wedge

Jeff said, "We needed to find a way to quickly understand how design changes affect what happens at the all-important moment of impact between the club head and the golf ball. This determines spin, trajectory, and distance of every shot, as well as the feel of the club by the player. We realized that simulation was the only way we could do this faster without having to hire many more engineers and build bigger test facilities".

Jeff's team began evaluating FEA software to find a solution that would enable them to accurately and reliably analyze the complicated physics of the golf club. "Most golfers don't realize how much engineering



HiBORE XLS Monster Driver

goes into designing a golf club", said Jeff. "We tune the natural frequencies of vibration for the club, the energy transfer from the clubhead to the ball, the spin imparted by the club face onto the ball, and other key characteristics that help players to perform well on the golf course. All of these things take place in just a fraction of a second during impact – so it's very challenging for engineers to optimize all of these characteristics simultaneously".

Jeff and his team evaluated all of their options and selected MSC.Software's MasterKey system to help them to improve their process. "We have diverse engineering problems to solve – everything from stress analysis to explicit dynamics and fluid-structure interaction – but we didn't want to make any compromises because on-the-course golf performance depends on all aspects of the club being optimized. The MasterKey licensing system provides us access to simulation tools that are best-in-class for various applications without having to spend a lot of money to purchase each one separately."

Today, Jeff and his team can perform a complete analysis of new or modified design within a day – a 3000% improvement in their engineering time. "Jeff

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and his team have made Cleveland Golf more competitive on the course and in the market", said Nate Radcliffe, Metalwoods Development Manager. "Most consumers never see the amount of engineering that goes into their golf clubs, but they recognize how our clubs give them better shots throughout a round. Through their advanced use of simulation technology, Jeff's team is making Cleveland Golf a more successful business, and our customers better golfers".

MSC Products Used:

Patran

Pre-processing

- Standard Geometry Access from
 - Parasolid
 - STEP 203 and 209
 - IGES
 - VDA
 - I-DEAS
- Parametric Modeling Capabilities
- Wireframe and Solid Geometry Creation and Modification
- Mesh Generation
 - Automatic 2-D surface meshing
 - Automatic solid mesher
 - Generalized 1-D, 2-D, 3-D mapped mesher
 - Mesh on Mesh
 - Mesh editing and modification
- Comprehensive Element Library
- Element Property Creation and Edit
- Material Property Creation and Edit
- Load and Boundary Creation and Edit
- Easy Contact Definitions
- Model Visualization and Verification
- Support for multiple FEA solvers
 - Marc
 - Dytran
 - MSC Nastran
 - MD Nastran
 - 3rd party solvers

Post-processing

- Results Access
 - Nastran
 - Dytran
 - Marc
 - 3rd party solvers
- Results Visualization
 - Contours
 - Vector arrows
 - Fringe plots
 - Isosurfaces
 - Data History / Animation
 - X-Y plots
 - Imaging
- Results Templates

MSC Nastran

- Powerful Analysis Capabilities
 - Static Stress
 - Normal Modes
 - Linear Buckling
 - Dynamics
 - Static and Transient Heat Transfer
 - Dynamics
 - Frequency / Harmonic Response
 - Static and Transient Nonlinear
 - Rotor Dynamics
 - Interior Acoustics
- Full range of material models
 - Isotropic
 - Orthotropic
 - Anisotropic
 - Temperature-dependent
- Design Optimization
 - Shape
 - Size
 - Topology
- Adams Integration
- Superelements for increased collaboration and solution efficiency
- Efficient Solvers
 - Sparse matrix solvers
 - Iterative solvers
 - Parallel and vector processing

Dytran

- Explicit nonlinear solver technology for simulating short duration dynamic events
- Robust and efficient 3D contact
- Complete finite element model library that includes beams, shells, solids, springs and dampers
- Nonlinear material models
 - Metals
 - Composites
 - Soils
 - Foam rubber
 - Liquids
 - Gases
- Coupled fluid-structure interaction
- Parallel processing for improved productivity
 - Shared memory parallel
 - Distributed memory parallel

Company Profile

Cleveland® Golf, Srixon®, Never Compromise® and Cleveland Classics™ are brands owned by SRI Sports Limited. With corporate headquarters based in Kobe, Japan, SRI Sports is the fourth largest golf company in the world, as well as one of the world's leading patent holders in golf ball technology. SRI Sports, LTD purchased Cleveland Golf in December of 2007. SRI Sports owns and operates several brands around the world which combine to make them the number one club brand and number two ball brand in Japan, as well as having a major presence in Europe and North America.

Cleveland Golf is regarded as one of the forerunners in product innovation and is home to the #1 Wedge in Golf. With more than 325 employees in its Huntington Beach, California headquarters, Cleveland Golf has a U.S. sales force of 65, three international affiliates (Japan, Europe and Canada) as well as 26 distributors worldwide. As a sponsor of the Byron Nelson Championship and Cleveland Collegiate Palmetto Championship (University of South Carolina, Aiken), Cleveland Golf is heavily involved in player development with support to junior, collegiate and developmental tour golf.

Cleveland Golf is proud to count among its professional tour staff members: Vijay Singh, Boo Weekley, David Toms, and many others.

For more information visit us online at www.clevelandgolf.com, www.srixon.com, www.nevercompromise.com and www.clevelandclassicsapparel.com.