

# SIEMENS

Ingenuity for life

High tech sports equipment

## FES

Sports institute uses NX, Fibersim and Teamcenter to optimize design and manufacturing of high-tech equipment for Germany's top athletes

### Products

NX, Teamcenter, Fibersim

### Business challenges

Optimize design, simulation and manufacturing processes

Accelerate product tests and concept verification

Improve consistent use of once defined digital data

Increase process transparency

### Keys to success

Deployment of an integrated CAD/CAM/CAE solution with a broad function set

Use of product data management for more process transparency and improved teamwork

Engagement of technology for the design and manufacture of components made of fiber-reinforced plastics

### Results

Significantly faster design processes

Optimized teamwork

Higher product quality through the elimination of data conversion

More design flexibility via faster exploration of variants



Francesco Friedrich has won three world championships with the FES bobsled. His last title was in 2016 in Igls, Austria. Copyright: Alexander Emmert.

**Using Siemens PLM Software solutions, FES increases operational agility, optimizing processes and collaboration**

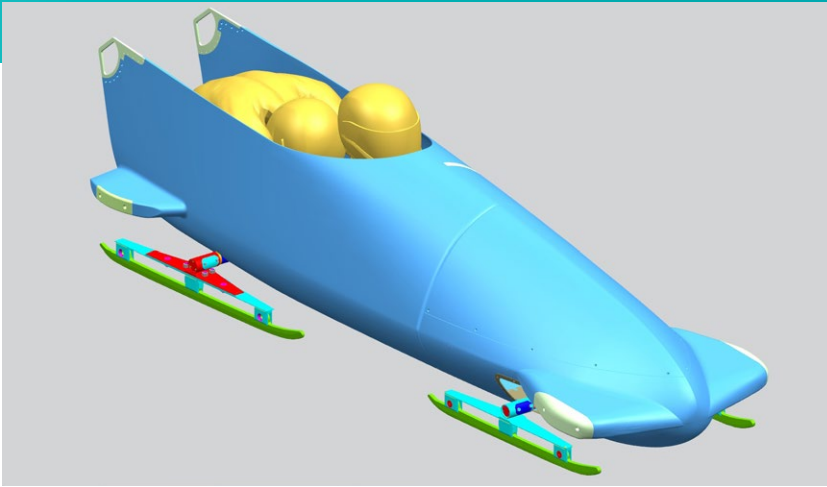
### Delivering innovative and highly competitive equipment

The institute for research and development of sports equipment, called FES, is an institute of the support association IAT/FES within the German Olympic Sports Confederation (DOSB). It was founded in 1963 to support athletes with advanced boats for rowing, canoe and sailing. The primary objective was then and still is to deliver innovative and highly competitive equipment exclusively to German athletes,

enabling them to successfully compete in international events, including world championships and Olympic Games.

That the original goal has been achieved is proven by a significant number of championship titles and Olympic medals.

Today's focus lies on the research, development and production for competitions like canoeing, cycling, bobsled, luge, skeleton, skiing, snowboarding, ice speed skating, and specific tasks for triathlon, swimming, and shooting. The goal is to design and to produce optimal equipment considering the overall athlete-device system. In addition, FES is developing measuring systems and



Hidden under the carbon fiber hood are the chassis components of a bobsled. The components represent a key factor in winning and losing a race. Teamcenter is an important tool in managing the many required modifications during the design process. Copyright: FES.

**“Using NX, we don’t need to import or export data between the different modules. This means far fewer chances for errors and faster turnaround, particularly when it comes to design changes.”**

Oliver Hecken  
Development Engineer  
for Laminate Design,  
Optimization and  
Manufacturing Planning  
FES

tools, because it is quite important to know the direction and degree of the air resistance, applied and other forces caused by the athletes and outside influences. These forces and the strict specifications of the international sport associations have a significant influence on the design process.

#### **Significant challenges**

Nearly all required tasks – research, conceptual design, design and engineering, tool design, and manufacturing – are accomplished inside FES, with its own employees. Another important task is the ongoing collaboration with athletes, coaches and technicians of the different

national sporting organizations. To handle the complete process requires highly qualified engineers as well as state-of-the-art support tools.

Theme managers are responsible for the different sports. They develop the requirements/specifications, together with the sporting unions, and work across all process steps.

Similar to the challenges faced by the manufacturing industry worldwide, the challenges faced by the sports institute can no longer be effectively fulfilled without advanced software solutions.

#### **NX: CAD/CAM/CAE**

In 2009, FES replaced its existing computer aided design/manufacturing/engineering (CAD/CAM/CAE) system with NX™ software from Siemens PLM Software. From the beginning, the engineers recognized the advantages of NX – on one hand the software’s tremendous number of functions for design, simulation and production planning; on the other hand with its tight integration of all modules. Ronny Hartnick, theme manager for cycling at FES, notes, “Initially, we felt a little bit uncomfortable with the huge range of functions offered by NX. However, ultimately, the breadth and depth of NX turned into an advantage, as there are practically no system-based

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Oliver Hecken  
Development Engineer for Laminate Design, Optimization and Manufacturing Planning  
FES

limitations. We work extensively with freeform surfaces, and NX offers a broad range of functions to design, manipulate and analyze curves and surfaces. Since we quickly achieved a strong feel for NX, everything has gone quite smoothly."

Today, about 30 engineers from different disciplines are using NX, as well as are students for their bachelor and master projects. FES is also using Teamcenter® software and the Fibersim™ portfolio of software for composites engineering. The use of Teamcenter provides effective, secure and transparent data management while the use of Fibersim is important for optimizing FES' significant work with fiber-reinforced plastics.

The major goal in developing sports equipment at FES is speed. However, it is also essential that the products comply with the size, weight and ergonomic standards set by the sports associations. Here, NX plays a significant role, with advanced and easy-to-use applications for 3D modeling, drafting and numerical control (NC) data creation. FES representatives note that the software's finite element (FE) modeling functionality is especially important in reaching component dimensioning and optimization targets.

Enrico Zinn, development engineer for bobsleds at FES, explains, "A bobsled needs to be as heavy as allowed, because weight means speed. Equally important are low wind resistance the desired rigidity of the whole system; or conversely, an adjustable elasticity. A bobsled should be fast on all different bobsled runs. Therefore, we try to develop a fast basic system and to implement the right 'adjusting screws.'"



The handlebar SL11 for a sprint bicycle, representing 136 parts, is the result of component optimization using NX Nastran. Copyright: FES.

While different, there are similar design factors to take into account with snowboards. "In designing a snowboard, it is essential to meet the motion style of the athlete, so the snowboard should not have fixed set points for the deflection curve or for torsion; it should also be adjustable," says as Mario Portsch, theme manager for snowboards at FES.

Bicycles represent their own set of unique challenges. Hartnick explains, "The bicycle fork should be flexible lengthwise, but as rigid as possible crosswise, which contradicts optimal flow conditions. With FE modeling, Fibersim and fiber-reinforced plastics, we can solve this challenge."

"Nearly all engineers using NX are able to utilize the whole spectrum of NX modules, from design to simulation to NC programming," explains Oliver Hecken, development engineer for laminate design, optimization and manufacturing planning at FES. "An integrated and complete process chain promotes innovation, whereas disconnected processes and borders between departments impedes the best outcomes."

**"We depend on efficient workflows, as we have to realize short development cycles according to the dates of international sports events. Using Teamcenter and NX enables practically all of our different development tasks to be solved within one common environment, which gives us a big advantage and enables us to be flexible, dynamic and fast."**

Mario Portsch  
Theme Manager for  
Snowboards  
FES

### **Teamcenter: more transparency, more secure processes**

When starting with NX, data is stored on a file/folder basis. That leads to a significant number of data files. When revisions are made, especially on large projects involving numerous engineers, it is difficult to quickly locate the right information. Errors can occur. With Teamcenter, data is assigned to a specific part or assembly. This enables all concerned participants to find the right data unambiguously, greatly increasing process efficiency as well as notably reducing the likelihood of errors. "We depend on efficient workflows, as we have to realize short development cycles according to the dates of international sports events. Using Teamcenter and NX enables practically all of our different development tasks to be solved within one common environment, which gives us a big advantage and enables us to be flexible, dynamic and fast," says Portsch.

### **Fibersim: optimized design and manufacturing of laminates**

Nearly all products designed at FES require components that are made out of carbon fiber-reinforced plastics. That's because these materials are very light yet provide adjustable strength and elasticity. They also enable the design of very complex parts. Prior to using Fibersim, the NX Laminate module was used for this purpose. The application was helpful, but required some manual design effort relative to the single laminate cuttings, their arrangement and number of plies.

A bicycle frame, for example, is made out of more than 400 different cuttings, which are produced on CNC cutters from pre-impregnated carbon fiber fabrics, called prepregs. The CNC data are now prepared with Fibersim. The single blanks are then inserted into molding tools, which are designed with NX, and then hardened in autoclaves under pressure and heat.



*The B10-5 in action during the track world championships 2016 in London. Roger Kluge won the silver medal in the omnium race. Copyright: FES.*



*The use of freeform surfaces enables FES engineers to solve complex aerodynamic phenomena in the design of a bicycle frame like the track bicycle B10-5. Copyright: FES.*

Hecken explains, "With Fibersim, the design and manufacture of carbon fiber parts are much more efficient. As the software is fully integrated with NX, our only need is a little bit of adaptation to fit our processes. Although the solution is quite new to us, we already use it effectively for projects for upcoming events."

## Solutions/Services

NX

[www.siemens.com/nx](http://www.siemens.com/nx)

Teamcenter

[www.siemens.com/teamcenter](http://www.siemens.com/teamcenter)

Fibersim

[www.siemens.com/plm/fibersim](http://www.siemens.com/plm/fibersim)

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## Customer's primary business

The institute for research and development of sports equipment, called FES, is an institute of the support association IAT/FES within the German Olympic Sports Confederation (DOSB).

FES's primary objective is to deliver innovative and highly competitive equipment exclusively to German athletes, enabling them to successfully compete in international events, including world championships and the Olympic Games.

[www.fes-sport.de](http://www.fes-sport.de)

## Customer location

Berlin

Germany

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Oliver Hecken  
Development Engineer  
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## Summary

With extensive experience, sports equipment subject matter experts in research, development and production and a goal to deliver better and better products, FES is very well positioned for future challenges. The use of state-of-the-art Siemens PLM Software technology supports the institute's need to optimize processes according to demanding schedules, helping the organization to test alternative concepts and realize creative ideas quickly.

Hecken concludes, "The use of NX offers so many possibilities that we have yet to hit a wall. Furthermore, using NX, we don't need to import or export data between the different modules. This means far fewer chances for errors and faster turnaround, particularly when it comes to design changes. And, the ease of use of NX is vividly demonstrated through the quick and productive performance of students who are working on these special projects."

***"The bicycle fork should be flexible lengthwise, but as rigid as possible crosswise, which contradicts optimal flow conditions. With FE modeling, Fibersim and fiber-reinforced plastics, we can solve this challenge."***

Ronny Hartnick  
Theme Manager for Cycling  
FES

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