SIEMENS

JSC STAR

Accelerating the design of aircraft engine control systems

Industry

Aircraft engines

Business challenges

Shrink design and production planning cycle times

Improve design quality

Reduce the use of physical prototypes

Keys to success

Solid Edge CAD deployment

Development of a unique, dedicated technology for complicated body piece design

Tight integration between Solid Edge and NX CAM

Results

Development time for complex parts reduced by 30 percent

Managed, collaborative assembly design

Fewer engineering errors

Improved NC machine tool performance

New, more efficient best practices

Virtual elimination of physical prototypes

The use of Solid Edge and NX CAM reduces development time for complex parts by 30 percent

Facing the challenges of the new millennium

JSC STAR, part of the United Aircraft Engines Corporation, is a research and production association. For more than 70 years, the company has designed and produced automated control systems for jet engines. It manufactures digital electronic regulators and hydromechanical control units for aircraft jet engines, gas turbine power plants, gas compressor units, and sea vessels.

The jet engine control systems developed by JSC STAR are used in the most well-known Russian aircraft, including the Tupolev 204/214, the Ilyushin 96-300 airliners, the Ilyushin 76 cargo jets, the Sukhoi 25 ground attack aircraft, the Sukhoi 27, Sukhoi 30 and Sukhoi 35 multi-role fighters, the MiG 31 interceptors, the Mil 8MTV, Mil 17, Mil 171 and Kamov 32 multirole helicopters, and the Mil 24, Mil 35, Mil 28N, Kamov 52, Kamov 27 and Kamov 29 military and transport helicopters. The quality management system for aircraft development, manufacturing, and maintenance established at JSC STAR is certified and compliant with ISO 9001-2008.

As JSC STAR entered the third millennium, it faced new challenges that made it necessary to reduce development time and costs. The world market required faster
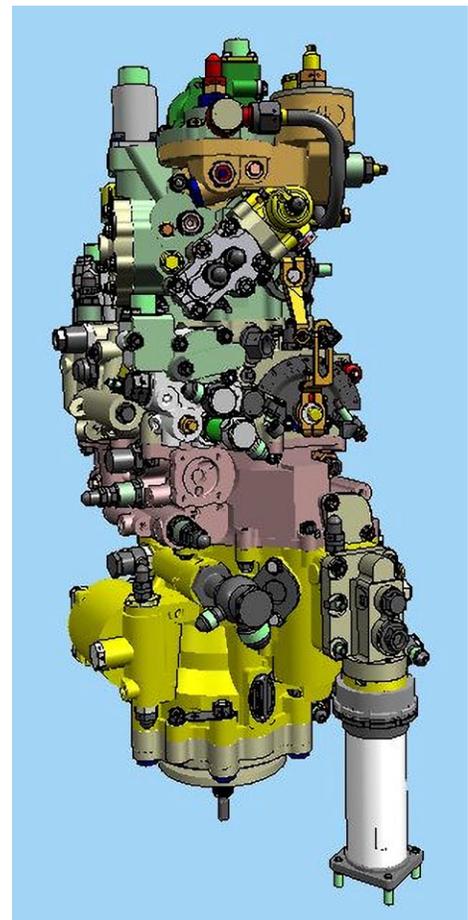
development from the Russian aircraft engine industry in general, and from JSC STAR as well.

Since the company develops entire engine control systems – from simple parts to complicated systems – there was a need

for a single design tool. The tool had to meet the following requirements: improve collaboration efficiency across the value chain, reduce design and production planning cycle time, improve design quality and efficiency, and reduce the number of manufacturing errors using product visualization prior to production.

Nearly all solutions available at the time were analyzed against several decision criteria.

In addition to functioning as a single design tool, the system had to improve collaboration efficiency over the entire value chain, from design and production planning to the unit's manufacturing. In addition, it was necessary to exchange models between the company and its partners, who were already using advanced software solutions. The company also had to support an efficient collaboration with the suppliers and clients. Another important task was the ability to export to computer-aided manufacturing (CAM) systems, since JSC STAR uses modern numerical control (NC) machine tools.

As the company's operations were getting more complicated, it was also looking ahead to future integration between the computer-aided design (CAD) system and a product lifecycle management (PLM) solution. "Solid Edge from Siemens PLM Software featured the most extensive functionality and could help with achiev-

ing our goals," says Elena Nikitina, senior design engineer, JSC STAR, who led the adoption of the new technologies. "Besides, Solid Edge was easy to learn and to use, and, what was really important, it was fully in Russian." The company's experts also note that the CAD system's price influenced the decision, and that Solid Edge® software was the best choice considering the cost-to-functionality ratio.

Fast start with easy-to-learn CAD software
The designers and manufacturing engineers mastered Solid Edge without specific training. "Solid Edge is an intuitive and easy-to-learn product," Nikitina notes. "Our experts mastered the system on their own. They share the knowledge they have gained, and in this way they improve their Solid Edge skills."
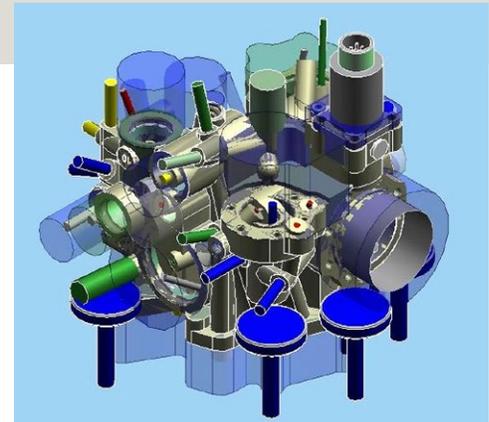
The company established a workgroup for the new software's deployment. The group included two experts each from the information technology (IT) department, the design department, the production management department, and the metallurgy department. "There was no pilot project as such, we just began working," Nikitina recalls. "We started with designing simple parts as we were getting used to the software environment, learning its capabilities and gaining experience. Gradually the parts being designed were getting more and more complicated. First, these were adaptors, covers, valves, bushes, and then complicated body pieces."
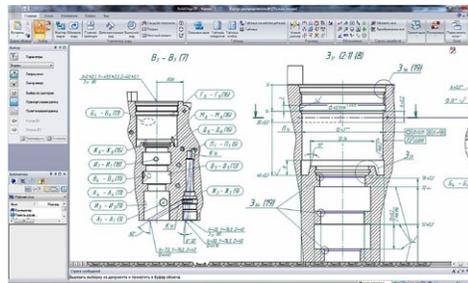
Initially Solid Edge was used only for creating 3D models. Drawings were made using another solution, since the Solid Edge version available at that time was not compliant with the Russian Unified Design Annotation System (ESKD). However, this issue was quickly resolved. Siemens PLM Software implemented all user-suggested improvements in the following Solid Edge releases. As a result, JSC STAR has switched to drafting using Siemens PLM Software's products as well. "All the time that our company has been using Solid Edge, we have seen the system's functionality evolving," says Rinat Talipov, CAD Department head, JSC STAR. "It is paramount that the developer pays close attention to user suggestions."

A unique approach for a complex part
Today the company uses Solid Edge for designing all parts, including complicated body pieces and all assemblies for hydro-mechanical units. One example of using the extensive capabilities of Solid Edge is the NR-2500 fuel control unit design. The unit is intended for the automated control system of the advanced VK-2500P engine to be installed on the midsize Mil and Kamov helicopters. The fuel control unit consists of a number of modules. The primary part is the body piece, which has a lot of holes and cavities interconnected with channels.

It would be very difficult to model the body in the conventional "boss-cut" way. "To make the unit work, the internal cavities, holes and in-body channels, which work under the same pressure, have to be interconnected and separated with thin 3-milimeter walls from the cavities, holes,

and channels working under different pressure," explains Nikitina. "Designing the body in the 'boss-cut' way was unacceptable, since it was very difficult to make the correct blends of the cast surfaces and to check the minimum wall thickness inside the body."

JSC STAR's experts found a different approach using Solid Edge. They developed a script for the fuel control unit's body design. The script overcomes all the indicated issues. The unique technology is based on the master model concept and on the efficient associative geometry copying tools available in Solid Edge.

"Solid Edge is a convenient tool for solving complicated problems," notes Talipov. "It has made the engineers' work much simpler. The NR-2500 fuel control unit's body design was started in March. Just half a year later, in September, the first unit was shipped to the customer. The time was reduced by about 25 to 30 percent."

Want a part? Easy to find in the library!
The implementation of new technologies from Siemens PLM Software has changed the work pattern of the designers and the manufacturing engineers. Today a model is jointly developed by experts from different domains: designers, manufacturing engineers and molders. The designer creates two related models: an exact geometric representation intended for the Production Management Department, and a second representation that includes machining operations to be used by the Metallurgy Department for making the casting.

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Rinat Talipov
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JSC STAR

This method of interaction enables starting the tooling design, body casting and machining process development prior to the release of the drawings. "This way of working greatly improves the quality of product development," says Talipov. "Thanks to using the out-of-the-box functionality and the standard parts library, the amount of human error has been greatly reduced. Now our designers and manufacturing engineers realize that they not only do their job, but also contribute to the common knowledge and best practices bank."

The unit's assembly is performed in the 3D modeling environment. The completed 3D model is sent to the customer for approval, eliminating the need to make physical prototypes for this stage of the process.

Benefits of tight integration: Solid Edge and NX CAM

One of the significant benefits of using Solid Edge for JSC STAR is its seamless integration with NX™ software, also from Siemens PLM Software. A large part of the work at JSC STAR is NC machining, specifically drilling and milling. Some of the NC tools are programmed using NX CAM and data generated with Solid Edge.

"Long ago we realized the benefits of NX for NC programming," says Talipov. "It improves efficiency, and reduces manufacturing errors. Besides, since both systems are from Siemens PLM Software; they are integrated, so overall product development time is reduced."

Modern solutions as a way to success

What is behind the successful implementation of new IT technologies at manufacturing companies? "It all depends on choosing the right system, and on the employees' motivation," says Talipov. "If a unified development environment is convenient, if it reduces time and manufacturing errors, then the personnel will be committed to it."

JSC STAR is happy with the result of its partnership with Siemens PLM Software. With Solid Edge, the company has streamlined its design process and significantly reduced design and production planning time. The visualization capabilities of Solid Edge save money by requiring fewer prototypes, while collaborative assembly design removes possible engineering errors. With these advantages, the company successfully develops advanced jet engine control systems.

JSC STAR plans to expand its use of Siemens PLM Software's solutions. The first step will be an implementation of Teamcenter® software. "The need for a digital product lifecycle management environment has long been overdue at the company," Talipov says. "Considering our specific needs, Siemens PLM Software experts have proposed a prototype of a Teamcenter solution that supports end-to-end engineering data exchange at every design and manufacturing stage. After the data model is refined, we are going to implement Teamcenter full-scale and teach the personnel."