



Functional Design of Aircraft Engines in VZLU with Autodesk Inventor

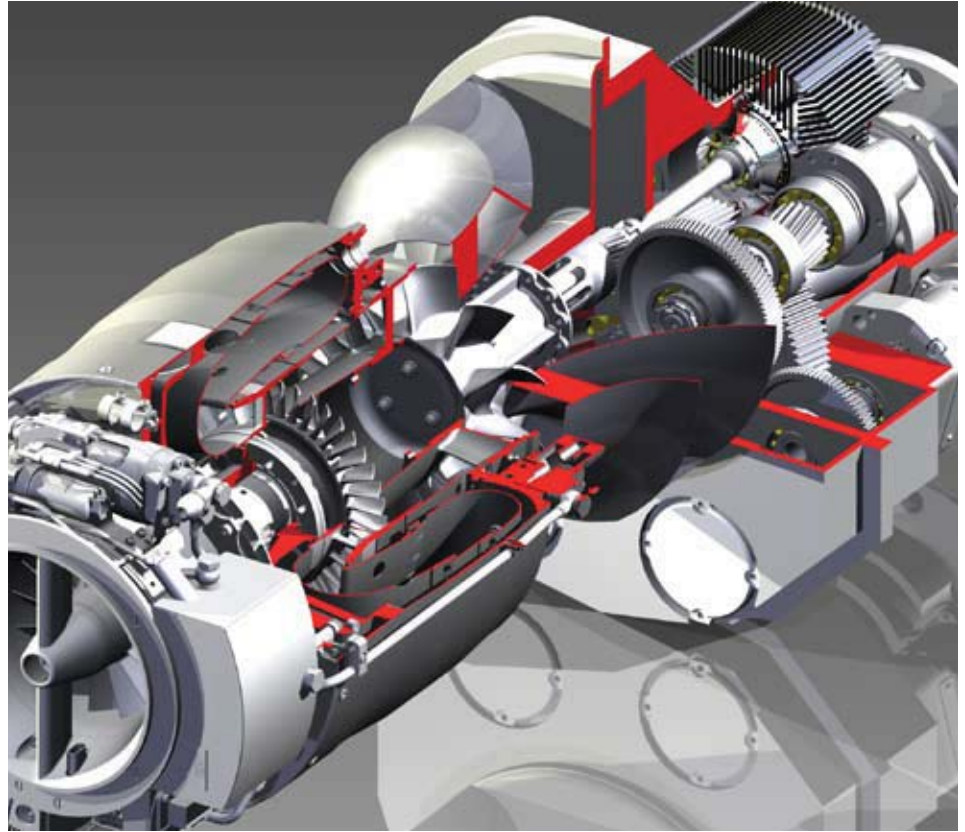
Customer

Aeronautical Research and Test Institute (VZLU) was founded in 1922, being one of the first establishments of that type on the European continent. More than 80 different aircraft types have passed through the Institute's labs to date. VZLU is a major centre for aeronautic research, development and testing in the Czech Republic. VZLU currently employs 350 professionals. The key part of VZLU's activity includes projects won from public competitions contracted by government administration bodies, projects contracted by EU, and commercial activities for both private and public companies from the Czech Republic and abroad. One of the significant sections of VZLU is the Engine Division.

Customer quotes

"Today, modern software enables to eliminate a number of tests on physical prototypes or to conduct them more effectively and thereby significantly boosts efficiency of the complete process of engineering product development. Autodesk Inventor, as a top representative of such software, dramatically accelerates the phase of construction works."

"Unlike other software, Autodesk Inventor environment is very intuitive and user friendly. Since the new version Autodesk Inventor includes Inventor Studio, which provided complex visualization of the designed engine for presenting to the customer."



Among many research activities, the Engine Division has been involved in a design of modern reduction gear-box for a small prop-jet aircraft engine representing a unique category in today's turbine aircraft engine global market. The engine is being constructed in co-operation with První brněnská strojírna Velká Bíteš, which had already developed commercially successful turbojet engine TJ 100 A based on a prop-jet engine, for which the new reduction gear-box has been designed. Construction of the prop-jet engine demonstrator is currently in progress in První brněnská strojírna.

První brněnská strojírna Velká Bíteš, a.s., a Czech machine manufacturer with approximately 800 employees, focuses on manufacturing power units, ecological devices, aviation engineering, cryogenics, precision casting, moulds for precision casting and the moulding of plastics, fixtures and special tools, galvanic surface finishing etc. The Aircraft Technology division of První brněnská strojírna Velká Bíteš, a.s. - as the

only one in the Czech Republic and one of few firms in Europe - is able to manufacture Auxiliary Power Units (APU) based on a small turbine engine with output up to 80 kW. The division newly developed and launched into production the small turbojet engine TJ 100A, which has become a basis of the prop-jet engine being co-developed with VZLU.

Project challenges

The overall research program started in 2005 and is expected to be finalized in 2008, while the prop-jet engine is one of pilot results of this research. Until now, the modeling phase and construction works have already been finished. A range of design variations were proposed, from which the final variation has been selected and prepared for production. Prop-jet engine for unmanned vehicles with compressive adjustment and approximately 200 kW power on propeller shaft has finally become the selected variant. The project is now in a phase of implementation of constructional engine parts.

VZLU expects that – with experience to be achieved from unmanned aircraft –in the future, the propulsion unit will be able to serve even in air vehicles piloted by human crew. From market standpoint, the engine represents an interesting high-power class standing on borderline between where piston engine with the same power is already too heavy and turbine engine is still too expensive.

The key constructional challenge of small prop-jet engine project was a design of modern reduction gear-box . The engine is twin-shaft with free turbine - flow of hot gas generated by engine core powers the spinning free turbine, whose shaft enters the reduction gear-box while spinning the airscrew shaft. The purpose of reduction gear-box is to lower high rotational speed of free turbine to rotational speed appropriate for aircraft propellers.

Solution

With regard to analysis of activities necessary for designing complicated aircraft turbine engine nodes, Autodesk Inventor as a high-quality software tool became the customer's choice. This, in conjunction with highly experienced construction engineer mastering the work on CAD systems, enabled designing the reducer construction quickly and effectively.

A major reason for choice of this software was positive experience from previous projects and knowledge of its environment, as construction engineer responsible for designing the reducer had been already working with Autodesk Inventor. Another key reason was the fact, that the solution has very effective price / performance ratio for the required volume and segment.



Important feature of the software includes also possibility of product visualization in pre-manufacturing phase, including various insights and animations, which are enabled through integrated module Inventor Studio. The results of constructional activities thus could be sent in very informative shape to Prvni brnenska strojirna in Velka Bites, where necessary compatibility with other system had to be ensured.

Benefits of Autodesk Inventor

Within the project Autodesk Inventor demonstrated itself as a product, which very well copes with functional design of complicated engineering issues. Inventor enabled create and visualise the design in real time and thanks to its tools for functional collision control, it provided the construction

engineer with reduced time that was previously needed for manual verification.

Autodesk Inventor enabled not only to easily create and verify 3D model of reducer, but even to derive all drawings from this model, project them into 2D plans, manage all links while eliminating bugs, that otherwise usually appear during manual redrawing . The construction engineer was able to easily estimate basic dimensions, basic dynamic characteristics and quantity allocation, whereby it extremely accelerated construction works.

In the future, VZLU assumes to use Autodesk Inventor in following projects to be gained in the area of governmental contracts or commercial projects from private subjects.

Project Overview:

- Development and construction of aircraft propjet engine with 200 kW power
- A key part of the project was a construction of the reduction gear-box
- Autodesk Inventor served in the phase of construction works
- Inventor helped to dramatically accelerate construction phase and eliminate errors
- It enabled to visualize view and functionality already in the pre-manufacturing phase

