HyperWorks helps ACENTISS in the development of Elias, a new electrically powered ultra-lightweight airplane

Overview

ACENTISS – Approved Center of Engineering, Technology and In Service Support – supports clients through all phases of the product life cycle. The company provides engineering services for structural design, stress and fatigue competencies for metallic and composite structures in all project phases. Within their everyday work the engineers apply Altair's HyperWorks suite for many development tasks. Recently, ACENTISS has developed the all-electric technology demonstrator ELIAS (Electric Aircraft IABG ACENTISS) based on the one-seater UL aircraft ELECTRA ONE from PC-AERO GmbH. Consequently, the research project EUROPAS was initiated by IABG and ACENTISS.

Within this scientific approach the engineers had to develop the full electric reconnaissance system, datalinks, and the ground control station as well as the structure of the wings and the landing gear of ELIAS. To perform all the needed engineering and development work of the project ACENTISS applied Altair's HyperWorks suite. Most of the tools included in the suite were used throughout the entire development process, namely HyperMesh and HyperView for pre- and post-processing tasks, MotionSolve and OptiStruct as MBD and FE solvers as well as to optimize the structure of the plane regarding strength, performance and weight. This also included the design and optimization of composite structures.

Test flight of the ELIAS electrical plane.

Business Profile

ACENTISS – Approved Center of Engineering, Technology and In Service Support – supports clients through all phases of the product life cycle, primarily in the industries of Aerospace, Renewable Energy, and Automotive. The ACENTISS knowledge and experience is leveraged to investigate and develop new technologies, to analyze and optimize clients' processes, to transfer engineering know-how and to provide interim management services.

In the area of Engineering, Simulation & Optimization, ACENTISS provides engineering services for structural design, stress and fatigue competencies for metallic and composite structures in all project phases, like conceptual design, preliminary design, detailed design, manufacturing, verification and certification including testing, and in-service support. ACENTISS uses advanced simulation techniques to achieve high quality for the developed products. To guarantee a light-weight design at reasonable costs, the organization uses numerical optimization methods and evolutionary strategies.

Challenge

In the scope of the research project EUROPAS the engineers from ACENTISS and IABG had to reengineer the structure of an existing airplane. In addition to the new development of the full electric reconnaissance system, datalinks, and the ground control station for the new aircraft, ACENTISS also had to design the structure of the wings and the landing gear. Since ELIAS is a manned electrical plane, weight plays an important role in the development. The less weight a plane has the longer and farther it can fly. Development time and costs are other topics that also play a big role in the conduction of a research project like this.

To reach the optimum regarding weight, strength and performance and to reduce design iterations with the real world prototype ACENTISS had to leverage computer-aided engineering tools. They were needed especially for the structural layout of the composite wings (FE) and the kinematics of the landing gear (MBD). ACENTISS had to deliver material properties, components stiffness and strength for the production.

"For an engineering service provider like ACENTISS, it is vital to have access to a powerful and at the same time flexible simulation environment covering all the needed tools for the development tasks our projects request. HyperWorks is offering exactly what we need and we are very much looking forward to continue to work with Altair and to leverage their simulation knowledge as well as their superior support" ACENTISS.

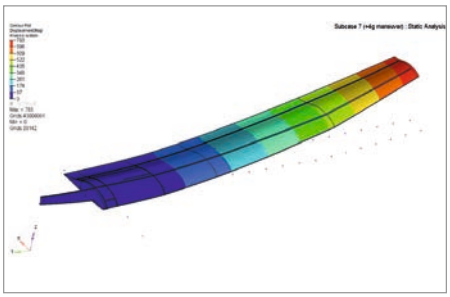
Dr. Christoph Katzenschwanz
Head of Engineering, Simulation & Optimization, **ACENTISS**

Solution

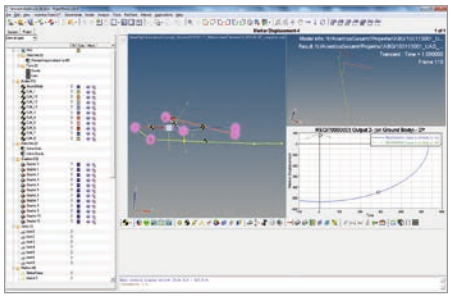
To conduct all the needed engineering work ACENTISS applied the Altair HyperWorks Suite including HyperMesh, HyperView, MotionSolve, and OptiStruct. ACENTISS has started to use HyperWorks in 2009 and has gained an in-depth expertise in working with the sophisticated virtual design tools since then. The applied HyperWorks tools were used to design, calculate, and proof the composite structure of the plane wings. Like this the engineers could determine the optimal fiber volume of the wings – ensuring that they would be light and at the same time as stiff as needed.

In the area of multi body simulation ACENTISS performed kinematic simulations of the landing gear design as well as topology optimization, to ensure the best possible weight/performance ratio. The optimization enabled ACENTISS to shorten the needed development time until they reached a final valid design with a minimum of weight.

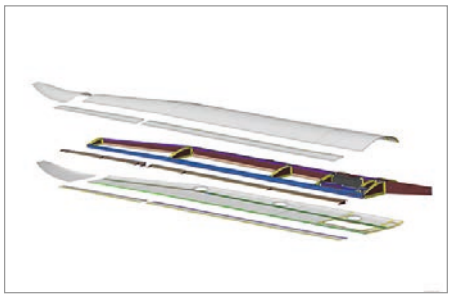
Overall, Altair's HyperWorks products enabled them to create optimal dimensions of all the components and systems they designed. The components were then produced based on the virtually determined specifications and the new plane passed all certification tests easily.



Contour plot of the static analysis of the composite wing structure.



Kinematic study of the landing gear with MotionView.



Composition of the ELIAS wing structure.

Benefits

HyperWorks and the tools the suite comprises, HyperMesh, HyperView, MotionSolve, and OptiStruct, enable the engineers of ACENTISS to establish a faster and less error prone development process. This leads to a higher product quality, since more design variants can be evaluated in the same time.

Thanks to HyperWorks and the flexible licensing system Altair offers for its suite and - within the Altair Partner Alliance – also for additional third party partner software, the ACENTISS engineers can access almost every tool they need flexibly, under one licensing agreement, and from one vendor.

All in all the use of HyperWorks helps ACENTISS to:

- Optimize component weight and performance
- Determine detailed component design specifications prior to manufacturing
- Deliver high product quality
- React flexible on development requests due to the broad access to needed development software tools