

Building more sustainable aircrafts

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Airbus production hall in Hamburg: using the “Eco-Design Software Tool,” Life Cycle Assessments can now be performed even during the design phase. Credit: EADS

Life Cycle Assessments of components can help make aircraft production more sustainable. The decisive factor is making the data available at an early stage. Thanks to a new eco design software, these data are now available even at the design stage.

The European aviation industry has set ambitious environmental

protection goals for itself: by the year 2020, it not only wants to reduce emissions of gases harmful to the climate – carbon dioxide by 50 percent and nitrogen oxide by 80 percent – but it also wants to improve the life cycles of the aircrafts themselves. "[Life Cycle Assessment](#) (LCA)" is the term experts use to describe the systematic assessment of the adverse [environmental impact](#) of aircraft components in use. The analysis comprises all of the environmental impact that a product has caused throughout the course of its entire [life cycle](#) – from production to use to recycling or disposal.

High-performance software is needed to collect these data. These programs are very complex and are currently usually operated by external experts with specific LCA expertise. A further drawback: for the most part, this software only records the relevant data and processes after the fact. "The aviation industry plans for the long term: oftentimes, aircraft models are kept in service for 20 years or more. In this context, if you fail to carry out a Life Cycle Assessment at an early stage, you'll have to offset the impact later on with great effort and expense," explains Robert Ilg of the Life Cycle Engineering Department (GaBi) of the Fraunhofer Institute for Building Physics IBP.

Simplified Life Cycle Assessment

Researchers have now developed a computer program with which environmental impact of aircraft components can be taken into account even at the design stage, during the R&D stage and before production begins. This "Eco-Design Software Tool" is based on an aviation database containing LCA-based environmental information on a host of reference components. "With a click of the mouse, the designer knows how large a component's "environmental backpack" is, based on its prior production process. This means that the related material and energy flows can be quantified," Ilg points out as he describes the functionality of the Eco-Design Tool.

A kilogram of aluminum sheeting, for instance, a material often used in aircraft construction, already has an environmental "backpack" of around 140 Megajoules as a result of bauxite mining, transport from overseas and further processing in Europe. This represents more than four times the energy quantity released when a kilogram of crude oil is combusted. "The Environmental impact of the components used is increased significantly during the further production process as a result of the particularly high material requirements in the aviation sector. That is why the Life Cycle Assessment datasets must be tailored exactly to the aviation industry. This aviation specific component has been missing in the tools used to date," Ilg adds.

Another key element of the new software are specially programmed LCA background models. With these models, designers can vary scenarios with various components and get an immediate picture of how different materials, construction options or processes affect the environmental performance. The designer does not have to perform detailed analysis and can instead compare the selected components to the reference component settings given in the Eco-Design Tool. An intuitive arranged user interface presents the most important LCA parameters via drop-down menu. There is another benefit as well: "The aircraft designer can use the software to generate the kinds of analyses that were once reserved to trained LCA specialists. This way, environmental aspects in the aviation sector can be taken into account at a very early – and hence decisive – stage in the production process: the planning and development stage," Ilg adds.

The computer program was developed together with the colleagues from the Interactive Engineering Technologies (IET) Department of the Fraunhofer Institute for Computer Graphics Research IGD in Darmstadt and the Life Cycle Engineering Department (GaBi) of the University of Stuttgart as part of "Clean Sky". With a budget of around 1.6 billion euros, the project is one of the largest initiatives of the European

Commission and was created in 2008 with the aim of making aviation more environmentally friendly. This is an area in which Fraunhofer has long worked hand-in-hand with the [aviation industry](#). Project partners include, for instance, EADS, Airbus, Eurocopter or Rolls-Royce. "The industry is currently using the technology as part of an initial test phase. With the help of the software, it creates its own Life Cycle Assessments that it then publishes as 'Eco-Statements,'" adds Laura Brethauer of the GaBi Department at IBP. At the "Paris Air Show (SIAE)" from June 17 to 23, 2013, at Paris-Le Bourget, Ilg and Brethauer will showcase the first version of their new Eco-Design Software Tool (Hall 1, Booth G316).

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