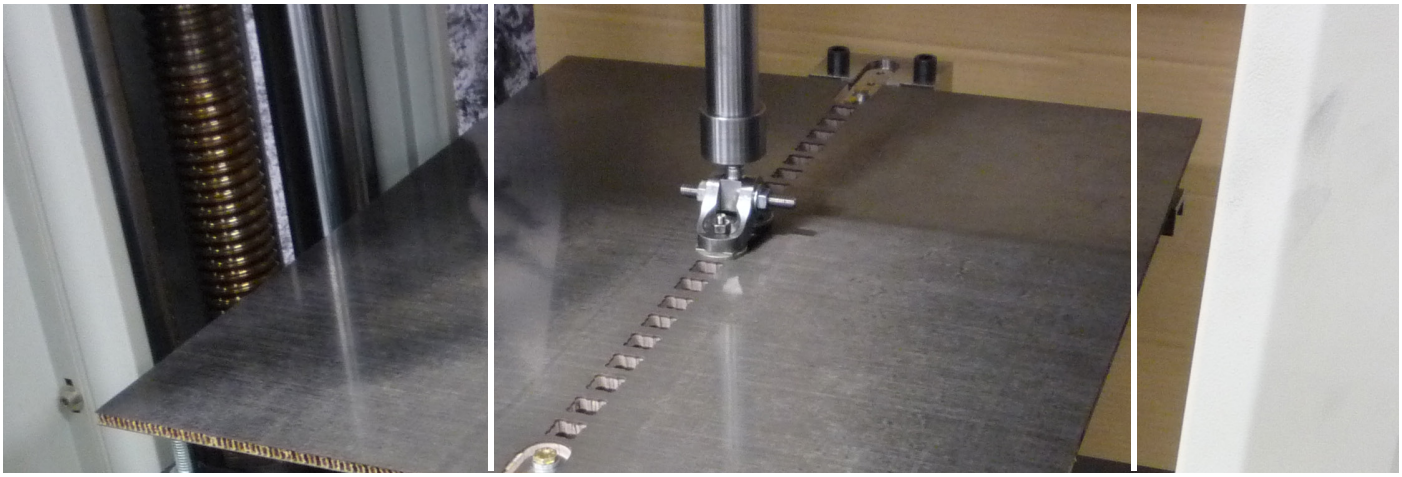
Altair | Enterprise Solutions

# HyperWorks helps SOGECLAIR aerospace to create new innovative flooring concept while saving development time and product weight



SOGECLAIR aerospace

## Key Highlights

**Industry** Aerospace interiors

**Challenge** Development of new flooring concept to fix the cabin seats while realizing a lighter structure, adjustable panels for all types of aircraft, and an easier installation and maintenance.

**Altair Solution** Use of HyperWorks, especially HyperMesh and HyperView as a pre- and postprocessor, OptiStruct for optimization issues, RADIOSS for linear and nonlinear simulation, and solidThinking Evolve/Inspire for concept modeling

**Benefits**

- Saving development time and costs
- Use a new approach in the design leveraging optimization
- Reduce product weight through structural optimization of composite components

## Overview

SOGECLAIR aerospace employs HyperWorks in most of their development projects and has been an Altair customer since 2009. Within the CAE suite, the engineers frequently use HyperMesh and HyperView as pre- and postprocessors, OptiStruct for optimization tasks, RADIOSS for linear and nonlinear simulations, and solidThinking Evolve/Inspire which is used as a concept modeling tool. To leverage all of the needed tools, SOGECLAIR aerospace is using HyperWorks units giving them access to all Altair solutions under one licensing agreement.

The aerospace industry has always been at the forefront of weight optimization and lightweight design, hence it was not surprising that aerospace also was one of the first industries to use alternative materials such as composites. In the recent development project "Optimfloor", the design and optimization of a new flooring concept for passenger aircrafts, SOGECLAIR aerospace's engineers used Altair's optimization technology to create a single piece flooring concept made of composite materials, which is replacing metallic seat tracks with composite-made stiffeners directly integrated into the floor panels. OptiStruct, and the other Altair solutions enabled them to design and optimize the composite structure of the new floor concept, leading to weight savings of 20% from the total floor weight compared to the previous floor design. These weight savings will contribute to a better fuel efficiency or an increased load capacity.



Keywords: Aerospace, Composites, Optimization

## Company profile

SOGECLAIR aerospace, as part of SOGECLAIR group, is a major partner in engineering and a prime contractor for the aerospace industry for each and all of its domains of expertise and product lines. Present in France, Spain, the United Kingdom, Germany, Tunisia, and Canada, as well as in the dollar zone and off-shore (India and Turkey), SOGECLAIR aerospace is attentive to its customers and to their technological and strategic expectations.

With a total team of nearly 1000 highly qualified people, SOGECLAIR aerospace relies on a variety of different partnership modes and sites to ensure its development for the benefit of its customers. The services of SOGECLAIR aerospace come in various forms, quality consultancy and management in the areas of: aero structures, systems installation, configuration and product data management, equipment, and manufacturing engineering. Besides consulting services, SOGECLAIR aerospace proposes solutions from development through to overall project management. The company provides I&D (Innovation & Development), project management, industrial cooperation programs, industrialization, integration, certification, processes, quality, IT resources, procurement, subcontracting, support, after-sales and more.

*"Altair and HyperWorks help me to rapidly create and optimize new designs – making sure that a new design fulfills all requirements."*

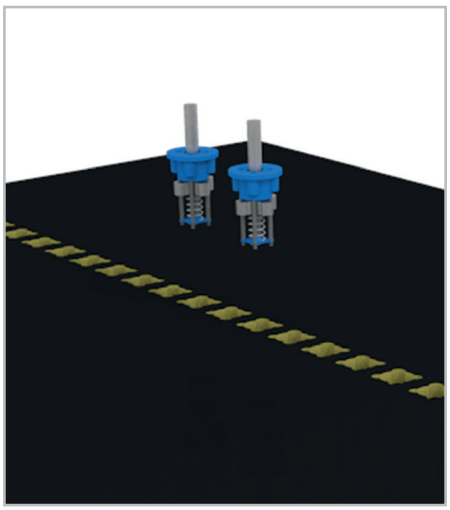
**Paul Mirguet, Innovation Engineer at the Innovation Department at SOGECLAIR aerospace.**

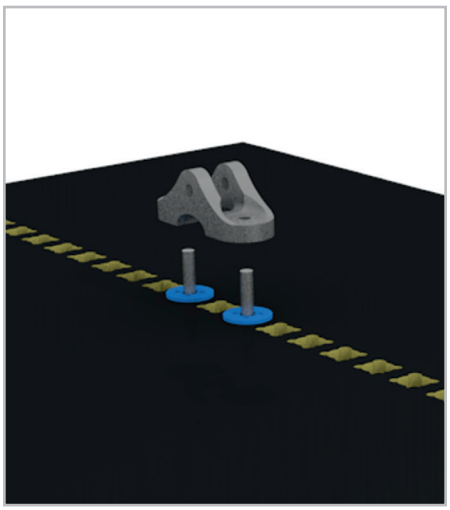
Within SOGECLAIR aerospace, the Innovation Department is active since 2009, encouraging innovative ideas and managing innovative projects developed by the technical departments, while being responsible for their promotion both internally and externally. This dedicated cell also aims to facilitate the activities of research and innovation by actively participating in various networks and clusters (Aerospace Valley, AsTech, EMC2, Gifas, Pegase ...). SOGECLAIR aerospace has chosen to put innovation at the heart of their corporate culture. The validated technical solutions are implemented in operational product lines.

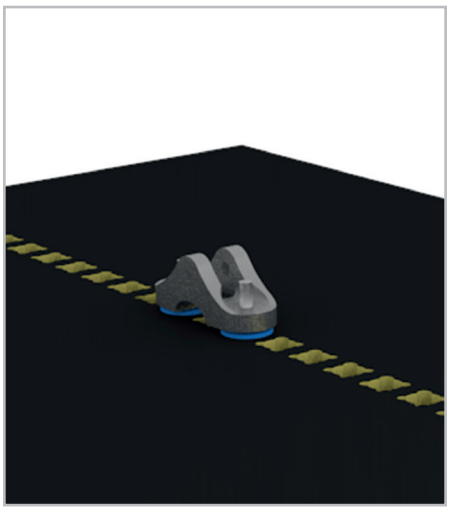
## Challenge

Every day SOGECLAIR aerospace is facing manufacturing challenges to optimize the product's structure regarding weight reduction. The engineers have to consider conflicting issues such as weight, design, maximal dimensions, strength, stiffness etc. The use of optimization technology is the solution to combine all of these constrains with respect to an optimal composite layout. In this context SOGECLAIR aerospace investigates innovative materials and processes to integrate them in the design, analysis, and optimization.

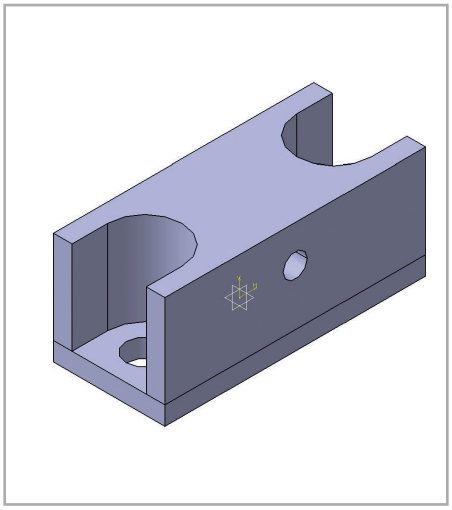
Since unnecessary mass reduces the nominal reach of an airplane and increases its fuel consumption, weight reduction is one of

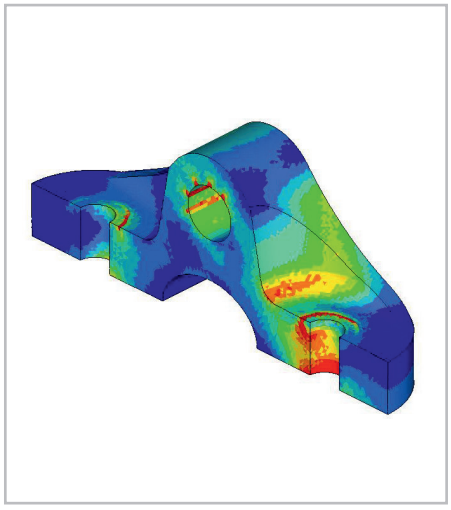






Thanks to the new fastening system, the aircraft manufacturers will also benefit from time savings during the panel installation. The cabin elements (seats, furniture...) can be quickly fastened. The fastening system, "easyfix" is very innovative and can be adapted to all types of domains (aeronautics but also construction).





The Titanium brackets have been optimized by starting with the definition of the design and the non-design space. The succeeding topology optimization revealed different possible designs from which the final form (center picture) was selected and then virtually tested in a finite element analysis.

the most important goals in the design of new aircraft components and systems. In a final product design all objectives have to be included and considered. Therefore, SOGECLAIR aerospace has to leverage sophisticated simulation tools enabling them to investigate designs, to optimize the product's structure and to reduce the final weight to a minimum. In addition, special modeling and optimization techniques are needed to fully benefit from the advantages of components made of composite materials. These techniques are necessary because composite materials are highly anisotropic in their behavior and the created parts are always individually adapted to the special use case.

*"The use of these design and optimization technologies is a great way to save time and money and to discover innovative design directions in the early concept phase of new products."*

**Paul Mirguet, Innovation Engineer at the Innovation Department at SOGECLAIR aerospace.**

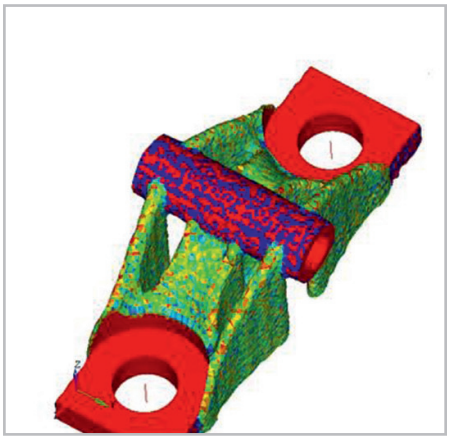
## Solution

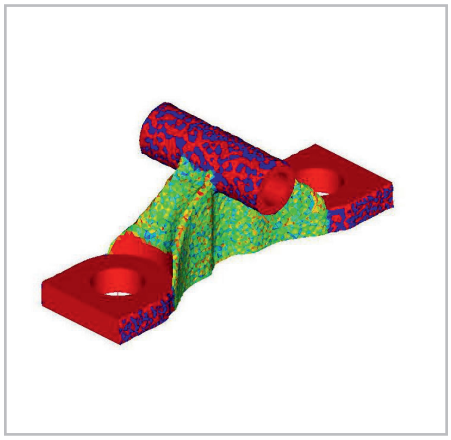
To cover all the required simulation and optimization disciplines, SOGECLAIR aerospace uses the Altair HyperWorks suite in the development of components made of composite materials. From the HyperWorks suite the engineers employ HyperMesh and HyperView as a pre- and postprocessor, OptiStruct for optimization issues, RADIOSS for linear and nonlinear simulation, and solidThinking Evolve and Inspire as a concept modeling tool.

In a typical project the first step is a feasibility study of the objectives to clear up whether it is possible to create an efficient solution. To develop composite structures, the engineers conduct Freesize and Size optimizations defining different patches and layer thicknesses of the composite material, followed by a shuffle optimization to determine the optimal stacking sequence of the single layers. Also gauge optimizations are conducted in order to reach the optimal dimensions of the composite stiffener. In the subsequent development process, the engineers compare the numerical analysis results with tests data, in particular the strains in different stackings. To compare the results, they test the bending in compression or traction load cases and the "pull through". As soon as validated results are available the engineers start with the commercialization of the solution.

## Use case

In the recent project "Optimfloor", the engineers at SOGECLAIR aerospace used sophisticated optimization techniques to create a single piece flooring concept replacing metallic seat tracks with stiffeners made of composite material that were directly integrated into the floor panels. The project was a perfect example for a conceptual optimization approach: thanks to OptiStruct the engineers were able to identify an innovative geometry already in the concept phase of the project. Unlike the airplane floor panels usually offered these days, the Optimfloor floor panel is an integral part of the plane structure and contributes to the overall stiffness. The new floor panel is adaptable to all types of aircrafts, including new programs as well as older ones. In addition the concept is also





**Topology Optimization**

The topology optimization results showed up different possible designs. After choosing the final shape, these results build the basis for the final CAD drawing

applicable to other types of transportation means such as trains. Two SOGECLAIR international patents have been filed (PCT).

The aircraft manufacturer will benefit from the time savings reached during the panel installation, because thanks to the fastening system of Optimfloor the cabin elements (seats, furniture...) can be quickly fastened. Additionally, the composite structure of the new part also allows for a weight reduction of 20% of the total floor weight, leading to more fuel efficiency or increased load capacity. The floor panels will be manufactured using a pultrusion process, a continuous high rate manufacturing process enabling the manufacturers to quickly meet the expectations of the market.

All in all, the new floor panel concept offers several benefits such as:

- A lighter structure (-20%)
- Adjustable panels for all types of aircraft
- Easier installation and maintenance
- Quick and easy fastening
- A ready-to-use floor system

## Benefits of HyperWorks

The use of Altair's HyperWorks solutions enables SOGECLAIR aerospace to investigate and optimize their products already in the early concept phase of a project – leading to a more streamlined development process offering significant time and cost savings. Using HyperWorks and following the described process, the engineers at SOGECLAIR aerospace can combine all constrains and boundary conditions and are able obtain a solution quickly.

All in all HyperWorks offers SOGECLAIR aerospace an innovative development environment and helps to:

- save development time and costs.
- use a new approach in the design leveraging optimization.
- reduce product weight through structural optimization of composite components.

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