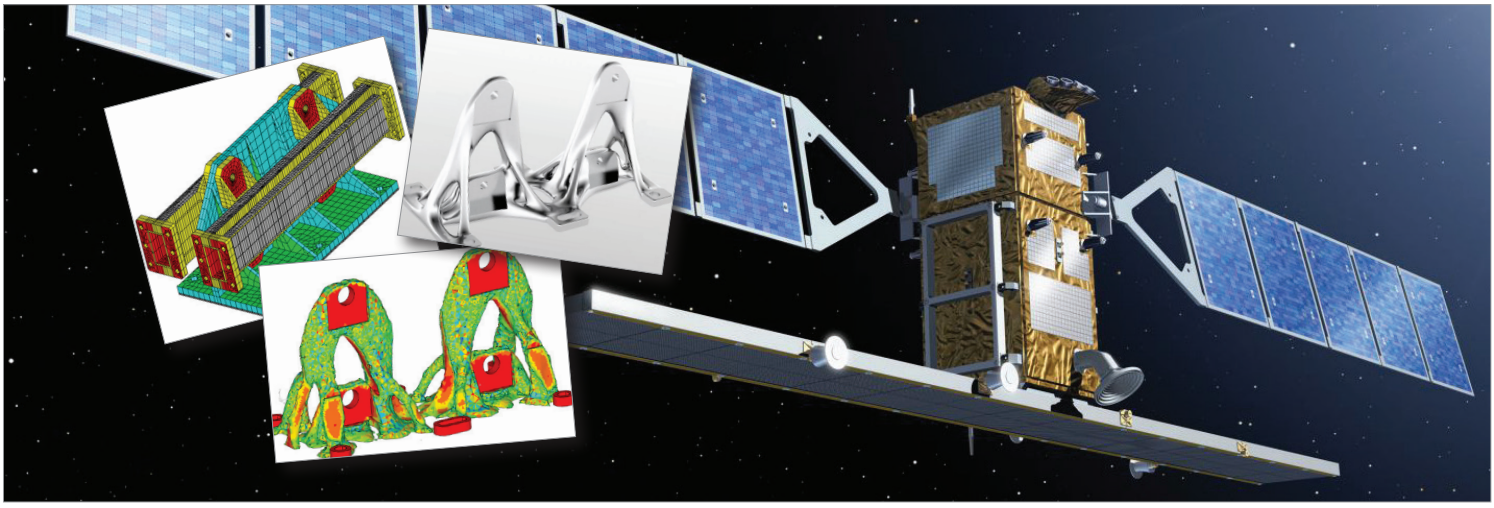
Altair | ProductDesign

case study

Thales Alenia Space

Maximizing the Potential of Additive Manufacturing with Design Optimization

Companies from across a wide range of industries are attempting to find the potential impact that additive manufacturing (AM) could have on design and manufacturing processes. During its own efforts to explore AM and its potential for space satellite development programs, Thales Alenia Space Spain wanted to conduct a research project to see how optimization techniques could be used in conjunction with new manufacturing technology. The primary objective of the study was to use design optimization techniques to reduce the thermal compliance of a satellite's aluminium filter bracket, while also optimizing the component for weight and readying the final design for the additive manufacturing process.



solution

After a detailed search into potential partners to conduct the research, Altair ProductDesign was selected due to its expertise in both developing design optimization technologies and being able to effectively implement them in the aerospace industry. The filter bracket was selected as a test case as it required a combination of both structural and thermal loads. Altair ProductDesign's first step was to combine two existing models to create a unique thermal-structural model of the bracket that could be used with HyperWorks' OptiStruct structural analysis solver. By combining the models using HyperWorks' HyperMesh pre-processor, the effects of both sets of constraints could be explored in parallel; a vital step to find the optimal design that would satisfy all design requirements in a reasonable timescale.

With the thermal-structural model built, the bracket was divided into sections of 'designable' space (areas where OptiStruct could remove material), and 'non-designable' space (areas where material had to remain in place such as fixing points). This information was combined with the structural and thermal loading data from Thales Alenia Space. Using topology optimization techniques, OptiStruct was able to suggest a new material efficient design that places material where it is required to meet the performance criteria while removing it from areas that do not positively affect the design. The suggested geometry from OptiStruct was then interpreted by Altair ProductDesign's engineers into a layout that was more suitable for the AM process and converted to a manufacturable CAD model.

result

The new design for the bracket achieved a 48% reduction in mass when compared to the baseline, far beyond the 15 – 20% reduction that Thales Alenia Space was trying to achieve. In addition, the thermal compliance of the filter bracket was successfully reduced while maintaining the same structural performance of the original, much heavier design. The study successfully demonstrated the potential impact that AM could have on Thales Alenia Space's products when combined with design optimization techniques. The unique, material efficient designs that are created during the optimization process can now be produced with minimal edits to the ideal shape thanks to the inherent flexibility of AM.