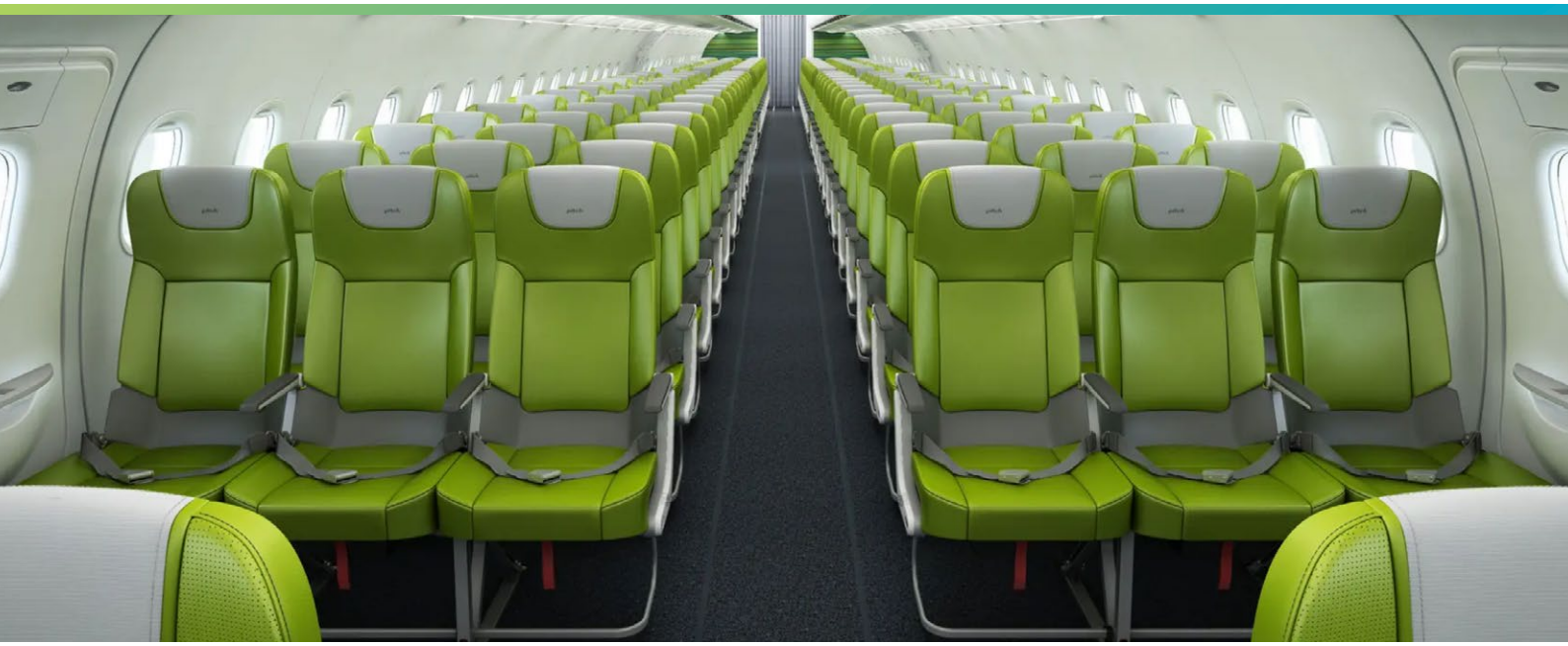
Airframe Designs, Ltd.

Engineers at Airframe Designs address Boeing 737 compartment design trade-off studies using MSC Apex



Due to the progressive post-Covid developments in the Aerospace Industry, time was not on their side. Engineers at Airframe Designs Ltd. needed to redesign, stress test, and analyze all on almost-parallel paths, so that a blueprint could be delivered as quickly as possible.

The global COVID-19 pandemic has hit our lives in ways that could not have been imagined previously. For many engineers, their work has been significantly impacted – through economic constraints, reductions in manufacturing demand, and company-wide remote working. This has resulted in new “budget tightening” across the entire aviation industry, which affects structural design and analysis engineering – a large source of company R&D spend for any aviation company.

Technology has become an important part of airplane engineering and has brought about a re-evolution of structural design. Today, the conceptual-level CAD and associated Finite Element Model (FEM) is the first step in any development work. Anything less than this is simply not an option – like a house of cards, if the FEA is wrong, then it is all wrong. But what happens when schedule pressure causes design and analysis to shrink their timelines and be on almost-parallel paths? Airframe Designs Ltd. decided that MSC Apex was up to the task.

Above: Airframe Designs Ltd. oversees many commercial projects such as a VIP galley upgrades on private jets, as seen above.

Challenge:

The global pandemic, and its impact on the aerospace industry challenged Airframe Designs Ltd. to re-think many of their existing processes and development methods, so that they could save costs and at the same time improve their overall analysis offering. One such opportunity came their way during the construction of a new Boeing 737 stowage compartment design, made up of lightweight metallic and composite sub-structures.

The application of an effective FEA strategy was required to not only develop the new design but yield a detailed understanding of structural behavior in a virtual environment. Airframe Design's engineers needed to re-design, stress test, analyze, and manufacture – all on almost-parallel paths, so that a blueprint could be delivered as quickly as possible. In addition to this, offering their clients high-value feedback from early concepts to finals designs was necessary to win customer loyalty, amidst adjusting losses due to the pandemic. MSC Apex was able to step up to the challenge and deliver rapid structural analysis results for engineers at Airframe Designs, thus meeting their client's needs as well.

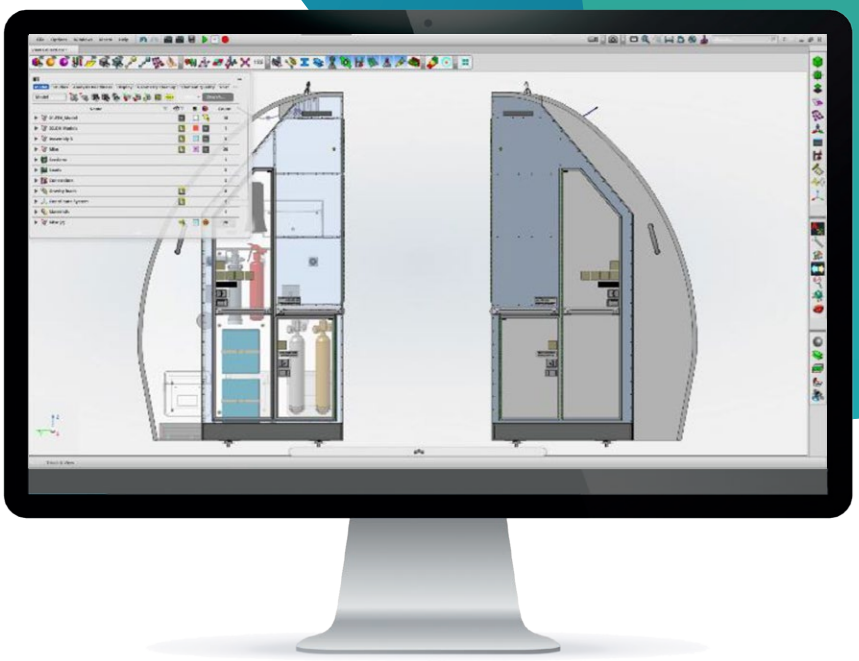
Solution:

After some initial training on the product, Airframe Design's engineering team performed the model build and analysis on their aircraft component designs in MSC Apex. The connection between the CAD and the mesh, as well as the model validation MSC Apex provided with first-run solver success in MSC Nastran meant that quick design changes could be made without having to rebuild the simulation model from scratch for each design change.

"Models developed in legacy FEA software can be difficult to adapt or re-model, as a design evolves...In Apex you can simply modify the underlying CAD, and the simulation model updates automatically." -Bill Thorne, Lead FEA Engineer, Airframe Designs Ltd.

Additional features like "Analysis Readiness" ensured that the components are verified during the build and the model was ready for full assembly verification using MSC Nastran. CAE-specific patented technologies and Python tools allowed automation of several build aspects including geometry modifications, mesh control and fastener connections.

Thus, the re-design of the Boeing 737 stowage compartment was achieved on-schedule and on-budget – and all structural analysis was conducted in accordance with airworthiness standards and requirements.



Above: Boeing 737 stowage compartment conceptual CAD design by Airframe Designs Ltd., visualized in MSC Apex.

Results:

Prior to this development, the use of other legacy FEA software was time-consuming and required a bigger learning curve for engineers at Airframe Designs Ltd.

MSC Apex finite element model building was performed by engineers with minimal product exposure and training – they were able to build MSC Nastran models faster than any other tool they've learned previously. Comparatively, it proved to be significantly faster for FEA model building and analysis than three other legacy tools they used previously –Patran, Altair HyperMesh & Simcenter FEMAP.

"The MSC Apex model build time took less than 3 days whereas using legacy tools were all around 8 days or more." - Dr. Steffan Evans, Lead FEA Engineer at Evotech CAE Ltd., contracted by Airframe Designs, Ltd.

In terms of the stowage compartment FEA model build, the main technologies which gave MSC Apex the advantage were:

> **"The MSC Apex model build time took less than 3 days whereas using legacy tools were all around 8 days or more"**
>
> **Dr. Steffan Evans,**
> Lead FEA Engineer at Evotech CAE Ltd., contracted by Airframe Designs, Ltd.

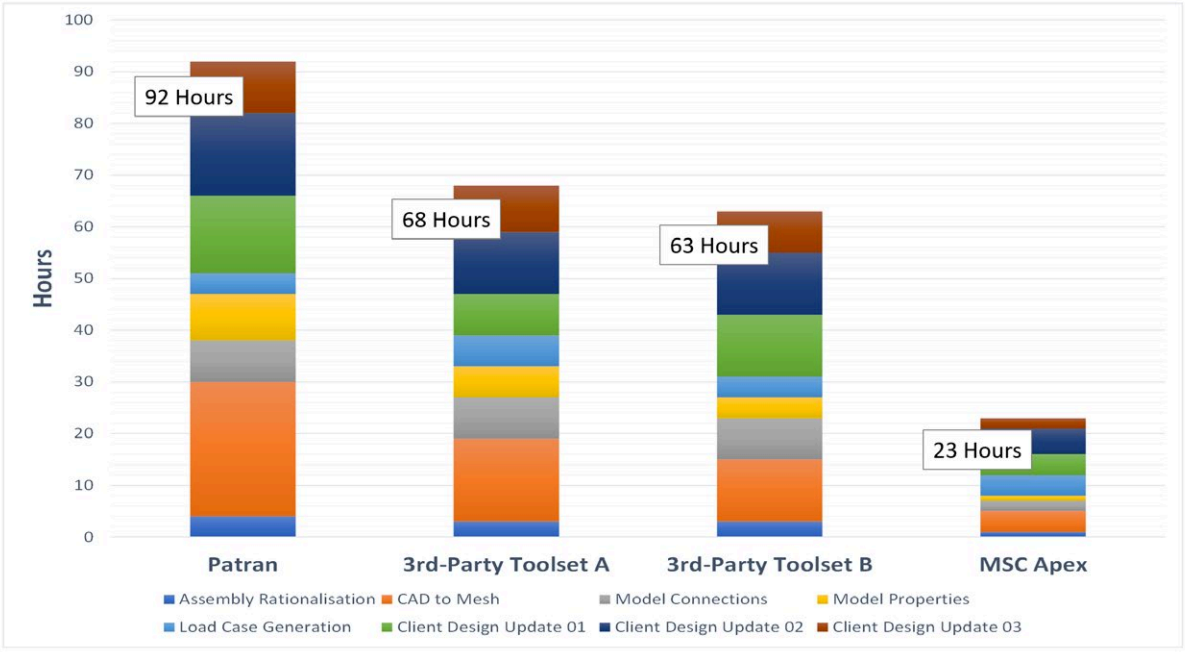
1. CAE-specific 'Direct Modeling', which allows powerful geometry editing, idealization, and mesh control, in a manner unseen in legacy toolsets.

2. 'Generative Model Update', where any change to the underlying CAD definition resulted in upstream model changes (such as mesh, properties, and loading) to update automatically.

3. Python customization tools to allow automation of several build aspects, including mid-surfacing/ composite lay-up generation directly from source geometry, and fastener connections.

4. 'Analysis Readiness' using the embedded Apex solver to ensure component-specific verification during build, and full assembly verification to ensure that the external MSC Nastran analysis of the full assembly would run successfully the first time.

So, what did the engineering team do with all the extra time they saved? These efficiency gains using MSC Apex translated into more time optimizing the actual aircraft interior cabin product. Flexibility was available in terms of model design, customer requirements were met promptly, and feedback received from their client helped in developing a better overall design of the various components in the aircraft cabin.



Above: Benchmark Results performed by Airframe Designs Ltd.

About Airframe Designs Ltd.

Airframe Designs Ltd. is an engineering services provider based at the Blackpool Airport Enterprise Zone in the UK that has works of platforms and products including aircraft, rotorcraft, and many types of interior structures. The core business is aviation safety, certification of changes and repairs to flight structures. Historically, their skills have been in very high demand due to a shortage of experience aerospace stress engineers, both in the UK and globally. Airframe Designs Ltd. is a respected solutions providers for the aerospace, defense, and special mission sectors.

Key highlights:
Product: MSC Apex
Industry: Aerospace
Benefits:
CAE-specific 'Direct Modeling' which allows powerful geometry editing, idealization, and mesh control, in a manner unseen in legacy toolsets.
'Generative Model Update' where any change to the underlying CAD definition results in automatic FEA updates.
Python customization tools allowing for automation of several build aspects, including mid-surfacing, composite layup generation directly from source geometry, and fastener connections.
'Analysis Readiness' which ensures component-specific verification during model build, and full assembly verification to ensure first-run success in MSC Nastran.

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Our technologies are shaping production and people-related ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future.

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