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# Rising to the Post-Covid Challenge – **How One North West Aerospace Consultancy Has Adopted MSC Apex**

By Dr Steffan Evans, Lead FEA Engineer & NAFEMS PSE, Evotech CAE Ltd and Jerrod Hartley, CEO & Chief Engineer, Airframe Designs Ltd

One area which has been hit harder than most by the pandemic is the aerospace industry. With limits on travel, the number of passengers in the air has fallen to previously unseen levels, which has placed the airline operators and aircraft suppliers under significant, sustained pressure. According to Forbes, international flights in 2020 saw a drop of 68 per cent compared with the previous year, however recent reports have suggested that the industry will bounce back, with market intelligence suggesting that double-figure growth will return by 2022.

**Airframe Designs**

One player with its roots planted firmly in the North West aerospace supply chain is Airframe Designs Ltd. An engineering services provider based at the Blackpool Airport Enterprise Zone in the UK. Founded in 2009 by Jerrod Hartley, the business has grown a strong team of aerospace engineering specialists, and concurrently supports a wide range of aerospace and defence projects. The core business is aviation safety, supporting UK CAA and EASA Part 21J design organisations to certify structural changes and repairs to flight structures. Historically, its skills have been in very high demand due to a shortage of experienced aerospace stress engineers, both in the UK and globally.

AFD works across multiple industries with an emphasis towards the aerospace, defence, and special mission sectors. They also work on a range of platforms and products including aircraft, rotorcraft and many types of interior structures. Commercial projects are numerous and have included bespoke VIP galley upgrades, narrow-body aircraft seat design, and various antenna installations to support avionic upgrades. For the special mission sector, AFD has certified a family of helicopter lifting baskets for human external cargo to access high-voltage power lines. Military projects have included support to ejection seat sled testing, UK Puma helicopter upgrades, and design activity associated with sixth generation fighter aircraft.

AFD specialises in employing static analytical methods to assess airframe structures, fatigue/damage tolerance assessment to ensure continued airworthiness, vibration assessment, especially prevalent for rotor and spacecraft and regulatory compliance to ensure that design changes meet the necessary airworthiness requirements.

However, one area which underpins all this work, is in the application of an effective FEA strategy to yield a detailed understanding of structural behaviour in a virtual environment.

**AFD's Journey**

AFD had been reliant on a number of legacy FEA programs for the past decade and assessment of contemporary methods highlighted many new platforms and toolsets which were now available and could improve its overall analysis offering. AFD performed a significant review of the modern FEA software market. The bulk of the aerospace market relies on the industry standard FEA solver, MSC Nastran, both for regulatory compliance and the ability to interact with other parties using a common data format. This meant that any new toolset must support this data format.

Discussion with numerous CAE/FEA software vendors showed the development in capability and deployment of many different toolsets over the past decade. It became obvious to AFD that MSC Apex, a contemporary, next-generation CAE platform developed by Hexagon/MSC Software, was gathering pace within the aerospace industry. Through initial contact at an aerospace industry event, AFD engaged Evotech CAE Ltd, Hexagon/MSC Software partner and dedicated MSC Apex training provider, to help with their initial assessment, through an offload development project.

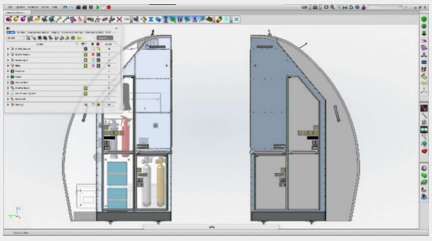




**Aircraft Galley Structure**

Once an offload consultancy project had been completed by Evotech, an in-house comparison was undertaken. This looked at a typical aircraft galley structure, a Boeing 737 stowage compartment, constructed of lightweight metallic and composite sub-structures, detailed joint definition and the appropriate loading. Client CAD was made available for detailed assembly definition and idealisation, dependent on the downstream meshing strategy.

AFD engineers took initial MSC Apex training using Evotech's 12-hour online training course 'Intro to FEA with MSC Apex', which gave the requisite skills to hit the ground running, followed by bespoke Evotech/Apex training in the application of specific galley structure FEA. Once enabled, AFD Lead FEA Engineer, Bill Thorne, performed the model build and analysis in MSC Apex.



Boeing 737 Stowage Compartment – CAD Definition

**The main steps in the FEA model build were**

Assembly Rationalisation → CAD to Mesh → Model Connections and Properties → Load Case Generation → Client Design Update 1, 2 & 3

MSC Apex proved to be significantly more efficient than Patran, the legacy AFD toolset, but also Altair Hypermesh and Siemens FEMAP (where build data was provided by sub-contract resource), two other popular FEA model build toolsets used in the aerospace industry.

Three interesting observations could be made by this comparison:

1) The MSC Apex build was performed by engineers with minimal product exposure and training, compared with significant exposure to all three legacy tools.

2) The Apex model build time took less than three days whereas using legacy toolsets were all around eight days or more.

3) The efficiency gains made using Apex could translate into more time optimising a product, rather than simply verifying a non-optimal initial design, as would have been seen with legacy toolsets.

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

1) CAE-specific 'Direct Modeling', which allows powerful geometry editing, idealisation, 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 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 verification during build and full assembly verification to ensure that the external MSC Nastran analysis of the full assembly would run first time.

**So, What Does This Mean to Airframe Designs?**

MSC Apex allows AFD to achieve far greater efficiency for their FEA modeling and simulation tasks for both new and existing structures. Time saved allows for effort to be focused on different areas of the design process, which simply would not be possible using legacy methods and toolsets. Clients can be assured that their development goals can be achieved earlier and with reduced risk.