Following GKN Aerospace's recent announcement that it has extended its design capability with Vistagy's SyncroFIT application, **Simon Lott** looks at how the software will help the tier one manufacturer make substantial savings throughout the design evolution process.

Boeing 767 blended winglet: On the assembly line at GKN Aerospace

THE HOLISTIC APPROACH

While GKN has been a long time customer of Vistagy, having used the US software developer's FiberSIM product over the last eight years to aid in the design of composite aerostructures, including Boeing 767 winglets, the addition of SyncroFIT now allows the manufacturer to cut down on repetitive assembly design tasks and reduce errors that could lead to costly redesign work.

As part of Vistagy's Aerosuite design and manufacturing solution, SyncroFIT has been developed to work in conjunction with 3D CAD systems to efficiently manage the complexities of airframe interfaces with a particular emphasis on fastened structures. The first major GKN project to take advantage of SyncroFIT will be the design optimisation of Bombardier CSeries winglets, a project potentially worth over US$100 million between now and 2025 and which is currently in the design definition phase.

FiberSIM enables designers to develop composite parts while taking into consideration key data, such as thickness requirements, stacking sequences, and structural interface requirements. With tight links between FiberSIM and FEA programs, composite parts can be optimised to achieve the required stiffness at the lowest possible weight. Just as FiberSIM is a dedicated solution for managing composite part design, SyncroFIT similarly addresses challenges at the aerostructure assembly level. By managing the joints and the massive quantity of fasteners within the assembly, SyncroFIT enables designers to automate tedious design tasks and react quickly to the inevitable changes that occur during airframe development processes.

Excluding the immeasurable saving on redesign work caused by errors, Vistagy quotes a typical time and cost saving of 45% related to assembly design through the removal of repetitive tasks, such as referencing and updating external information and adapting to changes. Just as important for GKN however is the additional freedom it allows for rapidly updating the assembly definition and fastener bill of materials when changes to the composite structure occur.

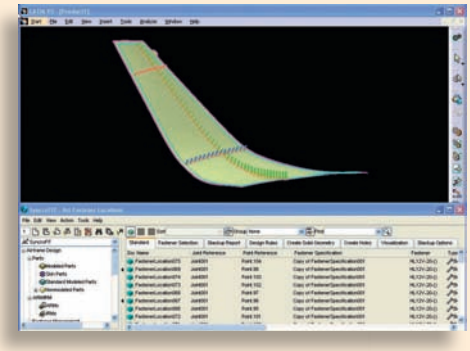
For example, one of the bigger headaches in composite assemblies is locating and sizing fasteners, with designers traditionally having to position these conservatively, such as well away from ply drop regions, adding weight and cost to a structure that is regarded as one of the most weight critical on the aircraft. However, with the greater visibility of the overall product allowed by SyncroFIT, engineers can optimise

designs for greater efficiency in service while being sure that strict rules regarding safety and use of materials are being met. This is particularly important given the significance of the role of winglets in reducing aerodynamic drag. Aviation Partners Boeing for example, revealed in 2007 that blended winglets for the 767-300ER, produced by GKN at its Isle of Wight facility, could be expected to save a maximum of 6% in fuel consumption as well as extend the aircraft's life cycle.

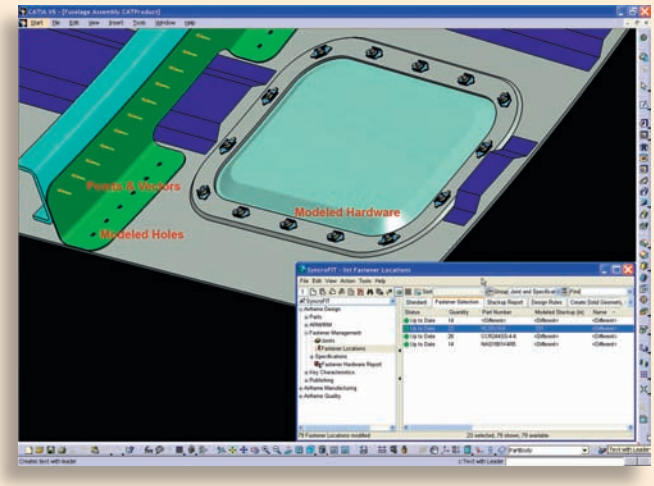
"With this kind of design you're torn between putting fastener data in early and then needing to modify it later or putting it in later and risking substantial changes to the design," explains GKN's chief engineer Justin Elliott. "With SyncroFIT you are effectively adding database information alongside your solid model. You can then add parametric data in so when it changes, it drives the requirements.

"We've found on numerous programmes previously that fastener data management is quite onerous. There are a lot of challenges associated with highly specific customer and regulatory requirements and always making sure you have the right capabilities for installation as well as the right fastener, nut and collar combinations. Historically that process has come fairly late in the design phase and you have to scrutinise a lot of data. SyncroFIT allows us to incorporate that data much earlier and control it to a high degree."

He continues: "Effectively the end design will not be that different, but because we're now using different types of fasteners and materials with varying thicknesses and different coatings, it becomes a mass of data and traditionally we would end up with specialists in the design office who were the only ones who could validate designs. With SyncroFIT, these specialists can impart that knowledge easily by entering all the data into the database. They can change a few rules and when the designers run checks it puts red flags up to validate."



CSeries winglet in design: Showing fastener locations in Catia V5 and SyncroFIT



Fuselage section: With SyncroFIT tracking all modelled hardware, holes, and points and vectors

Vistagy's director of product and market strategy for aerostructures, Steve Peck adds: "In customer surveys, we have found that in up to 50% of cases, engineering change orders come from assembly design errors, such as fasteners having the wrong callouts, mismatched hardware, incorrect edge distances or holes being drilled in the wrong places due to changes that are not implemented throughout the design. Much of that can be eliminated with all the design rule checks that are embedded in SyncroFIT."

Explaining the typical design process, he states: "The user will begin in FiberSIM with some stress inputs indicating how thick the part needs to be in different areas and develop all of the ply definitions. They will then generate the inner build up surface and that's where structure definition begins within SyncroFIT. They develop a sub-structure driven by fastener definition. Things like edge distance requirements will define the size of the mating area of the piece of substructure so designers have to be thinking about fasteners very early in the process.

"Once the location of fasteners is known, all the relevant information can be attached and the design can start to be verified. Through this they can immediately get grip length and bill of material requirements. As the skin thicknesses evolve and the substructure itself starts to change, the user can just go into the SyncroFIT environment and see where these changes have occurred and quickly update their design.

"Managing all the fasteners in an assembly is just so tedious. There are loads of them and much manual work is involved, which can be anything from measuring parts to determining how long the fastener needs to be, validating the design rules that revolve around fasteners, such as an edge distance requirement, or making sure countersunk fasteners don't penetrate too deep. Automating all this ultimately allows, as early as possible in the process, an up to date bill of materials which is important to meet leadtimes and as things change, the update process is almost instantaneous."

GKN will also expect to realise more potential from the software as time goes on, with the manufacturer planning to use FiberSIM and SyncroFIT in conjunction with a variety of automated processes being evaluated as composite and assembly production requirements continue to develop.

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