CADfix Helps BAE SYSTEMS Fight the Electronic Enemy

Meshes are generated directly within CADfix resulting in enormous time savings.

A whole plane, such as the BAE SYSTEMS Eurofighter, can now be meshed in just three or four hours.

CADfix

CADfix removes barriers preventing the reuse of solid models. By providing an extensive set of geometry manipulation tools for importing, repairing and exporting data, CADfix maximizes the reuse of CAD data in downstream applications.

Aviation has benefited more than most industries from the information revolution. The systems that keep aircraft in the air and guide them safely are increasingly reliant on electronics, both onboard the aircraft and elsewhere – on the ground or orbiting the planet. Ensuring that these systems work in harmony, with each other and with natural electromagnetic phenomena such as lightning, is a vital part of the aircraft manufacturer's job.

Military aircraft are even more reliant on electronics. In addition to navigation and flight control, they also must be able to locate, identify and pinpoint potential threats and targets. These activities sometimes involve powerful laser and radar systems with significant levels of electromagnetic radiation. It is therefore vital that the various systems do not interfere with each other or compromise the safety of the crew. The experts at BAE SYSTEMS must deal with these sensitive issues.

BAE SYSTEMS

The Electronic Engineering and Test department is responsible for BAE SYSTEMS' whole vehicle electromagnetic testing and analysis. This department reflects the planned change of remit from just aircraft to a broader base of land, sea and air vehicles.

Such developments are likely to put a greater strain on the computation analysis team. "Our product portfolio already includes Nimrod and Eurofighter, both extremely complex aircraft in their own ways," says Chris Jones, Technologist Consultant in the Electromagnetic Engineering department.

"Each vehicle we deal with has probably been designed in a number of different locations and possibly with a number of different design systems.

But the analyses we perform demand a single, accurate geometric representation, and the generation of this geometry is often the single biggest challenge. With new vehicles coming online it will be more vital than ever that we can maintain the integrity of our data – and fast."

Multiple modelers – multiple solvers

Chris and his team have been using electromagnetic analysis software since it became a viable option more than 15 years ago. Even then, with the CAD market still relatively young, a survey revealed that BAE SYSTEMS used no less than 17 CAD systems. Consolidation has reduced this number significantly, but diversity remains when it comes to defining geometry for computational analysis.

"Eurofighter is a classic example: the complete geometry comes from four countries, Germany, Italy, Spain and the UK." says Chris. "We have to bring all this data into a neutral environment, clean it up where necessary, assign material properties, generate a mesh and then format so that it can be used in our analysis packages."

Even with just a single analysis package, this would be a problem. But the different types of electromagnetic simulation performed at BAE SYSTEMS all demand different codes and different ways of defining mesh geometry.

"In effect, we go from a set of CAD systems to a set of numerical analysis codes," says Chris.

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- Paul Baker
BAE Systems

Enter CADfix

BAE SYSTEMS EE&T uses CADfix, the leading data interoperability tool developed by ITI, as a central resource of geometric data.

Because it offers a reliable link – either directly or via IGES – to every major CAD system on the market, CADfix provides the perfect platform for such a diverse range of data. In addition, it offers the perfect route from raw geometry to refined, analysis-ready mesh.

"CADfix is at the heart of everything we do," says Paul Baker, a BAE SYSTEMS Computational Electromagnetics (CEM) specialist. "In effect we use it as the hub of our operation, a central resource for all the geometry we have to work on. Whatever kind of analysis we need to perform, whatever mesh we need, the starting point is always the clean geometry that's been assembled inside CADfix."

Meshing at speed

CADfix is responsible for enormous time savings. In addition to providing a central data resource, CADfix also directly generates meshes. A single wing previously took six to nine months; a whole plane can now be meshed in just three or four hours.

"Even with the powerful computers we use, an analysis of a complete aircraft can take about ten days," says Paul. "So the last thing we need is to spend ages building meshes. With CADfix we can generate new meshes in just a few hours so we are not restricted when it comes to trying a different kind of analysis."

Graphical feedback

BAE SYSTEMS also uses CADfix's powerful post-processing capabilities. "We use pretty standard mathematical software to retrieve the precise graphs and figures we need for our reports and safety checks," says Paul. "But our first port of call is always CADfix, where we can display field contours on the original CAD model. This gives an instant picture of where we should be looking for maximum concentrations, and while this is often not much more than a 'sanity check' to make sure we're looking in the right place, it does throw up the occasional surprise."

Spark out

One such revelation came when looking at the effects of a lightning strike on the cockpit of the Eurofighter.

"Our initial analysis confirmed that a modified design performed just as well as the original, but it also revealed a slight anomaly that would have been impossible to spot through physical testing," says Paul. "It showed that, during a lightning strike, a small but significant current passed through some aerodynamic strakes on the outside of the cockpit. Although this current was within safety standards, there was a very small chance that a spark could have formed at one of the strake's fasteners. Such sparking is the last thing you want in a jet fighter."

"Such problems can usually be fixed quite easily if caught early enough – in this case with a relatively simple design modification," says Chris Jones. "But without the depth of analysis we get from using CADfix it could have taken us years to spot something so subtle."

About ITI

ITI is the global leader providing reliable interoperability, validation, and migration solutions for product data and related systems. Our customers recognize the value in having a trusted solution partner that provides more than just software. ITI solves complex product data interoperability problems so that the world's leading manufacturers can focus on making great products. You need to keep your engineering initiatives moving forward.

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