Virtual flight

Simulations are being developed to test the electromagnetic performance of aircraft components. The aim is to prepare new designs for flight more quickly and economically.

By **Neil Wilks**

To counter the serious threat that electromagnetic (EM) interference poses to aeroplanes, the European Union is backing a research programme to improve the assessment of the EM performance of airframes. The €26.5 million research project began last December, with EU funding to the tune of €17.8 million, and sees many of Europe's biggest aerospace manufacturers collaborating with leading academics.

The initiative is called the High Intensity Radiated Field – Synthetic Environment (HIRF-SE) project, referring to the computer simulations that will be created to test the EM performance of aircraft components both in isolation and in combination with others. This framework of simulations will be used during the development of new aircraft and their upgrading, as well for certification and qualification testing.

In total, 44 participants from 11 EU member states are involved in the four-year project, including from industry BAE Systems, Thales, EADS, Dassault Aviation and Agusta Westland. Various national aerospace research organisations also join forces with universities on the project, which is being co-ordinated by Alenia Aeronautica, the Italian maker of aircraft systems.

Andy Marvin, professor of applied electromagnetics in the electronics department at the University of York, is dissemination manager for the project. This role means ensuring that all partners are kept informed about the latest developments in HIRF-SE, in addition to overseeing the university's research work on the programme.

He outlines the need for this work, with particular reference to the growing number of consumer devices that transmit EM waves, to access the internet for example. "The potential risk is very low and, statistically, flying is incredibly safe. But the consequences of anything at all going wrong, with up to 300 people in an aeroplane, are catastrophic," Marvin says.

HIRF comes in to land: Researchers are looking at the effect of high intensity radiated fields on aircraft

To guard against the likelihood of EM interference – from sources outside or even within the plane itself – compromising aircraft performance, the team is developing a new approach to testing.

"The aim is to enhance our ability to test aircraft," says Marvin. "So we're developing a computer framework on which will hang a range of simulation packages which can carry out tests. They will be looking at a whole variety of aspects around the airframe and its internal characteristics, the fuselage, subsystems – effectively the whole airframe structure."

Traditionally, work on HIRF and EM compatibility has been carried out through experimental verification in the latter stages of an aircraft's development. This is an expensive approach because defects are only found during aircraft certification, at which point rework costs are very high, as Marvin points out, "because you have to build the plane first".

Faced with a growing number of electronic systems performing safety-critical functions and an increasingly complex external EM environment, ensuring aircraft safety requires new levels of accuracy and reliability from an EM compatibility assessment. Consequently the approach chosen for the project is to carry out extensive analysis and simulation in the early design stages, where the costs of rework are

much less than in the final phase of development.

The project's objectives have been boiled down to two main aims. These are: to create "full validated and integrated solutions to model, simulate and test air vehicles for EM aspects during the whole life cycle" and "to build (from past and ongoing works) an integrated approach with an open and evolutionary architecture".

The first sums up work to tackle drawbacks with the current design, certification and modification approach using computer modelling, while the second looks at bringing together the many specialised testing tools so they can be used in accord with each other, rather than simply in isolation.

A consequence of this work, it is hoped, will be to reduce the time it takes to get new aircraft off the ground, through cutting the period spent on physical testing, redesign and retesting. The HIRF-SE objectives also include the claim: "Development of virtual models and validation of virtual testing are key issues in reducing the number of development tests required to achieve the air vehicle's certification, and to obtain, at the same time, an improved quality of the results."

Marvin is quick to point out that this work does not mean the end of physical testing. "We're not replacing physical testing; it's merely a change in emphasis. We're trying to build a computational framework that can assess what's needed for testing and certification, before physical testing," says Marvin.

"A lot of the work programme is allocated to checking what we do computationally is replicated with what happens in the real world," he adds.

Safety on the flightdeck: With so much by-wire control, aircraft cockpits need comprehensive EM protection

In addition to accounting for the entire internal and external EM environment, HIRF-SE will also deal with the increasing use of composite materials in planes. The hope is to create a methodology recognised by the European civil aviation industry and in accordance with its many certification bodies – hence the varied nature and cross-European membership of the consortium.

The project commitments include creating 47 deliverables over its four years. And, although Marvin says it is too early to say specifically what they will include, by November 2012 he expects some totally new techniques to have been developed. "As well as developing the framework, our remit includes looking at new technology so some of the consortium's companies will be looking at this," says Marvin.

He adds that this project would not be possible without developments in computers. "We have much more powerful computers now that enable us to do much better simulations. The timing is right for this to happen now," says Marvin.

This increased ability to cope with many of the EM interference issues through computer modelling and simulations should also make the process of certification cheaper, something the fiercely competitive plane makers would welcome. From a business point of view, this project will help to maintain the competitiveness of Europe's plane makers through delivering cost savings and an increased reliability of the finished product. But ultimately HIRF-SE should improve safety in our increasingly congested – in terms of both planes and EM waves – skies.