

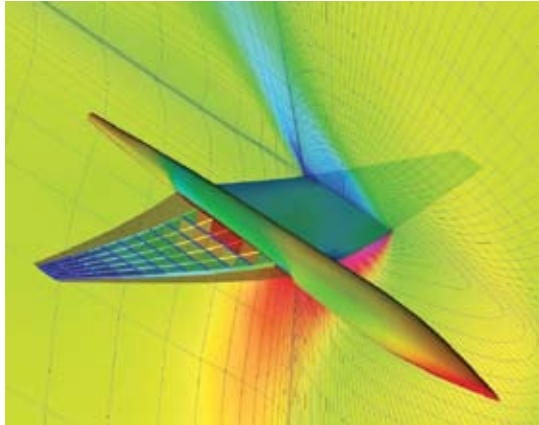
# Computers in engineering

## Students design more fuel-efficient airfoils

Graduate students at the **University of Toronto's** Institute of Aerospace Studies (IAS) are using an **SGI Altix 3700** server powered by 32 **Intel Itanium 2** processors to optimize wing designs for commercial aircraft. By using CFD coupled with a detailed structural model, students are attempting to improve airflow over the wing, resulting in reduced drag and better fuel efficiency. The wings are designed to satisfy multiple requirements such as lift, strength, and stability.

"You don't need much computational power to do basic aircraft design, but if you want to be more precise and model a more refined shape, you may need to use hundreds of variables to represent variation in the shape of the airfoil at many stations along the wing, the details of the internal structure, and other information," said Professor Joaquim Martins. "You would then perform a high-fidelity analysis of the airflow using CFD."

Historically, standards of wing thickness based on conventional structures have limited airfoil design studies, leaving the possibility of altering aircraft structure out of design optimization. By



*The Institute of Aerospace Studies at the University of Toronto uses an SGI Altix 3700 server to create wing designs with the potential of reducing drag and increasing fuel efficiency on commercial aircraft. Shown is an aero-structural solution for a supersonic business jet. The internal structure of the wing is shown on the left, with colors showing stress levels. The surface density of the airflow is shown on the rest of the aircraft as well as on a slice of the CFD mesh.*

using multidisciplinary design optimization (MDO), Martins and his students have varied both wing structure and airfoil characteristics to optimize overall design qualities such as fuel economy.

"The shared memory architecture of the Altix system is useful to us because some of the tools we use require a lot of RAM," said Martin. "It's also convenient to be able to submit jobs to a single-address architecture as opposed to logging into multiple processors."

The SGI Altix server, installed in

2004, is accessed by 16 IAS faculty members and up to 80 graduate students who develop code for aerospace and aeronautical engineering design projects. Martins and his team have previously used the SGI Altix server in the optimization of a supersonic business jet configuration similar to the one currently being developed by **Aerion**. The aircraft features laminar-flow wings and can cruise up to Mach 1.6.

*Matt Monaghan*

## Ice cool prediction

In-flight accumulation of ice has always been a potential hazard for aircraft. Huge advances have been made in anti-icing systems, but **BAE Systems'** scientists and engineers have developed a new computer model to accurately predict patterns of ice accumulation on complex 3-D surfaces, including wings, engine intakes, propellers, and helicopter rotor blades.

By combining a model of ice accretion with CFD codes used routinely for aerodynamic design applications, the BAE model is able to predict the build-up of ice in 3-D airflows, the calculations determining the trajectories of water droplets in the airflow and the effect of droplet splashing, plus the spectrum of droplet sizes typically encountered in a cloud.

The unsteady development of water



*A Eurofighter Typhoon has been used to support development of a multi-national collaborative icing prediction program.*

flow across a surface can be simulated in conjunction with the rate, type, and location of ice. The model also includes heat input from the aircraft's thermal ice protection system plus the underlying effect of the aircraft's structure. Results from the work have been applied to BAE Systems' work on the Nimrod MRA4 maritime surveillance aircraft and Tornado support programs. Code findings enabled one project to avoid the

requirement for an experimental icing trial, which potentially would have cost up to \$1.8 million.

It has taken six years to develop the model in collaboration with partners, **Airbus UK, Rolls-Royce, Dunlop Aerospace, Westland Helicopters, QinetiQ, and Cranfield University.**

*Stuart Birch*

## Briefs

**AleniaAermacchi** has selected **VISTAGY**'s FiberSIM 5.1 software as its specialized composite design environment for the CATIA V5 CAD system. AleniaAermacchi engineers will use the software to design, simulate, and manufacture composite aircraft parts for commercial airliners.

**TTTech** will work with **Verocel** on the certification of its embedded software components for advanced more-electric integrated systems in the **Boeing** 787 Dreamliner. The certification activities are part of TTTech's overall project with **Hamilton Sundstrand** for the common electric architecture of the aircraft.

**Airbus** will use ENOVIA, the 3-D collaborative virtual product life-cycle management (VPLM) solution from **IBM** and **Dassault Systèmes**, combined with CATIA, to standardize its product development process. Airbus is extending its ENOVIA VPLM user base to several thousand users.

**Smiths Aerospace** has selected **Altair Engineering**'s HyperWorks CAE technology suite to support the development and structural analysis of its aircraft landing systems and components. Smiths will use HyperWorks to improve its finite element modeling and visualization efficiency with Altair HyperMesh and other tools.

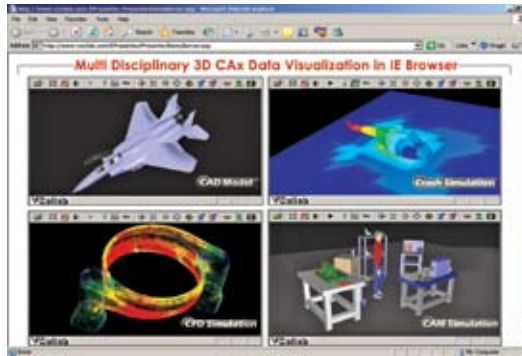
Science Applications International Corp. (**SAIC**) has acquired **GeoViz**, a Campbell, CA-based provider of commercial off-the-shelf (COTS) tools targeted at command, control, communications, and computers; intelligence, surveillance, and reconnaissance; test and evaluation; modeling and simulation; and embedded training markets. Employees of GeoViz will remain at the engineering facility in Campbell and provide the company's suite of COTS tools to current customers.

After a year-long evaluation, **Boeing** has named Teamcenter, **UGS**' digital life-cycle management solution, as its enterprise data management system for future commercial airplanes and integrated defense systems programs. Boeing's Joint Direct Attack Munition program is the first to implement the new system. Boeing selected Teamcenter because it needed an open, scalable platform that can be leveraged across the company and globally.

## VCT platform allows for CAD, CAM, and CAE visual collaboration

**Visual Collaboration Technologies (VCT)** has released VCollab 2006, the first common platform for viewing and manipulating 3-D digital product design, analysis, and manufacturing information authored in different engineering formats.

VCollab allows individuals and groups throughout the product development process to share and interact with CAD, CAM, and CAE files without having to access the native applications. VCollab 2006 extends product visualization across the spectrum of engineering disciplines, from the creation of 3-D digital product geometry to FEA, CFD, and manufacturing assembly simulation.



*VCollab displays virtual product data from 3-D CAD, CAM, FEA, and CFD software within Microsoft Internet Explorer. At the upper left is a 3-D CAD model, which users can manipulate and explore to understand the product. The upper right shows an interactive crash simulation. The lower left panel shows a fluid dynamics simulation. At the lower right, a sequence created in CAM software shows an assembly simulation.*

"Effective collaboration among distributed groups of experts is crucial for competitiveness in product development today," said Vijaya Kalimi, Business Relationship Manager for **Tata Consultancy Services**. "Because our customer base is multinational and crosses many industries, we are always looking for tools that improve communication. With VCollab we can easily create simple 3-D documents and presentations with embedded finite element analysis and computational fluid dynamics simulations, and then share this complex product data efficiently with clients all over the world."

"Our customers have to communicate sophisticated 3-D engineering information among their local and global teams and with upstream OEMs and downstream suppliers," said Prasad Mandava, CEO of VCT. "Many product development teams expend a great deal of time and effort accomplishing this, and they often end up juggling a constellation of viewing tools. VCollab 2006 is a significant step forward for

industry because it is a multidisciplinary solution. Manufacturers can use VCollab to share valuable data and results easily from all of their 3-D CAD, CAM, and CAE activities."

VCollab gives individuals and groups throughout global manufacturing supply chains the ability to interact with 3-D engineering details that have traditionally been difficult to communicate. The software combines powerful graphics tools with a compression technology that reduces file size while preserving engineering content. VCollab files can be embedded into **Microsoft** Office applications or opened directly within Internet Explorer.

The VCollab 2006 software suite contains:

- VCollab Pro, a scalable, high-performance visualization program that converts large 3-D CAD, CAM, and CAE data sets to highly compressed .vcb format. According to VCT, a file saved in .vcb format loads up to 100 times faster than it does in its native authoring format. VCollab Pro contains a variety of tools for visualizing 3-D digital models and simulations.
- VCollab Presenter, a CAx viewing software that enables nontechnical personnel to view and manipulate 3-D CAD, CAM, and CAE information using Internet Explorer, Word, Excel, and PowerPoint.
- VMove CAE, a direct native reader of CAE output results that converts native CAE results files into highly compressed VCollab .vcb files based on user inputs. CAE software supported includes **MSC Nastran**, **LS-DYNA**, **ANSYS**, and **ABAQUS**.

*Matt Monaghan*