

Computers in engineering

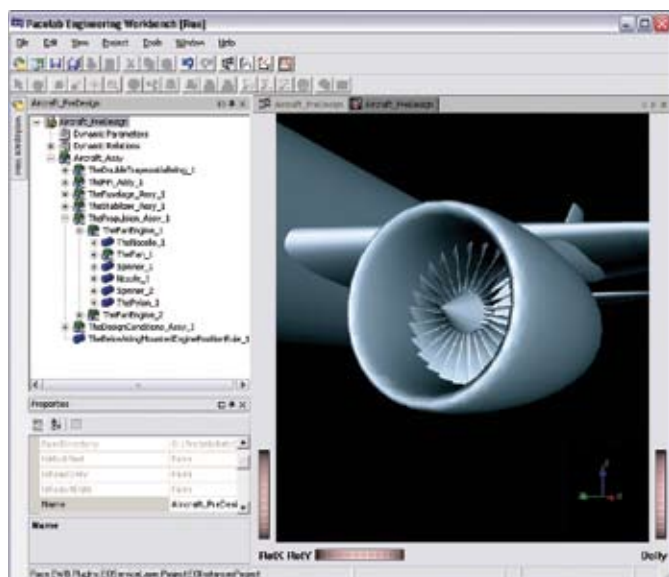
Pacelab aids in preliminary design

The ultimate task of the aircraft designer in the preliminary phase is to search for a set of potential solutions that comply with the market's high-level requirements. The design engineer needs to compare feasible solutions in a fair trade-off, which implicitly requires the ability to predict the properties of many different concepts and configurations at a very early stage of the design process.

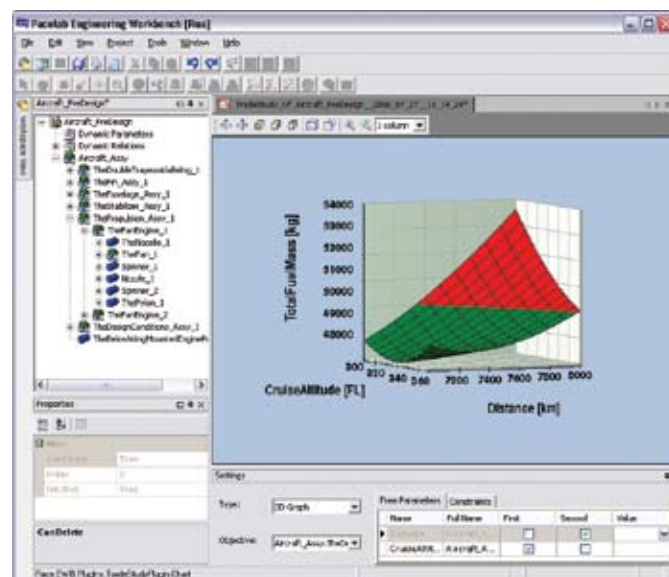
pects," said PACE Managing Partner Alexander Schneegans. "Our objective was to come up with an integrated answer to the entire set of challenges encountered in the early design phases."

The PACE solution is a commercial off-the-shelf set of three interoperating applications designed to capture, manage, and apply engineering knowledge in a consistent and transparent manner.

graphical authoring tool with the power of object-oriented programming, the Pacelab suite allows engineering teams to rapidly build multidisciplinary libraries of reusable knowledge components, which can be disseminated across the company network. This toolbox approach directly responds to an engineer's quest for a more efficient way to virtually manipulate ideas and model highly specific



The Pacelab suite is tailored to the needs of engineering professionals engaged in conceptual and preliminary design. It provides engineers a 3-D view of product geometries.



Trade studies allow engineers to explore the design space.

Since the chance of finding the optimum solution increases with the size of the design space explored, ideally the full range of options should be investigated—including those from off the beaten track. The constraints of economic pressure and short product life cycles, however, frequently force designers to choose the evolutionary over the revolutionary approach; innovation is typically the first casualty of having to play it safe.

Responding to this quandary, Berlin-based **PACE** has developed a knowledge-based software suite specifically tailored to the needs of engineering professionals engaged in conceptual and preliminary design. "We addressed the problem from a holistic perspective instead of just focusing on singular as-

pects. One of the key characteristics of the Pacelab suite is its unique knowledge modeling approach, which centers on the idea of breaking complex, abstract engineering knowledge down to more generic entities, or knowledge components. These components can incorporate highly diverse aspects of knowledge ranging from parametric product data models to algorithmic analysis methods, design strategies, or constraints. Pacelab's uniform handling of knowledge irrespective of type or discipline avoids an overly geometry-centric perspective, while still providing a feature-based, CAD-quality geometry engine with visualization, analysis, and downstream interfacing capability.

Combining the ease of use of a

design cases at short notice. "We found that engineers want to be able to define their own design cases. Being able to quickly change the design objective or incorporate new engineering disciplines is crucial for investigating multiple scenarios," said Schneegans.

Engineering task definition is performed by selecting the required knowledge components from the repository, stringing them together, and dynamically inserting additional parameters and formulas as applicable. The graphical representation of the resulting mathematical system and the intelligent intervention options keep structures manageable and assist users in rectifying inconsistencies interactively.

Unlike most design systems, the

Pacelab suite uses a purely declarative, demand-driven approach to numerical solving, or product sizing. This means that engineers only have to state which parameters constitute the input or output of the calculation and assign values or define constraints for them, respectively—the optimum solving sequence is determined automatically. Not only does this free the engineer's mind and time from one of the most laborious and error-prone tasks, but it also enables him the modification or reversal of the objective with hardly more than a few clicks.

A thorough validation of design options is likely to require the study of several configurations of the system and multiple solving rounds, and may necessitate a qualification by discipline-specific meth-

ods and tool sets. For more refined investigations, additional functionality is provided by the Optimizer module, which allows identification of optimum values for key parameters, while the optimum trade-off between key parameters can be explored with the Trade Study module.

The integration of different engineering disciplines in a single multidisciplinary software environment raises questions as to what becomes of existing domains' methods and tools. "Every customer has a clear-cut interest in leveraging existing IT investments," said Schneegans. "The Pacelab suite has extensive software-integration capabilities and provides a homogeneous environment in which integrated methods and tools are treated just as natively

defined ones."

Airbus was among the first companies to support its preliminary design teams with this design tool. Other clients include **EADS** Corporate Research and the Aerospace Design Laboratory at the **Georgia Institute of Technology**.

"The instant success of the Pacelab suite shows that there is a keenly felt need for a comprehensive software support in the conceptual and preliminary design sector," said Schneegans. "We continue our engagement in this field and intend to reach out to design communities in other engineering domains."

This article was written for *Aerospace Engineering* by **John Wilkes**, PACE Aerospace Engineering & Information Technology.

Coast cuts cycle times with CATIA V5

Coast Composites, an Irvine, CA-based provider of tooling systems to the commercial and military aerospace industries, has implemented **Dassault Systèmes'** CATIA V5 and ENOVIA SmarTeam product life-cycle management solutions, cutting product design cycles for major products up to 50%.

In an effort to reduce prices and production time and improve communication with its OEM clients, Coast hired **RAND Worldwide** to implement CATIA V5 as its design application platform. In addition, ENOVIA SmarTeam product data management software enabled Coast to consolidate all design and manufacturing information into a single system that is accessible to all of the company's engineers and designers.

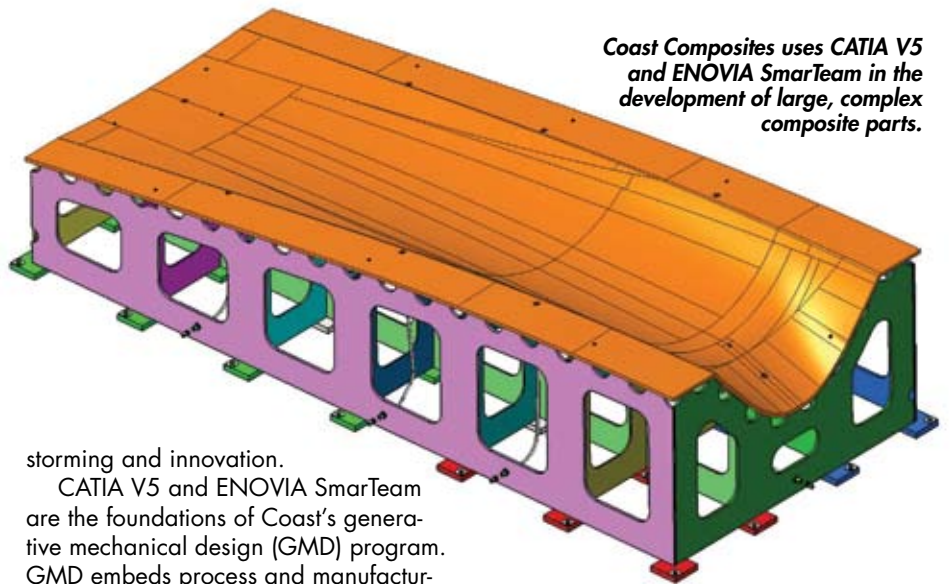
"We're always dealing with new designs and data for new products because we're often helping build plane number one of a new line, not number 1001," said Coast President Jerry Anthony. "When we're working on a new military or commercial airplane program, for instance, a mold tool can change 10 or 20 times throughout the design and build processes."

Coast has leveraged CATIA V5 KnowledgeWare Solutions to allow users inside and out of the company to capture expertise and best practices. Designers can now explore more design alternatives, automate goal-driven design optimization, ensure design consistency and quality, and promote brain-

storming and innovation.

CATIA V5 and ENOVIA SmarTeam are the foundations of Coast's generative mechanical design (GMD) program. GMD embeds process and manufacturing data into every 3-D part and system model Coast's engineers develop. By using ENOVIA SmarTeam to embed data in the CATIA V5-generated product model data, Coast can manage changes made during the design process, either by its own engineers or by its OEM customers' engineers.

By automatically communicating the change to everyone in the design process, the GMD program enable Coast to automate communication and work flow, reuse existing know-how and designs, respond to customers more quickly, and reduce design/NC programming cycle times on key projects by up to 50%.



Coast Composites uses CATIA V5 and ENOVIA SmarTeam in the development of large, complex composite parts.

"In today's market, most of an aerospace company's fortunes ride on how well it communicates with the major OEMs like **Boeing** and **Airbus**, and how quickly it turns those customers' requirements into workable designs," said Alex Zeltzer, General Manager, ENOVIA SmarTeam. "Coast Composites has turned that new need into a competitive advantage by adopting CATIA and ENOVIA SmarTeam so it can instantly communicate every change to its OEM customers while receiving updated designs back."

Matt Monaghan