

Integrated Design Tools Reduce Risk, Cost

NASA Technology

As NASA designs new spacecraft for its science missions and begins designs for the next generation of human spaceflight vehicles, it also works to revolutionize Earth's airspace with safer, more efficient air vehicles. Throughout its research and development activities, NASA employs the best design tools available.

Some of the tools focus on analyzing the strength of composite structures and new materials; while some experiment with size and shape configurations and their effect on performance; still others analyze propulsion systems, airflow, noise signatures, or fuel consumption. Many of the tools are commercial products, and others were developed by NASA. Each provides high-level analysis of complex systems to provide designers with key information for decision making.

A dilemma, however, is that the programs are not designed to communicate with each other. NASA, therefore, entered into multiple research partnerships with an industry leader to develop a program that could serve as a framework for various design inputs, allowing designers to save time while optimizing designs. The resulting toolset met both NASA and industry needs by enabling greater use of physics-based simulation models earlier in the design process. It ties together existing tools and simulates one complex system.

Partnership

Phoenix Integration Inc., based in Wayne, Pennsylvania, is a leader in the design process optimization software market. Even though it is a small business, the company has had a big impact on the aerospace engineering community. Client users include nearly all of the top aerospace companies such as Boeing, ATK, Airbus, Northrop Grumman, Pratt & Whitney, Lockheed Martin, and Raytheon, as well as nonaerospace clients such as Kawasaki, Samsung, General Electric, and Ford.



NASA's Fundamental Aeronautics Program (FAP) assesses concepts and technologies for a range of air vehicles, including the subsonic fixed wing aircraft in this artist's rendering. For a deeper look at FAP, scan this code.



Image courtesy of Massachusetts Institute of Technology

The company's software is also being used at NASA and other government agencies.

Despite its many industry and government partnerships, the company is quick to note that one of the most important has been with the Federal Small Business Innovation Research (SBIR) program. Through SBIRs, Phoenix Integration modified and advanced its PHX ModelCenter software, a graphical environment for process integration and design automation. ModelCenter provides a framework for integrating multiple design ele-

ments into one useable platform, speeding design time and increasing the number of design options. As a robust design and analysis framework, PHX ModelCenter can be used in the early stages of next-generation vehicle design.

The original NASA SBIR contract work involved development of a Multi-Disciplinary Multi-Fidelity Design Environment. Conducted through NASA's Langley Research Center, the project built upon SBIR work that Phoenix Integration had completed with the U.S. Navy in 1997. The results were enhancements to

PHX ModelCenter that, in combination with existing tools such as PHX CAD-Fusion, resulted in a robust design and analysis framework.

The technologies created were incorporated into the company's commercial software, increasing the capabilities of its PHX ModelCenter program. In January 2009, a new geometry rendering capability was incorporated into ModelCenter 8.0. A year later, additional technology was added to ModelCenter 9.0 to allow engineers to more easily integrate high-fidelity simulation tools into the ModelCenter environment and to create a multi-disciplinary, multi-fidelity system model.

Benefits

For NASA, the tool has resulted in lower project costs and reductions in design time; clients of Phoenix Integration are experiencing the same rewards. Because of the existing customer base for previous versions, the new product was rapidly commercialized when it was included in Phoenix Integration's core software.

PHX ModelCenter allows engineers to spend more time on engineering design and less time on software programming. It does this by enabling process integration for conceptual modeling in engineering design.

According to Scott Ragon, director of research at Phoenix Integration, "Given a fixed amount of time, designers can consider a greater number of alternatives." With ModelCenter automating the execution of a variety of systems, designers can more efficiently meet design requirements, which translate into a time savings, or they can review more design options in the same amount of time, which allows designers to experiment with a greater number of possibilities, perhaps finding a better solution to a problem. As Ragon explains, the program will either provide "better design results in the same time, or the same results in less time."

Ragon notes, however, that ModelCenter does not automate the design process. Qualified engineers still

make the final design decision; the framework simply makes them more efficient at the process.

The Jet Propulsion Laboratory will be employing ModelCenter to design new space architecture concepts, and engineers at Ames Research Center's Systems Analysis Branch have taken advantage of the design tool in their quest to improve aircraft safety and efficiency, minimize the environmental impact of aviation, and increase the competitiveness of the U.S. aviation industry.

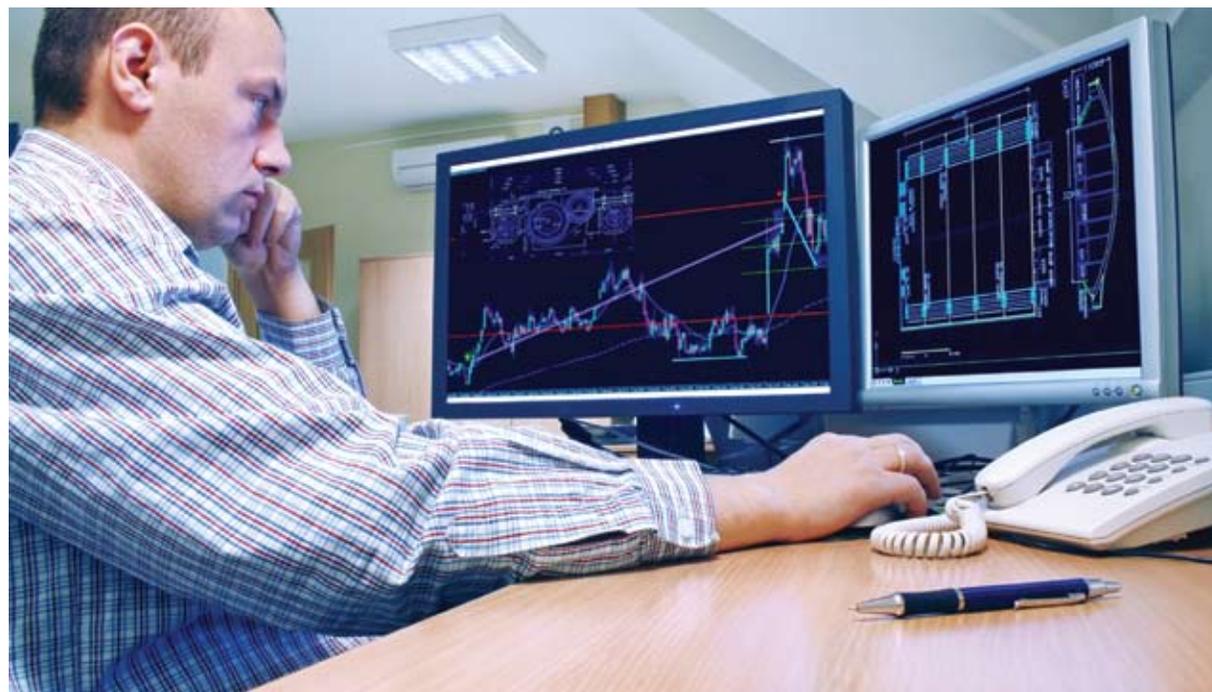
Primarily, teams at Langley are using the software as part of the NASA Fundamental Aeronautics Program (FAP), which is assessing concepts and technologies for a wide range of air vehicles. One focus of FAP is design and testing of new subsonic fixed wing aircraft that would

lower noise and emissions while increasing performance. Langley engineers will realize reduced risks and cost by using ModelCenter's physics-based models early in the design process.

Langley's Mark Guynn, who worked on this project, says, "The workflow process capability developed under this SBIR and commercialized in ModelCenter 9.0 was instrumental in the Subsonic Fixed Wing Project, meeting a major project milestone this year."

Today, over 1,000 engineers in over 100 different locations can use the SBIR-funded technology, which will allow NASA and industry to design innovations from next-generation air vehicles to consumer electronics. ❖

ModelCenter® is a registered trademark of Phoenix Integration Inc.



Software from Phoenix Integration Inc. was advanced through an SBIR with Langley Research Center. By enabling process integration, the tool allows engineers to spend more time on engineering design and less time on software programming.