



THE NEW Phantom Works

What's next for the organization that brought us the X-43, a range of unmanned air vehicles and Future Combat Systems?

By WILLIAM COLE

Phantom Works, the advanced research and development unit for Boeing, has been going through a true metamorphosis. It promises to emerge as the organization it was always meant to be: a truly enterprise-wide organization that replicates effective technologies across Boeing and equally serves the company's two big business units – Commercial Airplanes and Integrated Defense Systems.

Founded in the 1990s, Phantom Works has always been associated with military projects, even though it has long been providing common technologies to all of the business units. That's an image that even Phantom Works executives say has been hard to shake.

"Because of our McDonnell Douglas heritage and our very prominent role in the development of advanced experimental military systems and platforms, people across the enterprise tended to think of us as a defense-oriented organization," says Bob Krieger, who, with the advent of the Engineering, Operations and Technology organization, has become the new chief technology officer and the president of Phantom Works.

An 8.5 percent scale model of the X-48B is shown being prepared for wind tunnel tests at the NASA Langley Research Center in Hampton, Va.

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What is the role of the CTO?

Bob Krieger has a fundamental faith in the power of team effort. When he was in college, he observed that students were far more creative and productive working in a group than they were working in isolation.



Bob Krieger, chief technology officer and president of Phantom Works.

Now, as he becomes chief technology officer as well as president of Phantom Works, Krieger is working with a huge team – thousands of Boeing engineers, technologists and scientists.

“This presents us with a tremendous opportunity to increase the yield of our R&D investments and help in the growth and productivity of Boeing,” he says.

His CTO duties:

- Working with the business units on companywide technology and R&D strategies, plans and annual investment levels.
- Defining and institutionalizing companywide technology standards.
- Helping to identify and approve opportunities for global technology relationships.
- Developing new business ventures derived from Boeing-developed technologies that are beyond the scope of its current business unit product lines.
- Defining strategies for engaging with technical schools and universities, for technical R&D investments, and for coordinating contribution and recruiting strategies with Human Resources.
- Defining, integrating and executing Boeing strategies and investment levels for companywide external industry technical affiliations.
- Administering and overseeing the Boeing Technical Fellows program.

Krieger comes to his new position with strong engineering credentials and experience. He joined McDonnell Douglas in 1968 as a senior engineer. He played a key role in the National AeroSpace Plane, Joint Direct Attack Munition, SLAM-ER and Harrier AV-8B programs, ultimately becoming president of Phantom Works, where he developed technologies for the commercial business.

Krieger has a bachelor's degree in civil engineering from the Carnegie Institute of Technology and an master's and a doctorate in applied space sciences from Carnegie Mellon University. He is a fellow of the American Institute of Aeronautics and Astronautics and a fellow of the Royal Aeronautical Society.

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“To the contrary, Phantom Works has been – and remains – committed to the development of technology for improving the productivity and growth of both the commercial and defense businesses,” says Krieger. “There will continue to be a need for a centrally managed R&D organization that can meet the technology needs of the business units through the development of common technologies,” says Krieger.

Recent changes, he says, will establish more clearly the Phantom Works' enterprise role. Originally, Phantom Works' mission had a two-fold mission: (1) to provide technologies – such as advanced materials, structures and manufacturing processes – to businesses across the company, and (2) to develop government-funded advanced systems for the military side of Boeing that will eventually be moved to Integrated Defense Systems for full-blown production.

However, Phantom Works' Integrated Defense Advanced Systems (IDeAS), was transitioned to IDS in 2005. The Engineering, Operations & Technology organization was created in June of this year.

“These reorganizations provide us with two opportunities: to refocus our Phantom Works technologies and to seek out the best of Boeing's technologies,” says Krieger. “We will better be able to align our research with our long term business unit strategy, to ensure that we are developing the right technologies, and

“We must address the rapidly changing world around us. It is critical that we develop innovative ways to keep moving forward.”

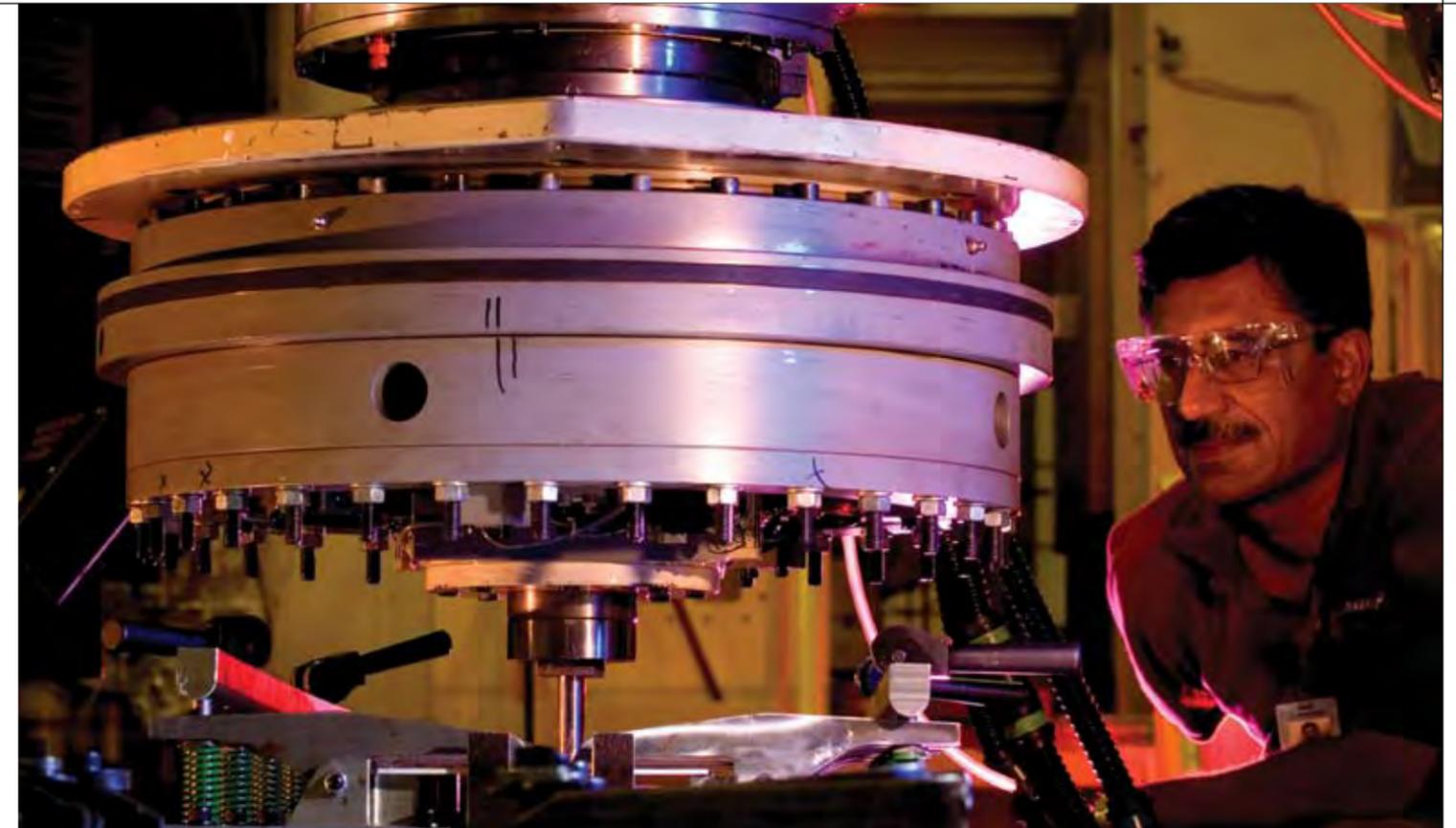
Bob Krieger – chief technology officer and president of Phantom Works

to help the business units to achieve their business goals.

“We have been providing technologies for Boeing Commercial Airplanes (BCA) – particularly to the 787 program – for some time,” says Krieger. “Previously, our enterprise technology efforts tended to be overshadowed by our advanced systems work, which received much more publicity. The advanced systems research resulted in many exciting platforms such as the X-43 hypersonic vehicle, which set a world record by flying at more than Mach 10 using scramjet engines. We competed for and won early contracts for Future Combat Systems. And we developed a substantial array of unmanned systems.”

Now that those programs are part of the Advanced Systems unit at IDS, says Krieger, Phantom Works will be able to concentrate even more on providing the enterprise with the technologies that will have a direct impact on the company's bottom line by enabling the business units to do their jobs better, faster and more affordably. Phantom Works employees will also be able to make a direct contribution to the corporate initiatives by:

- Helping to pinpoint opportunities for *integration* of technology efforts. The enterprise wants teams working on the same technologies to work together and not duplicate effort, says Krieger.
- Ensuring communication and project reuse by looking for opportunities for *replication* of the results of Phantom Works efforts. Replication means taking technologies and making them applicable to as many programs as possible, he adds.
- Looking for useful technologies developed elsewhere and helping spread and replicate those across the enterprise as well.



Friction stir joining is a technology that has been replicated throughout Boeing.

How is Phantom Works moving toward longer term technologies?

Krieger says that the work for Boeing's commercial and defense businesses will continue to be exciting. “We will be looking five, 10, 20 years down the road with enabling technologies such as active flow control, morphing structures, and advances in manufacturing that will keep Boeing on the cutting edge,” he says. “We will be working on the X-48B flying wing, fuel-cell technology, Advanced Air Traffic Management, and Homeland Security,” he says. “And we will continue to search the globe for the best-of-the-best people and technologies. We will continue to build our relationships with universities and educational institutions here and overseas. Our efforts in Spain, Russia and India are establishing Boeing as a global citizen as well as providing us with the special kind of expertise that we can find only abroad.

“For the near term, we will be focusing on our five Phantom Works Thrusts, which are intended to bring technologies to the business units within one to three years. We are focusing heavily on meeting the needs of BCA, the new IDS Advanced Systems unit and Logistics Support Systems at IDS. And most important, we will be concentrating on technology breakthroughs that will continue to serve the country as a whole.”

The reconstituted Phantom Works will also be working hard to integrate its technologies, says Krieger, through an effort called Integrating Projects.

“These are projects that will lead to major demonstrations of

integrated technologies to within five years from now,” he says. “They help define and focus our R&D across the multiple technologies the business units will need to be competitive in the long term. We are now working with our business unit partners to identify candidate integrated projects for 2007 that align with their long-term strategies. These strategies include developing technologies and processes for the next-generation large composite structures, autonomous systems, mobile networks, and logistics systems.”

Breakthroughs will continue to be part of Phantom Works' strategic goals, says Krieger. “In 2005, Phantom Works teams produced 25 breakthroughs, and we have already achieved our first technology breakthrough for 2006, in flutter testing,” he says. “Using a tool developed by the Enterprise Lab and Test Technologies team, the BCA Structural Dynamics group was able save two days from the time it takes to evaluate 767 Tanker flutter characteristics.”

Finally, says Krieger, “We must continue to address the rapidly changing world around us. It is critical that we develop innovative ways to keep moving forward. Here at Boeing we can play our part by using the resources of the entire enterprise more effectively and by promoting a more cohesive, integrated strategy.

“We want to both discover and develop the kinds of technologies and processes that will allow Boeing to better protect and connect the people of the world – and to make it a safer and more secure place to live.” ■