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Here's how engineers are working together, across distances and business-unit boundaries, to help Boeing succeed

by Daryl Stephenson, Dan Ivanis and Bev Holland



“The Engineering function is the company’s steward of technical expertise, processes and tools, and its most important responsibility is to make the right technical judgments.”

– John Tracy, Boeing chief technology officer and senior vice president of Engineering, Operations & Technology

When Robert Atmur gets a call for help, he has a simple aim: Add value. “Essentially, that’s my job,” said Atmur, a Boeing Defense, Space & Security Senior Technical Fellow in electromechanical and power systems who is based in Huntington Beach, Calif. “One of the reasons I’m a member of the Technical Fellowship is because I have demonstrated a capability to go somewhere and add value.”

Tom Walton and Sigvard Wahlin, Boeing Commercial Airplanes propulsion engineers on the 777 program, think Atmur’s value is as good as gold. The duo sought his assistance in investigating—and ultimately solving—a 777 ultrasonic fuel probe puzzle. “It’s cool that at Boeing we can reach out and tap into the enormous amount of expertise throughout the company,” Wahlin said.

Now more than ever, Boeing’s Engineering function is operating as an integrated companywide organization. It’s no longer novel for Commercial Airplanes and BDS engineers to support each other’s programs. Nor is it something reserved for emergencies. This is because Boeing has been strengthening the Engineering function over the past several years by integrating it as much as possible companywide and, more recently, by re-emphasizing the importance of technical leadership and excellence (see related story on Page 49).

The function’s focus on cross-enterprise integration and technical excellence is being spearheaded by John Tracy, Boeing chief technology officer and senior vice president of Engineering, Operations & Technology. Supporting Tracy are Mike Denton, Commercial

PHOTO: Ken Teasley (left), Commercial Airplanes engineer and integration lead, and Jack Howard, Defense, Space & Security engineer, observe an engine borescope inspection conducted by Commercial Airplanes technicians including Terry Gennow (back). JIM ANDERSON/BOEING

Airplanes vice president of Engineering, who leads the Enterprise Engineering team, and co-leader Rick Baily, recently appointed BDS vice president of Engineering and Mission Assurance. Mark Burgess, Boeing Research & Technology chief engineer, also is integral to this team.

"The Engineering function is the company's steward of technical expertise, processes and tools, and its most important responsibility is to make the right technical judgments and decisions to assure the highest level of quality," explained Tracy. "We want engineers to be able to seek one another out easily to deal with issues, so that whenever they arise, we will have a mechanism in place that will automatically enable top experts to work on those problems regardless of where they are located."

Denton said Engineering must ensure Boeing is providing the necessary engineers and technical people that programs need to be successful. That means having the right skills, processes and tools on hand when needed.

"We have an excellent enterprise skills team," Denton said. "So when [Commercial Airplanes] needs help on an airplane program, we are able to get highly skilled support from BDS. And, it works the other way around. It's not just a matter of getting more people to help; it's being able to reach out to people who have specific expertise. This makes a big difference."

Baily said Boeing is doing things today that it could not or would not have done five years ago. "The power of this new environment is that we can now reach

across Boeing and look at how other people are doing things and learn from them, and they from us," he said.

This working-together spirit is what led to Atmur providing assistance on the 777 ultrasonic fuel probe issue. Walton came across Atmur's name after searching the Boeing intranet for an expert in ceramic transducers, a component in ultrasonic fuel probes. Atmur, it turned out, has a unique, extensive knowledge of ceramic transducers.

The fuel probes on the 777 had transducers that were failing earlier than expected. The problem was significant, as the probes send data to flight-deck displays showing how much fuel the

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Dream network

Engineers from all over Boeing teamed to advance the 787 program
by Daryl Stephenson

As a Preliminary Design Review for the 787-9 loomed in mid-2009, teams overseeing specific systems of the airplane, along with their respective suppliers, were concerned that the technical requirements for their systems were incomplete. They wanted a third party to assess the 787 program's processes for determining and managing these requirements.

That request came to the Systems Engineering Core team of Boeing Commercial Airplanes, and what followed was an example of how Boeing engineers are working together across business units, using common processes, training and tools, to help Boeing produce superior products more efficiently and effectively. In this





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– Robert Atmur, Senior Technical Fellow, Boeing Defense, Space & Security

PHOTO: Senior Technical Fellow Robert Atmur has a unique knowledge of ceramic transducers. The 777 team sought his expertise in this field to solve a challenge with ultrasonic fuel probes. PAUL PINNER/BOEING

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– Joe Massimino, Technical Fellow, Boeing Defense, Space & Security

case, the Systems Engineering Core team learned that a team led by Joe Massimino, a Technical Fellow with Boeing Defense, Space & Security, had extensive experience in evaluating the soundness of systems engineering. They contacted Massimino, who assembled a team that included three engineers from Commercial Airplanes and one from BDS. The team met in Seattle last July for a one-week review of 787 systems engineering work products, interviews with program personnel and observations of program activities.

The team employed a model used to evaluate more than 100 projects in BDS and Commercial Airplanes. After a week, the team achieved its

commitment to “provide a cohesive set of findings and actionable recommendations,” Massimino said. The team also used the model to provide a benchmark comparison of the 787 to other Boeing programs.

“We learned a lot from the folks we interviewed and they had a lot of lessons to share,” Massimino said. “I think most of us realize we are part of a bigger team than the one we work with on a day-to-day basis and that we share our destiny across Commercial Airplanes, BDS and [Engineering, Operations & Technology].” ■

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PHOTO: Technical Fellow Joe Massimino, who has extensive experience in evaluating the soundness of systems engineering, last summer led a cross-enterprise team that reviewed 787 systems engineering.

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“We get on the phone and resolve issues quickly. The only way to get a program like this to work is through constant communication and shared destiny.”

— Dennis Eng, systems engineer and leader of the “installation and checkout to in-line” team



airplane has. Replacing the probes is difficult—someone has to go into the fuel tanks to do it. That means an airplane can be out of service a long time.

Over 18 months, the Boeing and supplier team members, with Atmur’s help, discovered that the transducers were failing early because they were being subjected to undue stress, mainly in their production process. The solution: Analyze what steps in production were causing stresses, change them, modify the assembly process and provide more training. The supplier’s engineers endorsed the solution in the fall of 2008 after testing verified that transducers made using the revised processes far outlasted previous transducers. The 777 program has been taking delivery of ultrasonic fuel probes with the new transducers since early 2009.

Atmur, Walton and Wahlin estimated the improvement will save 777 operators at least \$1 million a year in maintenance costs. It has also helped the company’s image, said Atmur. “If you have to take airplanes out of service because of a problem like this, what does that do to the Boeing brand?” he asked.

Here are two more of the many examples of how an integrated Engineering function is supporting Boeing.

Dennis Eng, a systems engineer and leader of the Commercial Airplanes team’s “installation and checkout to in-line” effort, is working with his BDS counterparts to make sure the P-8A Poseidon program remains on the leading edge. Boeing is assembling and testing five P-8A long-

range anti-submarine warfare, anti-surface warfare, intelligence, surveillance and reconnaissance aircraft for the U.S. Navy as part of a contract awarded in 2004.

Eng works closely with Keith Smith, P-8A director of Mission Systems with BDS, and an integrated Commercial Airplanes–BDS team to determine which work packages currently being performed in installation and checkout can be more efficiently completed upstream—at final assembly in Renton, Wash., or with suppliers. Installation and checkout, the final step in the production process, is where BDS employees install and integrate mission systems and perform any remaining modification work.

“Constant communication has been the key to our success from the beginning,” Eng said. “We get on the phone and resolve issues quickly. The only way to get a program like this to work is through constant communication and shared destiny.”

The BDS design for the Airborne Early Warning & Control aircraft, which is based on the 737-700 commercial jetliner, owes much to the help of Commercial Airplanes engineers. When it comes to the engines, BDS engineers figure that nobody knows them as well as Commercial Airplanes Propulsion Systems do.

“BDS has worked with [Commercial Airplanes] to develop configuration modifications for years,” said Jack Howard, a BDS mechanical systems engineer for the airplane. “When issues arise during certification and we need expertise on engines, the commercial side

has the experience with the airplane.”

His counterpart in Commercial Airplanes, integration lead Ken Teasley, noted that before work on the first derivative airplane began, Propulsion Systems worked with engine manufacturer CFM to develop modifications to be able to certify the AEW&C version to commercial aircraft regulations. “That was an essential step in the process,” Teasley said. In fact, all systems modified in the aircraft had to be certified for the new derivative, and BDS worked with Commercial Airplanes to accomplish that feat.

Teasley and Howard have been through several design issues that have taken ingenuity to resolve. One involved engine wire bundles. “During testing, we found interference between an engine wire bundle and the electrical system power feeder,” Teasley said. “It took working together between Propulsion Systems, BDS and the engine manufacturer to develop and certify a bracket that would hold the two separately and meet requirements.”

The working relationship of the two engineers has been open and respectful, according to Teasley. “We don’t focus on either BDS or [Commercial Airplanes] as different businesses,” he said. “We make sure we are doing the right thing for Boeing.” ■

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PHOTO: Defense, Space & Security P-8A director of Mission Systems Keith Smith (left) and Dennis Eng, Commercial Airplanes systems engineer, determine where work tasks should be handled. ALAN MARTS/BOEING