

With more than 75 years of aerial-refueling experience, Boeing remains an industry-leader with the KC-767 and its groundbreaking technologies. Here at the Integrated Defense Systems Wichita facility in Kansas, the KC-767A is undergoing modifications, flight tests and other activities to meet the Italian Air Force's aerial-refueling needs.



'A GAME



BUZZ SHADY PHOTO

With the KC-767 Tanker, Boeing is revolutionizing aerial-refueling and transport aircraft

By KATHERINE SOPRANOS

Inside the Integrated Defense Systems facility in Wichita, Kan., Boeing employees are working hard to bring the world a new aircraft they hope will redefine military in-flight refueling and transport.

Boeing has introduced, with its supplier-partners, the KC-767—the world's most advanced multimission aerial-refueling and transport aircraft. It's a fuel-efficient, long-range aircraft specifically sized for diverse air-refueling; cargo, troop and passenger transport; and aeromedical evacuation missions.

The Italian Air Force in 2001 became the program's first KC-767 customer. The Japan Air Self Defense Force also has selected the aircraft to meet its aerial-refueling needs. The first tanker, Italy's KC-767A, rolled out in February 2005 and made its international debut at the Paris Air Show in June 2005.

"The KC-767 is a game changer. It takes tanker aircraft to the next level, offering unparalleled mission flexibility, with advanced avionics, network-enabled capabilities and aerial-refueling systems, as well as versatile cargo-carrying ability," said George Muellner, Boeing Air Force Systems vice president and general manager. "For more than two years, Boeing and our supplier-partners have been working hard on this program. As a result of these efforts, we will soon be delivering to Italy and Japan the world's most advanced aerial-refueling tanker."

The new KC-767 is the derivative of Commercial Airplanes' 767-200ER, com-

binning the proven commercial performance with integrated tanker systems.

"The KC-767 Tanker is part of Boeing's global strategy, bringing the best of BCA's 767 capabilities and the best of Integrated Defense Systems to the international marketplace," said Jim O'Neill, IDS vice president, Tanker Programs.

With more than 75 years of aerial-refueling experience, Boeing continues to lead the industry with the KC-767 and its groundbreaking technologies that will dramatically improve aircraft and aircrew capabilities. These include integrated avionics and communication systems, a high-tech boom operator station enabled by camera systems, improved situational awareness, and combination passenger and cargo transport capabilities.

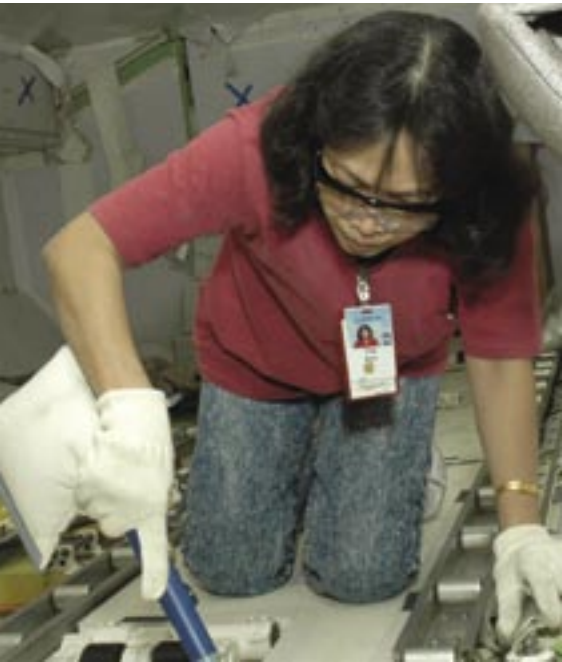
Building on proven technology from the KC-10 Extender, the KC-767 will transform aerial-refueling operations from manual to fly-by-wire. Today, KC-135 Stratotanker boom operators perform their intricate aerial-refueling duties using a mechanical control system. They lie on the floor in the rear of the aircraft, looking through a window to visually control the tanker aircraft's boom and successfully connect with the receiver receptacle of another military aircraft.

Now, the KC-767's fully automated, all-digital operator station will enable the boom operators to perform their duties in a normal sitting position, to safely "fly-by-wire" using control sticks and state-of-the-art visual and head-mounted displays to perform precision boom contacts.

"The shift from manual boom opera-

CHANGER'

KC-767



BUZZ SHADY PHOTO

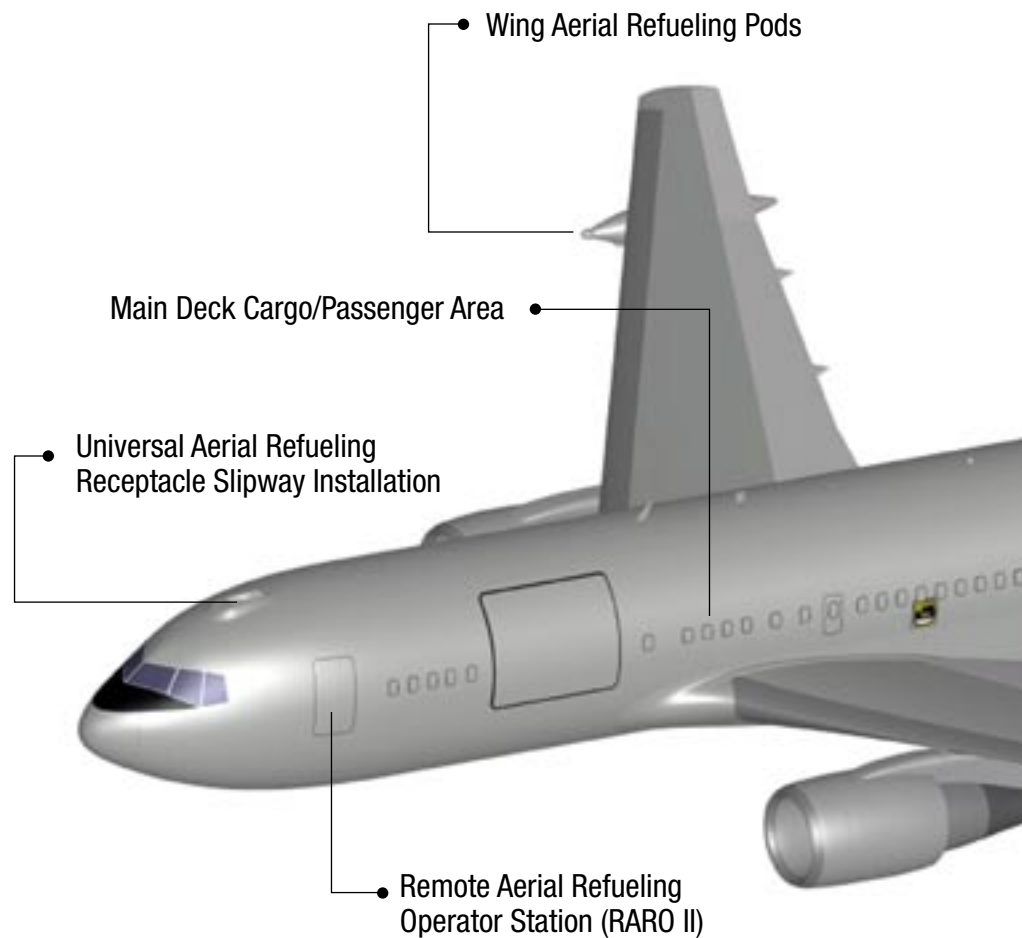
At the Boeing Wichita facility, Boeing's Tha Son works on modifications inside the KC-767A for the Italian Air Force.

tions to a fully automated and digitally integrated platform will provide aircrews with a safer, more efficient and improved aerial-refueling mission capability," said Pam Leblond, 767 Tanker Program air vehicle chief engineer.

PROVEN MARKET

Currently, the world's military air forces mainly use Boeing's KC-135 and KC-10 tankers, with Boeing responsible for nearly 2,000 new tankers or tanker conversions. Boeing has delivered more than 99 percent of the boom-equipped tankers ever made, said Tom Crawford, Boeing IDS senior manager of Tanker Business Development. This August marks the KC-135's 50th anniversary. Boeing introduced the KC-10 Extender in 1980. With maintenance costs rising on an aging tanker fleet—which averages 46 years old—as well as parts obsolescence, air forces will consider replacing their aircraft, Crawford said. Boeing forecasts the market for new tankers at \$100 billion over the next 40 years.

"Boeing is in a unique position to take our commercial aircraft expertise and marry it with military systems and technologies," Crawford said. "It helps governments avoid huge costs of designing and building an airplane from scratch and ensures longer-term support of these planes."



KC-767 Tanker facts

Length: 159 feet, 2 inches (48.51 meters)

Height: 52 feet (15.85 meters)

Wingspan: 156 feet, 1 inch (47.57 meters)

Maximum takeoff weight: 395,000 pounds (179,169 kilograms)

Max fuel capacity: 160,000 pounds (72,575 kilograms)

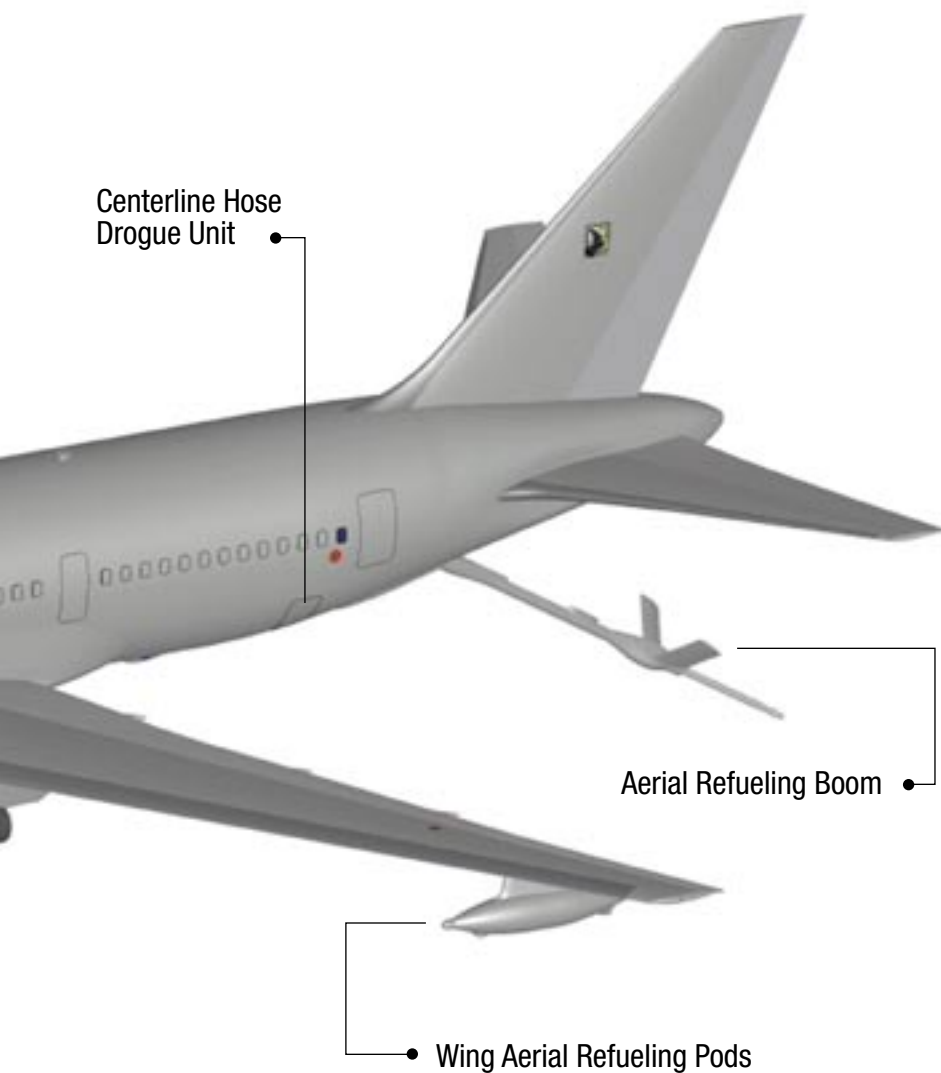
Engines: General Electric GE CF6-80C2B6F

Supplier-partners: Aeronavali, GE Aircraft Engines, Honeywell, Pratt & Whitney, Rockwell Collins, Smiths Aerospace, Vought Aircraft Industries

Various 'firsts':

- The KC-767A will be Italy's first tanker with a boom; its current 707 fleet has wing pods only.
- The KC-767 will be the first-ever aerial-refueling tanker for the Japan Air Self Defense Force.

TANKER



Groundbreaking technologies

New capabilities, network-centric operations and upgraded systems make the KC-767 Tanker the world's most advanced tanker aircraft—and the most versatile to customize for specific multimission needs. The KC-767A's unmatched technologies and capabilities include

- Remote Aerial Refueling Operator Station (RARO II).** Located in the forward crew area, RARO II entails an all-digital station where boom operators, using a video console, perform boom refueling using control sticks and a high-tech head-mounted display.
- Improved situational awareness.** New technologies include improved night and day vision through onboard camera systems, and Link 16, a data network, for increased situational awareness. To monitor approaching aircraft, cameras give boom operators and pilots panoramic wingtip-to-wingtip views via the Situational Awareness Camera System and the Boom Air Refueling Camera System.
- Improved air-refueling equipment.** The KC-767A's Centerline Hose Drum unit has 600 gallons per minute offload capability; the refueling boom handles more than 900 gallons per minute offload and has a fly-by-wire control system and improved nozzle with independent disconnect capability. The Wing Aerial Refueling Pods can simultaneously refuel two receiver aircraft at an offload of 400 gallons per minute each.
- Versatile configurations.** In the combination configuration, the KC-767A can carry up to 100 passengers, plus 10 side-by-side or five centerline cargo pallets. A safety barrier separates the passenger cabin from the cargo compartment. In the all-passenger configuration, the aircraft can carry up to 200 passengers on palletized seats. In the all-cargo configuration, the aircraft can carry up to 19 military cargo pallets. The aircraft can carry additional cargo below the main deck, to include up to three additional military cargo pallets.

Above: The KC-767A, in this graphic, will have unmatched technologies and capabilities, including being able to refuel two airplanes at a time.

BUILDING THE TANKER OF THE FUTURE

In July 2003, the first KC-767A airframe was flown from the Boeing production line in Everett, Wash., to the IDS facility in Wichita, Kan. Since then, Boeing employees and supplier-partners on the Global Tanker Team have engaged in extensive, Lean-driven modification activities to build the tanker to meet Italy's military-unique requirements. The Global Tanker Team also is working under an aggressive schedule to modify Japan's first 767 into a tanker transport. This work began May 2005 in Wichita.

Approximately 1,000 square feet of original 767 fuselage skin is cut out to transform the plane from commercial to military use. Modification activities include removing floor beams and building and installing new ones, and installing cameras, palletized seating, a main deck cargo door and air-refueling equipment. The modifications involve 48,000 parts, 54 miles of wiring and one mile of tubing and ducts.

"We have a terrific team modifying the 767 Tanker," said Steve Reichard, 767 Tanker senior operations manager. "The team's pride, hard work, experience, dedication and desire to succeed are the driving forces behind Boeing's ability to deliver the world's most advanced aerial-refueling tanker."

In addition to complex modification activities, the KC-767A continues flight testing, which includes validation of airworthiness, stability and control, avionics integration, and checking the mission equipment. The flight-test time to date for the KC-767A is 123 hours in 37 flights. Other behind-the-scenes activities include testing all software and hardware systems in the Systems Integration Laboratory before they are installed in the aircraft. Also, the Advanced Technology research and development group is continually planning for technologies and capabilities that will further advance the aircraft. In addition, Logistics Support Systems focuses on providing contract-specific customer support, such as technical data and training for aircrew and maintenance personnel.

"It's great to see the teamwork, and great talent across all Boeing, brought on the KC-767," O'Neill said. "There's nothing more exciting than working hard these past years and seeing the tanker fly over the fence and now into flight tests."



BUZZ SHADY PHOTO

Tsuyoshi Tung, engineering test pilot with Boeing Integrated Defense Systems, works on the Global Tanker Team to help develop new capabilities for the KC-767 Tanker.

Tanker team profile: Tsuyoshi Tung

Tsuyoshi Tung, a Wichita, Kan.-based engineering test pilot with Integrated Defense Systems, is also a U.S. Air Force Reserve KC-135 instructor pilot. After serving 10 years of active duty in the Air Force, Tung joined Boeing nearly four years ago. His job entails flight testing the new aircraft and applying his expertise to help develop its advanced digital flight deck. He shared with *Boeing Frontiers* his perspective from the KC-767 flight deck.

Q: What are some of the differences between previous tankers and the new KC-767?

A: The KC-767 can refuel via the boom—one airplane at a time—and the wingtip drogue basket air-refueling pods—two airplanes at a time. Currently, most tankers lacking wingtip pods are limited to one type of refueling on the same flight. They can do one or the other, but not both on the same flight. Using its centerline drogue, the KC-767 also can refuel a large aircraft equipped with a probe receptacle. The KC-767 has revamped flight management functions, improved situational awareness and communications, and increased airlift capabilities. It also has improved takeoff and landing performance, allowing the KC-767 to operate from shorter runways at maximum gross weights. This enables mission planners to deploy assets to more airfields around the world.

Q: How are you participating in the development of the new KC-767?

A: I'm involved in all aspects of what will make the flight deck and air-refueling operations the most user-friendly from the pilot's perspective. I work with engineers, software designers, supplier-partners and other team members, helping with design specifications that will minimize workload for the aircrew and make the end users' job easier. As a pilot, I like the fully integrated tanker. It's nice to have a new airplane with a higher reliability rate than previous tankers.

Q: As a pilot, is it rewarding to be part of the new aircraft's development?

A: I get personal satisfaction that I have a direct impact on the design of the plane. I never had that opportunity until I came to Boeing.

ITALY TO FLY 1ST KC-767A

The Italian Air Force became Boeing's first 767 Tanker customer in 2001 when it selected the aircraft following a competition; in October 2002, it signed a contract for four aircraft. Delivery of the first aircraft is planned at the conclusion of flight testing this year.

"On entry into service, we will have the most advanced tanker in the world," said Lt. Col. Roberto Poni of the Italian Air Force, who has served as Italy's on-site liaison in Wichita since July 2003. "With the KC-767 tanker, we will have the ability to refuel all NATO aircraft, including cargo and AWACS. That's a real advantage to the aircraft."

The Italian Air Force fleet currently has 707-derivative air-refueling aircraft equipped only with wing pods and a centerline hose drum unit. The KC-767A not only will accelerate the air force's capabilities, it also will introduce the boom and boom operator role to Italy.

"The 707 is not equipped with a boom, so we can't refuel with any United States Air Force-type aircraft or other allies," Poni said. "We will be in a position to refuel now."

The Italian Air Force decided to get the new KC-767 platform, Poni explained, after

In 2001, the Italian Air Force became Boeing's first KC-767 customer. Below, the KC-767A undergoes a flight test in 2005 over Kansas.

Tanker team profile: Dennis Struve

Dennis Struve, a Boeing air-refueling specialist in Wichita, Kan., served 16 years as a boom operator on the KC-135 (-R, -T and -E versions) in the U.S. Air Force. He joined Boeing two years ago and also serves in the U.S. Air Force Reserve. He shared with *Boeing Frontiers* his insights about flight testing the KC-767 boom technologies, as well as his perspective on how they may change the operator's role.

Q: What are your flight-testing responsibilities?

A: I serve as an air-refueling specialist for various aircraft programs, models and types. I analyze complex products to determine acceptability and recommend solutions, if needed. My range of responsibilities include specifying test criteria and conducting hardware and software research, development, product improvement, qualification and associated tests. I provide technical guidance and assist in the resolution of complex technical issues.

I fly as a test operator for new and modified air-refueling equipment, including boom and drogue systems. I accomplish engineering flight tests of related aircraft systems and accomplish Functional Check Flights of modified aircraft, as needed, to return the aircraft to service.

Q. As an experienced boom operator, how do you feel about the new Remote Aerial Refueling Operator Station (RARO II)?

A: Growing up in the computer age, I'm a big fan of technology as long as it improves the process.

Q. What's different about boom operations with RARO II?

A: The best example I can give would be lowering the boom. In previous tankers, it is a six-step process using levers and handles. With the fly-by-wire system on the KC-767, the process has been reduced to a single button push.

Q. Is there anything you will miss doing when using RARO II?

A: I will miss the eye-to-eye contact with the receiver.

Q. How has the RARO II system made your job safer and more effective?

A: The systems on the KC-767 do a lot of the things automatically that had to be done manually on previous systems. This automation simplifies the process and makes the job easier.

Q. How will fly-by-wire refueling change the boom operator's role?

A: The advantage of fly-by-wire from the operator's standpoint is that during contact, the operator no longer has to keep the boom lined up with the receiver aircraft. Fly-by-wire systems allow the boom to control itself, similar to being on autopilot, while the two aircraft are in contact. The operator monitors the flight controls, keeps a watchful eye on the receiver and is ready to take over should anything go wrong.

ITALY'S KC-767A

July 2003

Leaves Boeing factory in Everett, Wash., and arrives in Wichita, Kan.

September 2003

Modifications begin in Wichita

February 2005

Rollout ceremony

May 2005

First flight

June 2005

On display at Paris Air Show

Late 2006

Scheduled delivery



BUZZ SHADY PHOTO



BUZZ SHADY PHOTO

Above: Japan's KC-767 is at the Integrated Defense Systems facility in Wichita, Kan. It will be configured as a convertible freighter, with air refueling boom and Japan-unique avionics requirements. **Right:** Boeing's Chris Dahl and his colleagues work inside Japan's KC-767, which will be the country's first-ever aerial-refueling tanker.

careful deliberation. "The 707 had low reliability, and the cost for flying hours was extremely high. What was best? Refurbish the 707 or get a new platform?" he said. "We decided to get the new platform because it was important for the Italian Air Force."

Italy plans to use the KC-767A for future NATO operations, Poni said, and for operations Italy now supports in Iraq and Afghanistan. It also will use the aircraft for humanitarian relief operations.

Italy's first KC-767A is being modified in Wichita. In May 2005 its second 767 was inducted into the Aeronavali tanker modification center in Naples, Italy. Boeing has partnered with Italian aerospace companies, such as Aeronavali, to design,



BUZZ SHADY PHOTO

build and support the 767 tanker transport. Alenia is responsible for payloads and systems engineering design and development. Aeronavali will conduct the structural and system modifications on the second, third and fourth aircraft, and will produce parts and installation kits. Italy's third 767 airplane is currently in Final Body Join at the Boeing site in Everett, Wash.

JAPAN TO LAUNCH AIR REFUELING

In 2003, the Japan Air Self Defense Force signed a contract with Boeing to meet its aerial-refueling and cargo and passenger transport needs. The KC-767 Tanker program continues Boeing and Japan's relationship, which has lasted more than 50 years (see the July 2003 issue of *Boeing Frontiers*).

The KC-767 will make history in Japan as the country's first-ever aerial-refueling tanker. "We are very excited about getting the first tanker for Japan," said Lt. Col. Masayuki Suzuki. "I think Boeing is the best company for aerial refueling, and I believe it has more experience."

Japan's KC-767 will be configured as a convertible freighter, with air-refueling boom and Japan-unique avionics requirements. Flight tests are scheduled for the fourth quarter of this year, and the first Japan KC-767 is scheduled for delivery in December.

"The KC-767 will strongly contribute to the efficiency and extended endurance of fighter operations for our Air Combat Command," Suzuki said. "In addition, the tanker will contribute to the quick response of the command and to survivable, flexible and effective Air Defense operations." Japan also will use the KC-767 for fighter and safety training, international peacekeeping activities, international emergency assistance and humanitarian assistance, Suzuki said.

The second 767 for Japan is scheduled to arrive in Naples from Everett in June. Aeronavali will modify this aircraft, along with Japan's two forthcoming tankers. (Boeing partnered with Kawasaki Heavy Industries as the in-country provider of aircraft technical support, including heavy maintenance. Boeing's logistical support will include providing technical publications, support equipment and training.)

"The new KC-767A is a testament to the brilliant skills and minds of Boeing people across the enterprise," Leblond said. "Together with our supplier-partners, we have developed and completed significant modification activities to build the world's most innovative refueling aircraft." ■

katherine.sopranos@boeing.com



Jen Moore, an avionics engineer in Boeing Integrated Defense Systems' Advanced Design-Tanker Programs, is part of the Global Tanker Team developing new capabilities that will make the KC-767 Tanker the most versatile to customize for specific multimission needs.

Tanker teammate profile: Jen Moore

Jen Moore, an avionics engineer in Integrated Defense Systems' Advanced Design-Tanker Programs, flies the KC-135 as a part-time Illinois Air National Guard officer with the 126th Air Refueling Wing. She joined Boeing six years ago and currently works with the Advanced Design team on research and development projects aimed at advancing the technology and design of new tankers. She shared with *Boeing Frontiers* what it's like to fly an aerial-refueling tanker and help create future designs.

Q: What does your role in Advanced Technologies include?

A: I help coordinate and research capabilities and features the tanker program is considering. My job is to provide management with the data they need to make decisions about what technologies to include and how to include them.

Q: As a trained KC-135 pilot, is it exciting to work on the R&D behind new tanker technologies?

A: Absolutely! It's amazing to see what the future holds and to be a part of developing some of the pieces. We are working to provide the best tanker for our government customers, and the technologies will directly benefit military fighting forces.

Q: What is the most challenging part of your job?

A: Remembering there are program cost limitations. I get so excited about all the potential capabilities and possibilities, it's easy to forget that everything costs money.

Q: How do you feel your experience helps the team?

A: I can keep the team aware of how pilots are using our current capabilities and provide insight related to the current tanker. Some of my team members don't have military experience, and it makes me feel good when they have a question I can answer about how things work.