



Chopper Toppers

In the defense-rotorcraft business, Boeing is using its time-tested formula for success: continuously improving capabilities, and paying close attention to the needs of its customers

BY DEBBY ARKELL

Humankind has long been fascinated by vertical flight, with initial concepts dating back to the 5th century. However, the earliest viable helicopters didn't get off the ground—literally and figuratively—until the early 20th century.

While the general public might associate Boeing with fixed-wing aircraft, the company has a successful defense rotorcraft business. The Boeing helicopter heritage traces its roots to the 1960s. Forged from aviation legends including Howard Hughes and Frank Piasecki, Boeing-manufactured helicopters now make up a rotorcraft family renowned for providing vital military and humanitarian services to armed forces and communities around the world.

Led by program Vice President and General Manager Chuck Allen, Boeing

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Rotorcraft employees manufacture the venerable Apache and Chinook, and the unique V-22 Osprey for customers that include the U.S. Armed Forces and many nations worldwide. All three platforms will continue to play critical roles in combat and humanitarian missions for decades to come.

"Rotorcraft Systems had a great year in 2007," Allen said. "Our success is a direct result of the tremendous amount of hard work, dedication and teamwork you'll find in our factories and in our offices at both of our Rotorcraft plants."

In 2007, Rotorcraft Systems delivered 36 Chinooks (the most since 1995), 42 Apaches and 15 Osprey fuselages, along with contributing to the delivery of 14 complete V-22 aircraft from the Bell plant in Amarillo, Texas.

"Our business outlook for the next five to 10 years is solid, and we're showing outstanding growth," Allen said. "Our challenge is to keep everyone focused on the future."

Indeed, Rotorcraft leaders expect continued long-term growth for their businesses across the board.

Chinook program leader Jack Dougherty expects the Chinook program to have a useful service life of 75 to 100 years. And under the \$10 billion U.S. Army Modernization Program, that won't be far off the mark. The first of more than 452 new and renewed CH-47F helicopters was certified combat-ready by the U.S. Army and fielded to the first operational unit last August.

The AH-64D Apache Longbow also is successfully in service and on order with



BOB FERGUSON PHOTO

The AH-64D Apache Longbow is a multirole, heavy-attack combat helicopter that can transmit real-time digitized information to air and ground forces.

the U.S. Army—and nine allied defense forces as well. Efforts are under way to deliver the first Apache Block III helicopter to the Army in 2011. Indeed, the enhancements featured in the Block III Apache will offer crews and battlefield commanders the right mix of technology and performance—network-centric capabilities, increased sensor ranges, enhanced survivability and greater agility—and continue to address customers’ changing needs.

Bell Boeing is expected to implement a multiyear procurement program beginning this year for the V-22 Osprey. The multiyear effort involves 167 aircraft: 141 for the U.S. Marine Corps and 26 for the U.S. Air Force Special Operations Command—about half the current full program requirement of 458 aircraft. A follow-

on multiyear procurement to complete the program by 2017 is likely to follow in 2008. Bell Boeing expects to produce aircraft for several international customers as well, though those discussions are preliminary.

The following pages provide an introduction to the capabilities of this triad of fielded, proven rotorcraft products; they also will demonstrate how Boeing employees continue a tradition of flawless execution and create products that meet the needs of customers—now and into the future.

AH-64D APACHE LONGBOW

Apaches have been in production since the mid-1980s. The AH-64D Apache Longbow, first delivered to the U.S. Army in 1997, is the successor to the original production attack helicopter, the AH-64A Apache. The Apache Longbow is a multirole, heavy-attack combat helicopter capable of transmitting real-time digitized information to air and ground forces.

Boeing in May 2007 delivered to the Army its first new-build, wartime replacement AH-64D Apache Longbow. Before that delivery, Boeing delivered 501 Apache Longbows—remanufactured AH-64As—for the U.S. government under two multiyear contracts. The Army has 47 new-build Apache Longbows and 96 remanufactured AH-64Ds on order. The first Block III helicopter will be the first Army aviation platform with the capability to be part of the network and connect to the Global Information Grid.

“Intimate product and customer knowledge are key to maintaining the competitive advantage of the Apache program in today’s rotorcraft market,” said Al Winn, vice president, Apache programs. “Teammates working in all facets of Apache design, production, delivery and service—and within the support areas—bring expertise and extensive experience, enabling customer relationships to be established and grown for the benefit of the customer and the company.”

CH-47F CHINOOK

The CH-47 Chinook is a twin-turbine, tandem-rotor helicopter that first saw military service in 1962. A multimission,



FRED TROILLO PHOTO

The tandem-rotor Chinook helicopter has gained worldwide renown for humanitarian and medical evacuation missions, in addition to its support of military conflicts around the world.



FRED TROILLO PHOTO

The V-22 Osprey is a complex aircraft that brings unique, transformational capabilities to the U.S. Armed Forces. The first operational U.S. Marine Corps squadron deployed to Iraq in 2007.

heavy-to-medium-lift transport helicopter, the Chinook's primary role is to move troops, supplies and a variety of other equipment on the battlefield. However, Chinooks have gained worldwide renown conducting humanitarian and medical evacuation missions, disaster relief and fire fighting and supporting heavy construction and civil development.

Boeing has built a variety of CH-47 models over the years, the most advanced of which is the CH-47F. Certified combat-ready by the Army, the new Chinook was first fielded in August 2007.

"Boeing Rotorcraft is the original equipment manufacturer of five U.S. military platforms (H-47, AH-64, V-22, OH-6, CH-46)," said Jack Dougherty, Chinook program leader. "This level of experience with different platforms means Boeing engineers can pull on knowledge and expertise from around the company to provide customers cutting-edge technology and solutions."

One of the principal features of the Chinook program is that it strives to have employees take ownership in the products they produce. Dougherty also noted the Chinook program has an ongoing Lean initiative, which focuses on lead- and cycle-time and cost reduction. In recent years this Lean manufacturing program

has successfully saved the U.S. Army millions of dollars. Under the current Army modernization program, Chinooks will remain in service through 2035—a service life exceeding 75 years.

V-22 OSPREY

The V-22 Osprey, built jointly by Boeing and Bell Textron, promises to transform the U.S. Armed Forces. The V-22 Osprey takes off, hovers and lands like a helicopter; however, its rotors can be tilted in flight so the aircraft flies like a turboprop airplane, making it capable of high-speed, high-altitude flight. The Osprey is a multi-role helicopter used for assault, cargo and search-and-rescue operations.

"The V-22 brings unique, transformational capabilities to our Armed Forces," said Gene Cunningham, vice president, Bell Boeing. "It's a potentially huge competitive advantage for Bell Boeing, and no one else can match the versatility of this aircraft."

Boeing is responsible for the V-22's fuselage and all subsystems, digital avionics, and fly-by-wire flight-control systems; Bell is responsible for the wing, transmissions, empennage, rotor systems and engine installation. The first V-22 was delivered in 2005, and the aircraft currently is transporting U.S. Marines in Ramadi, Iraq.

"Now that V-22s are deployed over-

seas, we expect to see growing interest in the operational capabilities of our revolutionary tiltrotor aircraft," said John Rader, V-22 program manager. "We've increased our production rates to enable the Marine Corps and Air Force Special Operations to field V-22s as quickly as possible, and we're focusing closely on quality to ensure our servicemen and servicewomen receive superlative aircraft to complete their missions." ■

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Chinook's relief role



As part of a post-earthquake relief effort in 2005, members of an Australian Defence Force team unload relief goods in Dhanni, Pakistan, from a U.S. Army Chinook helicopter.

AUSTRALIAN DEPARTMENT OF DEFENCE PHOTO

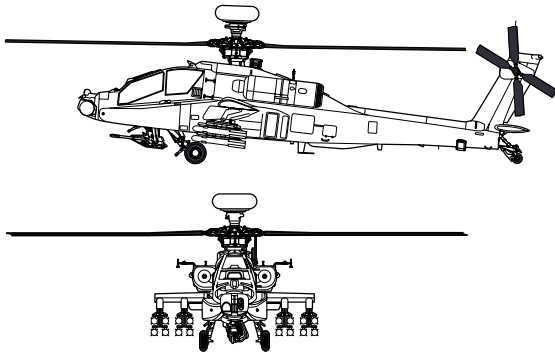
Indonesia, Dec. 26, 2004: tsunami.
Louisiana, Aug. 29, 2005: Hurricane Katrina.
Louisiana, Sept. 24, 2005: Hurricane Rita.
Pakistan, Oct. 8, 2005: earthquake.

These four dates mark some of the most significant natural disasters the world has experienced in recent years. One constant in these four crises—and others since—is the CH-47 Chinook.

CH-47s are ideally suited to humanitarian relief efforts because of their ability to handle useful loads up to 24,000 pounds, among the heaviest lift capabilities today. Its tandem rotor configuration also provides exceptional handling qualities that enable the CH-47 to operate in climatic, altitude and crosswind conditions that typically keep other helicopters from flying.

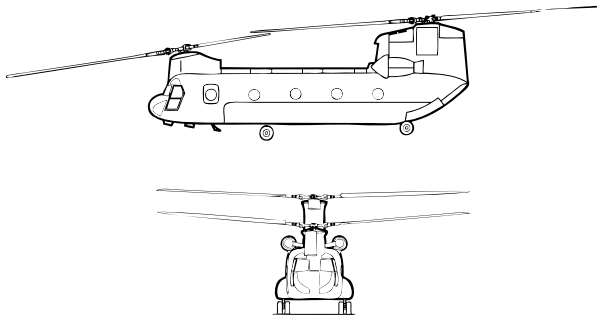
Tale of the tape: Boeing Rotorcraft products

AH-64D Apache Longbow



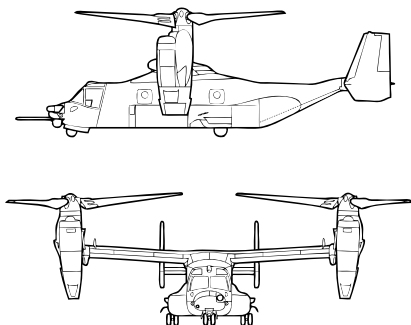
Length	58 feet (17.7 meters)
Height	16 feet (5 meters)
Fuselage width	17 feet (5.2 meters)
Mission gross weight	16,600 pounds (7,530 kilograms)
Vertical rate of climb	1,475 feet per minute (450 meters per minute)
Cruise speed	141 knots (261 kilometers per hour)
Other models	AH-64A
Customers	United States, Egypt, Greece, Israel, Saudi Arabia, United Arab Emirates, Japan, Kuwait, The Netherlands, Singapore, and the United Kingdom
Number ordered/delivered to date (all models)	More than 1,600
Place of manufacture	Mesa, Ariz.
Program leader	Al Winn

CH-47F Chinook



Length	52 feet (15.8 meters)
Height	19 feet (5.8 meters)
Fuselage width	12.4 feet (3.8 meters)
Mission gross weight	50,000 pounds (22,680 kilograms)
Vertical rate of climb	1,980 feet per minute (604 meters per minute)
Cruise speed	155 knots (287 kilometers per hour)
Other models	CH-47A/B/C/D, MH-47E/G
Customers	United States, Argentina, Australia, Canada, Egypt, Greece, Iran, Italy, Japan, South Korea, Libya, Morocco, The Netherlands, Republic of China, Singapore, Spain, Thailand, United Kingdom
Number ordered/delivered to date (all models)	More than 1,500
Place of manufacture	Ridley Park, Pa.
Program leader	Jack Dougherty

V-22 Osprey



Length	57 feet (17.4 meters)
Height	20 feet (6.1 meters)
Width, rotors turning	83.3 feet (25.6 meters)
Mission gross weight	47,500 pounds (21,546 kilograms)
Vertical rate of climb	2,320 feet per minute (707 meters per minute)
Cruise speed	250-300 knots (463-556 kilometers per hour)
Other models	N/A
Customers	U.S. Marine Corps, Air Force and Navy
Number ordered/delivered to date (all models)	About 458 (projected)
Place of manufacture	Amarillo, Texas (final assembly and delivery)
Program leader	John Rader



In Philadelphia, Chuck Allen (left), Rotorcraft Systems vice president and general manager, reviews a CH-47F Chinook airframe with Frank McCabe (center), with the Primary 1-3 Fuel Shop, and Craig Moore of IDS Technical Training.

FRED TROILO PHOTO

Focusing on the future

Chuck Allen became vice president and general manager of Rotorcraft Systems in March 2007. *Boeing Frontiers* recently spoke with Allen to discuss his goals for the organization and gain some insight into Rotorcraft's top leader.

Q: What are your top priorities for your organization?

A: First, making it a place where mutual trust and respect for everyone is a hallmark. Second, be an organization renowned for world-class quality in everything we do—our products, our business systems, our HR processes, and on and on. When we accomplish those two things, we will see our business expand more than even I can imagine. And I have a vivid imagination!

Q: Integrated Defense Systems' vision is to be the preferred partner based on integrity, innovation, performance and value. Of those four things, which do you feel is the biggest challenge for your organization?

A: They are all important and all have their own challenges. I'm going to say integrity—certainly not because I think we're lacking there today, but because none of the others are really possible without unquestionable integrity, and one lapse in judgment by one person can do such enormous damage.

Q: What's the forecast for rotorcraft in the coming decades?

A: We are very fortunate to be in a growing market for some time to come. On the other hand, our competitors see the same forecast and are working to displace Boeing as the market leader.

I know we have the best products and the best people, so we need to be sure we have the right vision, the right discipline in execution and the right commitment to keep that from happening.

I've been pleasantly surprised at how solid our business outlook is for the next five to 10 years. We're showing outstanding growth, and it's in firm or near-certain work. The challenge is to keep everyone focused on the future and how good we really can be rather than focused on how much we've improved in the last five years, because that improvement has been phenomenal.

Q: You served in the U.S. Marine Corps for 13 years before joining Boeing. How did this prepare you for a career in aerospace?

A: Did I mention that discipline thing? Seriously, it taught me how important it was to build trust and confidence in a team. The only thing more sobering than realizing your life can literally depend on other people doing what they promised is to realize they feel the same way about you.

Q: Do you have a pilot's license, and did you pilot any helicopters during your time with the Marines?

A: I do have a pilot's license, but the only time I flew helicopters was while a student in Test Pilot School. And they only let us fixed-wing guys fly them enough to convince ourselves all helo pilots were supermen!

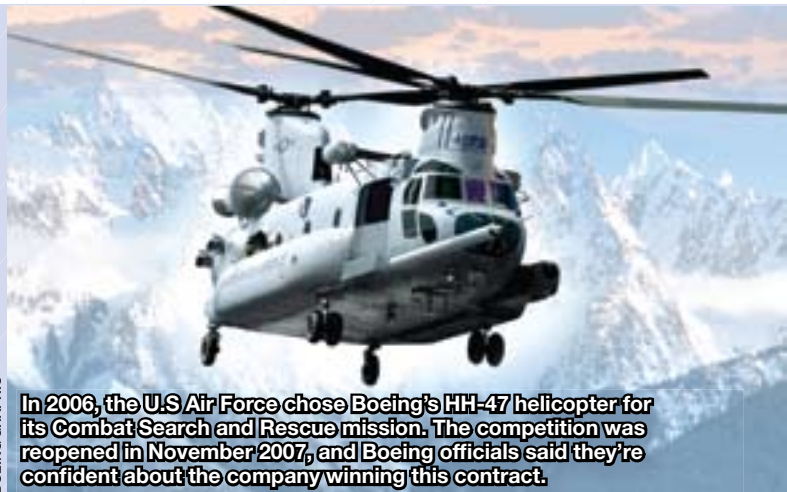
—Debbly Arkell

What is CSAR-X?

When pilots are downed, or soldiers, sailors or Marines wounded or injured on the battlefield or in hostile territory, it's of paramount importance to find them and return them to safety.

The Combat Search and Rescue mission belongs to the U.S. Air Force and relies upon state-of-the-art equipment to answer the call. However, the service's current helicopter, the Sikorsky HH-60G, is aging and suffers from low mission-capable rates. Fielding a new helicopter through the CSAR-X competition is one of the Air Force's highest acquisition priorities. In November 2006, the service chose Boeing's HH-47 helicopter as the platform for the lifesaving job.

Both the global war on terror and humanitarian relief operations demand a helicopter that can operate in high altitudes and rough terrain and provide medical and transport capabilities safely. The HH-47, based on the Chinook, met and exceeded the Air Force requirements. But following the award, competitors Lockheed Martin and Sikorsky protested the selection based on evaluation and calculation of the Most Probable Life Cycle Cost. This resulted in a work-stoppage order to Boeing. After being upheld twice by the Government Accountability Office, the protests led to the reopening of the competition last November.



BOEING GRAPHIC

In 2006, the U.S. Air Force chose Boeing's HH-47 helicopter for its Combat Search and Rescue mission. The competition was reopened in November 2007, and Boeing officials said they're confident about the company winning this contract.

"We are pleased that the process can now move forward, and remain confident Boeing's HH-47 is the best choice," said Rick Lemaster, HH-47 CSAR program manager. "In the end, we feel the HH-47 will be again selected by the Air Force, based on its exceptional capability and low risk."

The three competitors submitted new proposals Jan. 7, and the Air Force is expected to reaward the contract this fall. The contract is worth an estimated \$15 billion and, should Boeing win again, Rotorcraft Systems will build 141 new aircraft at its Ridley Park, Pa., facilities.

—Debby Arkell

Other rotorcraft players

Boeing has fared well in the defense helicopter market. But by no means is it the only company in this business. Here are short profiles of some of the world's other helicopter manufacturers that compete with Boeing. (This summary is not intended to be all-inclusive; instead, it looks at a sample of companies with in-production aircraft.)

AgustaWestland

AgustaWestland, based in Italy and the United Kingdom, is a provider of light- to medium-heavy-lift helicopters. The company teamed with Lockheed

Martin and Bell Helicopter Textron in 2005 to win a contract to build the new U.S. presidential helicopter—*Marine One*—which is a variant of the AgustaWestland EH101. That aircraft made its first flight in July. AgustaWestland was the prime contractor for the AH-Mk1, the British version of the AH-64D Apache Longbow. Boeing was the prime subcontractor to AgustaWestland.

Bell Helicopter Textron

Bell Helicopter Textron Inc., headquartered in Fort Worth, Texas, produces military and commercial vertical-lift aircraft in the light- through medium-lift categories. Bell has built approximately 35,000 helicopters since 1946. Bell now partners with Boeing on the tiltrotor V-22 Osprey.

EADS Eurocopter

EADS Eurocopter Group is a wholly owned subsidiary of European Aeronautic Defence and Space Company, or EADS. The Eurocopter product line includes light,

attack and medium-lift helicopters. As of 2007, more than 9,800 Eurocopter helicopters were in service with more than 2,500 military and civilian customers in 140 countries. Eurocopter teams with Agusta and Stork Fokker to build the NH-90 medium-lift helicopter.

Mil Moscow Helicopters (now Oboronprom Corp.)

Mil Moscow Helicopter Plant, founded more than 55 years ago, has designed and produced some 15 baseline helicopter models. It produces helicopters of all types and classes, including unique heavy helicopters. Mil recently merged with Kamov and Rostvertol, forming Oboronprom Corp., but has retained the Mil brand name.

Sikorsky

Sikorsky Aircraft Corp., headquartered in Stratford, Conn., was founded in 1923 by Igor Sikorsky—the designer of the R-4, the first helicopter to go into full-scale production. Sikorsky produces light, medium and large helicopters, most notably the S-70/H-60 Black Hawk series. One of its newest models, the S-92, is operating with several commercial operators and will enter military service as the CH-148 Cyclone with the Canadian Forces in 2009. Boeing worked with Sikorsky on the RAH-66 Comanche, a twin-turbine, two-seat armed reconnaissance helicopter. The Army canceled the program in 2004 as part of a reorganization of Army Aviation.

—Debby Arkell



In this 2005 photo, the new U.S. presidential helicopter, the US-101 medium-lift executive aircraft (VH-71 test 1), lands at its future home, Marine Corps Air Facility Quantico, Va.

U.S. MARINE CORPS PHOTO BY SGT. DONALD BOHANNER

They keep the blades turning

Boeing has succeeded in the defense helicopter market thanks to the combined efforts of the 9,500 dedicated employees in the Rotorcraft Systems business. Below, some of these many individuals talk about their roles on the team.



FRED TROILLO PHOTO

Name: Fred Bergner
Title: Operations analyst, Chinook program
Worksite: Philadelphia
Job description: My group is responsible for studying and analyzing current and future rotorcraft systems for both domestic and international customers. I support the international and domestic sales organization for Business Development with studies, analyses, briefings, brochures and marketing materials.



FRED TROILLO PHOTO

Name: Cathy Anthony
Title: Chinook Business Development
Worksite: Philadelphia
Job description: I am the Boeing face to the U.S. Army customer, and my job entails attending state conferences, welcome-home events and change-of-command ceremonies. At these events we conduct "after-action reviews" where we talk with our customer about what went well with the Chinook while deployed,

Proudest Rotorcraft moment: The Chinook is the longest-running production program for Boeing, which makes me very proud to say that the great products we build today deliver the capability our customers demand and will continue to do so well into this century.

and what can be improved.

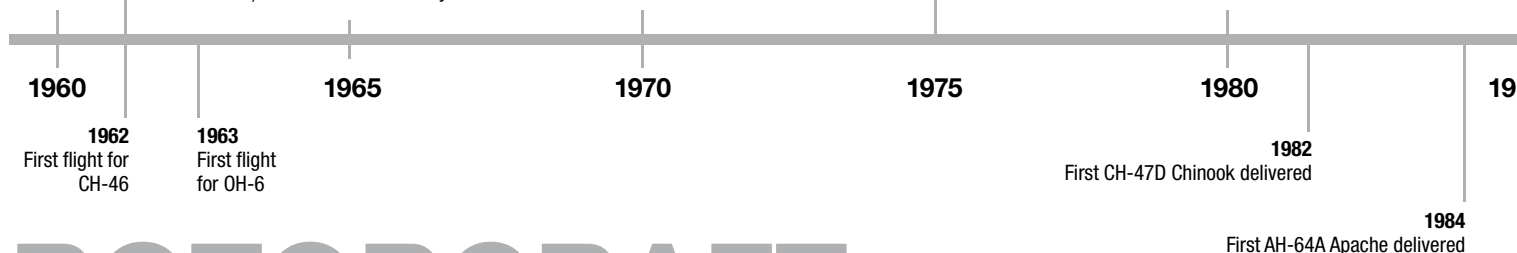
Proudest Rotorcraft moment: The soldiers I interact with tell me they love Boeing and they love our products. Some might think of Boeing as an airplane company or a rocket company, but my customers all know Boeing for the Chinook.



1962
 First CH-47 Chinooks (models A, B, C used in Vietnam War) introduced to U.S. Army



1975
 First Apache prototype flies



ROTORCRAFT TIMELINE



BOB FERGUSON PHOTO

Name: Bob Harmon
Title: Apache program liaison
Worksite: Fort Hood, Texas
Job description: I am the Fort Hood liaison between the plant in Mesa (Ariz.) and the customer—which includes the U.S. Army, the National Guard, the reserves, as well as international customers such as the Kuwaitis and Dutch.

Proudest Rotorcraft moment: I've been here since we started fielding the Longbow. Early on I participated in a unit-fielding

program where units trained with me at Fort Hood for nine months. Many of those unit members are now in leadership positions with the Army, and I'm proud of the strong relationships that have come from that experience.



BOB FERGUSON PHOTO

Name: Jules Maddon
Title: Apache manufacturing/ordnance technician
Worksite: Mesa, Ariz.
Job description: I currently work in Final Assembly in Position 8, where we install the components in cockpits, fairings, upper controls, actuators, upper windows and more. My specialty is fairing work, which is composite; most of the fairings on the Apache are either kevlar or carbon. Our current project is remanufacturing "A"-model aircraft to "D"-models.

Proudest Rotorcraft moment: I never get tired of watching the Apache fly. We were featured on the National Geographic TV show "Ultimate Factories" about a year ago—it was great! My proudest moments, though, are when the pilots come in to visit. They tell us stories of their time in Iraq or Afghanistan, how much they love our aircraft and how safe they feel flying in them.



FRED TROILO PHOTO

Name: Andrea Allen
Title: V-22 Program Project Management
Worksite: Philadelphia
Job description: As part of V-22 Operations I'm responsible for rate readiness—essentially ensuring we get our V-22s out to the customer on time. As we look to increase rates, we work together to determine requirements to execute at a higher production rate, and I work with the team proactively up front to identify issues before they become obstacles.

Proudest Rotorcraft moment: My proudest Rotorcraft moment was when the "Transformers" movie came out. The V-22 was in the movie, and I pointed it out to my son when we watched it. My son asked me, "How come [the V-22] doesn't transform in the movie like the others?" I told him, "Because it transforms in real life!"



JASON BARRAS PHOTO

Name: Michael Fries
Title: V-22 Assembly Aircraft Mechanic
Worksite: Philadelphia
Job description: I install and swage hydraulic lines in the V-22 cabin and aft sections. I also install actuators, hoses, filters and other components in the aft section.

Proudest Rotorcraft moment: I came to Boeing after serving 20 years in the U.S. Air Force working on various military aircraft. When I retired, I figured my contribution to the war effort was over. My proudest Rotorcraft moment occurred last year when I learned that a squadron of MV-22s were on the way to Iraq—aircraft that I worked on. I knew right then that even though I was no longer in uniform I was still directly contributing to the war effort.

