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CORE BUSINESS ACTIVITIES

The Boeing Company in Philadelphia

BOEING IN Philadelphia is a world leader in the rotorcraft industry specializing in:

- designing, developing and manufacturing transport and combat helicopters and tiltrotor aircraft;
- designing and integrating advanced avionics and electronic flight-control systems for rotorcraft;
- designing, developing and fabricating all-composite airframes and rotor blades;
- manufacturing wing subassemblies for Boeing jet-transport airplanes.
- Boeing is best known for its production and support of turbine-powered tandem-rotor transport helicopters.
- Boeing supports UH-46D and CH-46E Sea Knights operated by the U.S. Navy and Marine Corps.
- Boeing upgrades and builds new CH-47 Chinooks for the U.S. Army and customers overseas. It also supports the Boeing 234, a commercial version of the Chinook, which is operated commercially in the United States.

Global Perspective

OVER THE YEARS, BOEING has expanded distribution of its products through licensed production and co-production. A Japanese licensee built the Boeing H-46 and its civil variant, the Boeing 107, for customers in Asia, Europe and the Middle East. An Italian licensee built a version of the CH-47 Chinook for military operators in the Mediterranean region.

Boeing is assisting in the co-production of a Chinook comparable to the CH-47D; this aircraft has been ordered in substantial numbers by the Japanese Defense Agency.

Boeing has remanufactured and modernized early model Chinooks to the advanced CH-47D standard for the U.S. Army and international customers. The company is now preparing another U.S. Army modernization program to the CH-47F configuration, which will keep Chinooks in the Army fleet at least through 2033, an unprecented 71-year service life. Additional U.S. Army contracts provided for completion of modernized CH-47D airframes to the MH-47E Special Operations configuration and also the fabrication of new CH-47Ds. Future contracts will provide updates for Special Operations Chinooks.

Boeing also has built all-new CH-47D International Chinooks for customers overseas, and will build CH-47SD (Super D) international Chinooks in the future.

PRODUCTION PROGRAMS

U.S. Army CH-47D Chinook/Improved Cargo Helicopter (ICH)

THE TWIN-TURBINE, TANDEM ROTOR, heavy-lift, transport helicopter is primarily used to move troops, artillery, fuel, water, barrier materials, supplies and equipment. Secondary missions include medical evacuation, aircraft recovery, fire-fighting, parachute drops, heavy construction equipment, civil development, search and rescue, and disaster relief missions. Boeing completed production of 481 aircraft for the U.S. Army in 1995, of which 26 were completed as all-weather, aerial-refuelable MH-47E Special Operations Chinooks. Deliveries of all U.S. Army Chinooks concluded in late 1995.

In late 1996, the Army approved a funding plan to modernize 300 Chinooks to the Improved Cargo Helicopter configuration, with first deliveries slated for 2003. Boeing is now in the Engineering and Manufacturing Development phase of the CH-47F modernization program. This effort will ensure Chinooks remain in the Army helicopter fleet until at least 2033. All U.S. Army CH-47D Chinooks can be prepared to accept future options that will reduce vibration levels and improve the Chinook's current powerplant to generate cost-effective benefits for both maintenance and performance.

Vibration reduction - Lower Chinook vibration levels can benefit both airframe structures, avionics and onboard system reliability. Boeing is evaluating ways to reduce structural loading through dynamic tuning, or selective stiffening of specific airframe structures. These methods will improve crew comfort and reduce unscheduled maintenance time spent repairing cracks found during major interval inspections.

Powerplant improvements - The Honeywell T55-L-714 engine, with a Full-Authority Digital Electronic Control, or FADEC, is a readily available Chinook powerplant improvement that will reduce specific fuel consumption, torque measuring system problems and the maintenance burden while increasing engine reliability and performance. Addition of the -714 engine also will permit operations closed to the CH-47D's 50,000-lb. maximum gross weight in high altitude/hot temperature (4,000 ft./95°F) conditions to carry standard loads without reducing fuel, range or endurance.

Preparing for the Digital Battlefield - The next-generation Chinook will require an electronic architecture using data bus technology to meet the future needs of communication, navigation, survivability and other electronic systems in development for all modernized Army aircraft. Current efforts involve improved situational awareness, and command

and control, including GPS and Doppler integration and development of HUD capability for night vision goggles. Long-range communications also may be addressed. Future hardware changes will add value to the CH-47D's mission and sustain required system capabilities.

MH-47E Special Operations Chinook

THE U.S. SPECIAL OPERATIONS COMMAND equipped the 160th SOAR (Airborne) with a total of 26 MH-47Es. Most of these aircraft are based at Fort Campbell, Ky., with others equipping the 160th SOAR units at Hunter Army Airfield, Savannah, Ga. The MH-47E is required to complete a 5.5-hour covert mission over a 300-nm radius, at low level, day, or night, in adverse weather, or any type of terrain, and do so with a 90 percent probability of success.

In November 1992, Boeing and the Army completed negotiations leading to a definitive contract for production of 25 aircraft. Deliveries were completed in May 1995.

MH-47E Special Operations Chinooks were modernized in the same manner as CH-47Ds. Major differences are in the installation of upgraded engines and other mission-specific improvements that include the most sophisticated global navigation and communication systems ever developed for Army helicopters.

In addition to receiving more powerful engines, the MH-47E gains a fuel system having twice the capacity of the CH-47D. This fuel system, combined with internal auxiliary fuel tanks, enables the MH-47E to successfully complete extremely long-range missions. In-flight refueling will allow MH-47Es to perform transoceanic deployments while carrying full combat loads. The company is currently converting a CH-47D to the MH-47E standard under an attrition procurement contract. Negotiations are also under way to modernize and update the entire MH-47E fleet.

CH-47 International Chinook Production and Modernization

CHINOOKS HAVE BEEN PRODUCED in various military and civilian configurations for 19 international customers. More than 600 are currently in service around the world. Worldwide Chinook population also includes Model 414 Chinooks (equivalent to the CH-47C built by the Boeing licensee in Italy -- Costruzioni Aeronautiche Giovanni Agusta S.p.Al, of Casina Costa, near Milan).

In November 1990, the British Ministry of Defence contracted to update more than 30 HC Mk1 Chinooks to HC Mk2 standards. The HC Mk2 is the RAF's designation for the CH-47D. Deliveries started in 1993 and ended in 1995. In 1993, the RAF ordered three new HC Mk2s to replace operational losses, and these aircraft were completed in 1995 as well. Also in 1995, the United Kingdom concluded contract negotiations for 14 additional all-new HC Mk2s, and HC Mk3s. Spain contracted to convert nine of 18 CH-47Cs into CH-47Ds. Deliveries

began in September 1991 and ended in April 1993. These deliveries will extend through 2001. All additional Spanish Chinooks have been or will be converted by 2002.

Nine Agusta-built CH-47Cs also were modernized to the CH-47D configuration for the Greek Army. This order was announced in December 1991. Deliveries began in the fall of 1993 and were completed in 1995. Greece also ordered seven new CH-47Ds for delivery in 2001 and 2002. Seven former Canadian armed forces CH-47Cs were acquired by the Royal Netherlands Air Force-(RNLAF) and modernized to CH-47D model standards. These upgrades, incorporating the first integrated cockpit management system in CH-47Ds, were authorized in December 1993. Deliveries began in January 1995 and concluded in 1996. Boeing also received Dutch government approval in December 1993 to build six new CH-47Ds for the RNLAF, with deliveries in 1997 and 1998.

Since 1988 Boeing has delivered 30 new CH-47D International Chinooks to two Asian customers. Six additional aircraft were ordered by one of these customers in 1995 for 1998 delivery. The Australian Defence Forces also have received four modernized and two new CH-47Ds, delivered in 1995 and 2001 respectively, after selling an additional seven Chinooks to the U.S. Army for operational use after modernization was completed that same year. In addition, the Singapore Defense Forces took delivery of six new CH-47Ds in 1995.

The global demand for Chinooks continues to grow and will keep Chinooks in production for the foreseeable future.

Chinook 47SD International

BOEING LAUNCHED THE CH-47SD (Super D) configuration in early 1998, with rollout scheduled for Oct. 31, 1999. The Super D Chinook is the new standard CH-47 model. It incorporates several system improvements as standard equipment, such as a fully integrated glass cockpit with automated flight controls, and Full Authority Digital Engine Control. Although the Super D is aimed primarily at the international market, the rotorcraft also will be available to the U.S. armed forces.

The Super D will retain the familiar Chinook profile, but provides long-range fuel tanks with 2,068-gallon capacity, doubling the operational range of the D-model. In addition, the new Chinook will utilize the longer "radar nose," found on the MH-47E Special Operations Chinook and several international CH-47Ds, which can accommodate radar antennas.

The Super D's cockpit is state of the art, with a fully integrated cockpit management system, including automated flight controls. The new Chinook also is the first model to utilize full-color digital display units. Developed by Boeing and Honeywell, instrumentation includes a complete digital GPS/INS navigation/communication suite with radar altimeter. The cockpit also has provisions for a digital map, forward-looking infrared imager, heads-up display, weather radar and data-

transfer system. In addition, health and usage monitoring systems are available. Airborne survivability equipment includes radar and missile warning systems and chaff/flare dispensers.

The SD-cockpit design provides full flexibility in a variety of flight conditions, including night and adverse weather, while streamlining the pilot's workload. The new Chinook will carry a three-person crew and standard seating for 37 passengers in the main cabin, although up to 55 troop seats can be installed. A variety of additional "plug-in" option kits are available to configure the Super D for operations on water or in snow, or several specialized missions such as search and rescue, fire-fighting and special operations. A launch customer for the CH-47SD has ordered six of these aircraft and the Republic of China has ordered nine under a foreign military sales contract.

CH-47J Chinook Co-production In Japan

Boeing and Kawasaki Heavy Industries Ltd. are co-producing CH-47J Chinooks at Kawasaki facilities in Gifu, Japan. Boeing builds the aft pylon, main-cabin section panels, fuel pods and rotor blades, as well as structural parts and castings for forgings for the main dynamic components. Through March 2001, Kawasaki has delivered to Japanese Ground and Air Self-Defense Forces 61 of the CH-47Js currently under contract. The Japanese Defense Agency currently has an open-ended program with no final requirement. CH-47Js are identical to the U.S. Army's CH-47D, differing only in engine, rotor brake and avionics installations.

AH-64D Apache Longbow

Boeing Philadelphia completed an agreement with Boeing Mesa in 1998 to begin fabrication and assembly of Apache Longbow fuselages for international customers. The company shipped its first fuselage to Boeing Mesa for completion in June 1999. Through February 2001 Philadelphia completed and shipped 29 Apache fuselages. To date total orders for international customers are approaching 150.

Bell Boeing V-22 Osprey

The Bell Boeing V-22 Osprey is a twin-turbine vertical-lift tiltrotor transport aircraft developed for the U.S. Marine Corps for combat assault and assault support and for the U.S. Special Operations Command for long-range special operations missions.

During Engineering and Manufacturing Development, or EMD, Bell Boeing built and flight-tested four new V-22s in the production-representative configuration and developed associated logistics systems. The U.S. Navy and Bell Boeing definitized the EMD contract March 24, 1994, valued at $3.4 billion. Construction of the first EMD Osprey

began in early 1994. Wing-to-fuselage mating occurred in December 1995 and first flight took place in February 1997. Aircraft Nos. 7-10 were used for MV-22 EMD operational testing. Developmental flight envelope expansion was completed in July 1998.

The V-22 Osprey is in production. A contract for the first Low Rate Initial Production, or LRIP lots, a total of 19 aircraft, was awarded in April 1997, and a contract for 10 more LRIP aircraft was awarded in January 2000. The first production aircraft was delivered to the Marine Corps on May 27, 1999. Three aircraft were delivered in 1999, five aircraft were delivered in 2000, and nine are scheduled to be delivered in 2001. Four low rate production MV-22 aircraft flew 810 hours in support of Operational Evaluations, or OPEVAL, which was completed in July 2000. Long-lead funding for the fifth production lot of 20 aircraft was released in January 2000. Full rate production decision, or milestone III, is pending for Lot 5.

Bell Boeing also is conducting EMD for the U.S. Special Operations Command variant, the CV-22. Two of the EMD aircraft were modified to support the CV-22 EMD program. Aircraft No. 7 received the CV-22 fuel system and the multimode terrain following/terrain avoidance radar to be used as the CV-22 developmental test aircraft. Aircraft No. 9 was remanufactured through July 2000, into a production representative CV-22 to be used for CV-22 OPEVAL along with No. 7 at Edwards Air Force Base, Calif.

DEVELOPMENT PROGRAMS

Boeing Sikorsky RAH-66 Comanche

THE U.S. ARMY'S TRANSFORMATION PLAN has as its centerpiece the Boeing Sikorsky RAH-66 Comanche armed reconnaissance helicopter, the only platform currently designated as an objective force weapon system. The Army's aviation plan reflects its new post-Cold War strategy to react to regional conflicts by using fewer personnel and long-range, self-deployable aircraft based in the continental United States.

The Comanche is needed to replace nearly 3,000 obsolete attack and observation helicopters. The Comanche will provide capabilities demanded of a smaller force structure. Among these capabilities are improved mobility, increased survivability and dramatically reduced operation and support costs.

In April 1991, the Army selected Boeing and United Technologies' Sikorsky Aircraft Division, of Stratford, Conn., to develop the advanced twin-turbine aircraft. The program completed its demonstration/validation/prototype phase in 2000 and entered EMD in June 2000. EMD calls for additional flight tests, validation of the advanced digital mission equipment package and, beginning in 2004, testing of 13 additional production representative aircraft for flight test, U.S. Army operational tests, and evaluation and training. Production is currently

scheduled to begin in 2004, with an initial operational capability of 2006.

The Comanche features a five-bladed bearingless main rotor and FANTAIL™ antitorque system. The new aircraft's all-composite airframe and rotor system assure high mission readiness, immunity to corrosion and high resistance to ballistic damage. Triple redundant electronic and hydraulic systems and triple redundant digital electronic flight-controls enhance survivability.

LHTEC, of Indianapolis and Phoenix, Ariz., is providing the Comanche's T801 turboshaft engines under a separate government contract. First flight was completed in January 1996 and continued throughout the year. First flight with landing gear folded took place in February 1997. To date, the two Comanche prototypes have accumulated more than 230 flight hours. In 2001, prototype No. 2 will be upgraded to begin scheduled flight tests to develop mission equipment package systems.

SUPPORT PROGRAMS

U.S. Navy and Marine Corps UH-46D and CH-46E Sea Knights

IN EARLY 1989, THE COMPANY COMPLETED deliveries of Safety, Reliability and Maintainability improvement kits. Navy civilian employees used these kits to remanufacture U.S. Navy UH-46 and U.S. Marine Corps CH-46 Sea Knights, and U.S. Marine Corps CH-46 Sea Knights. The kits allowed these aircraft to operate economically through the 1990s.

Other Boeing-supplied kits improved H-46 operational and safety characteristics.

Boeing completed deliveries of 47 increased-fuel-capacity kits for CH-46Es in May 1991. It completed deliveries of 194 mission kits providing emergency-flotation capabilities for UH-46Ds and CH-46Es in September 1991. Deliveries of 211 emergency-flotation provision kits were completed in March 1992.

In July 1992, Boeing received a $41.7 million contract to develop validation, verification, flight-test and spares kits aimed at eventual replacement of dynamic components in all UH-46D, HH-46D and CH-46E aircraft. Production of more than 330 improvement kits began in 1995. Contracts for these kits, which were installed by Navy depot personnel were worth about $350 million over six years.

Boeing 107 and 234 Commercial Helicopters

THE BOEING 107 IS THE CIVILIAN VERSION of the H-46 Sea Knight; the Boeing 234 is the commercial version of the CH-47 Chinook. Oregon's Columbia Helicopters operates 12 Boeing 107s and 13 Boeing 234s.

Jet Transport Assemblies

BOEING PHILADELPHIA BUILDS ADVANCED composite and composite aluminum wing subassemblies for Boeing 757 and 767 jet transports. The division also designed and built fixed leading-edge assemblies for the new Boeing 777 airliner. The first shipset was sent in March 1993 to Boeing Commercial Airplane Group. This work will be transitioned out of Philadelphia over the next several years.

F A C I L I T I E S

Boeing Philadelphia's manufacturing facilities and administrative offices are located on 355 acres in Ridley Township, Pa., a few miles west of the Philadelphia International Airport.

The division occupies more than 1 million square feet of office space, equivalent to a 100-story office building.

In addition, roughly 3.5 million square feet of covered space is devoted to the manufacturing of helicopters and advanced aircraft assemblies.

On-site technology centers include a state-of-the-art wind tunnel and a whirl tower for testing rotor blades.

The wind tunnel's 20-foot-square (6.1-m-square) test section allows engineering evaluations of aircraft performance, stability, control, air-load distribution, dynamics and air-flow visualization.The tunnel provides measurement of up to 100,000 pieces of information per second during an average test.

Employment

One of the largest employers in Delaware County, Pa., The Boeing Company in Philadelphia is a major contributor to the economic vitality of the Delaware Valley. The company's work force consists of about 5,500 employees. As the Comanche program enters production and the Osprey program enters full-rate production in the years ahead, Boeing Philadelphia expects its labor force to grow.