

PROCEEDINGS...

Aerial refueling is the latest of a growing list of mission-expanding capabilities offered by Boeing Vertol's modernized CH-47D Chinook helicopter. The installation of a 38-foot-long telescoping fuel probe permits the CH-47D to hook up to a tanker airplane and be completely refueled in as little as six minutes.

(story on page 3)



\$20 million each month on average leaves Boeing Vertol in the form of payroll checks to company employees, and through purchases of materials and services from 1,700 suppliers located in southeastern Pennsylvania's Delaware Valley.



Saving money for the taxpayers and the U.S. Army is one of the primary benefits of last year's \$1.17-billion multiyear procurement (MYP) contract awarded to Boeing Vertol for the modernization of 240 early model Chinook helicopters to the advanced CH-47D standard.

(story on page 4)



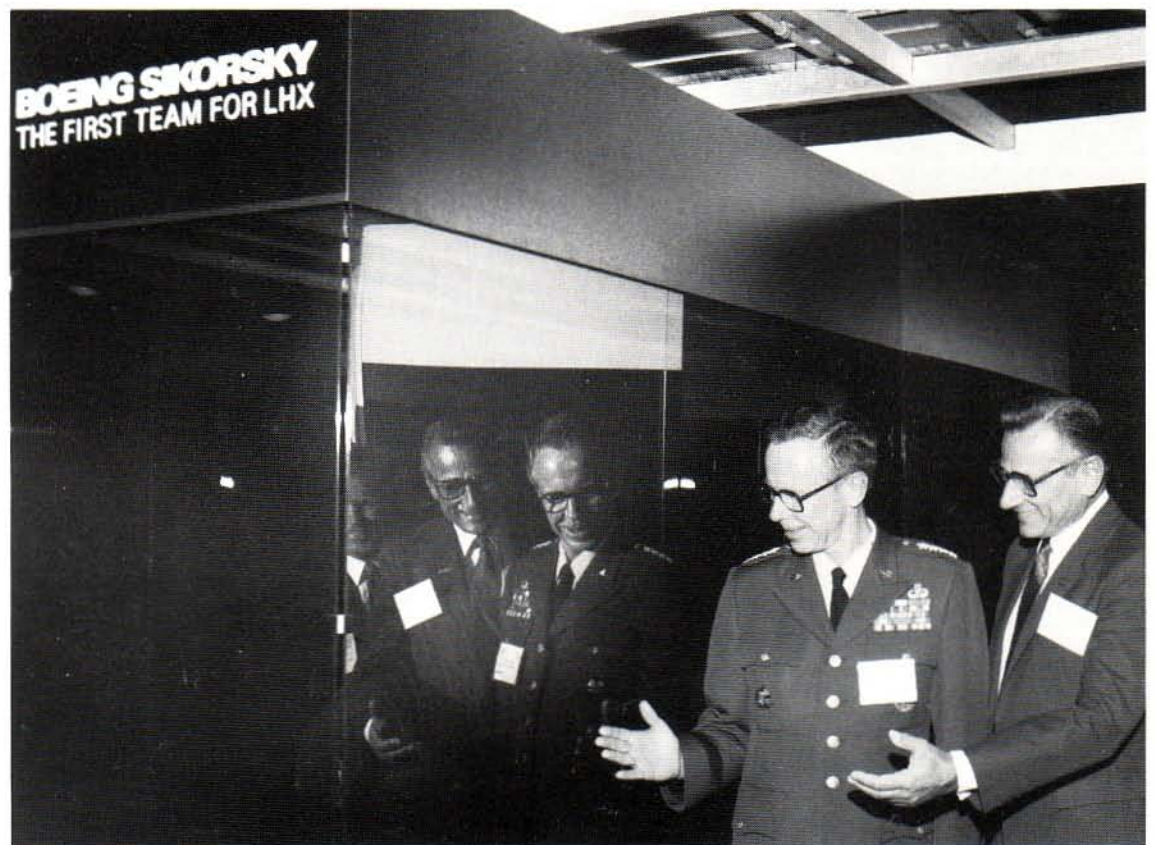
Prospective employees of Boeing Vertol can now dial (215) 522-2910 and listen to a recorded message that describes job skills being sought and for which employment applications will be accepted. Messages repeated on this 24-hour "job hotline" will be updated regularly according to current needs.



Keeping customers happy is the role of Boeing Vertol's Product Support Department, and it requires tireless efforts from hundreds of dedicated Boeing employees to keep more than 1,200 Boeing helicopters flying efficiently and safely all around the world.

(story on page 8)

Boeing Vertol and Sikorsky Form LHX Helicopter Program Office



REFLECTING ON LHX — Boeing Vertol President Joseph Mallen and Army Vice Chief of Staff Gen. Maxwell R. Thurman examine a display case containing information regarding the Boeing Sikorsky LHX Team's current program efforts. The occasion was the 1985 Association of the U.S. Army convention held last fall in Washington, D.C.

BOEING VERTOL and Sikorsky Aircraft have made several significant accomplishments since joining forces last June to bid to develop the U.S. Army's new LHX family of light helicopters. The Boeing Sikorsky LHX Team has selected its management and principal subcontractor teams and has made important progress in several technical areas essential to the success of the LHX program.

"Our teaming arrangement is working very well," said Boeing Vertol President Joseph Mallen. "A prime example is the open exchange of engineering, manufacturing and product-support technologies now taking place between Boeing Vertol and Sikorsky. This sharing will enable the Boeing Sikorsky LHX Team to produce for the U.S. Army the most advanced and affordable light helicopter system."

The U.S. Army's current LHX program plans are to procure at least 4,500 of these advanced helicopters in two versions, a scout/attack (SCAT) aircraft and a utility machine. The LHX is planned as a single-system replacement for the Army's current fleet of 7,000 light helicopters that encompass 11 different models. Army plans are for the LHX to feature several automated advanced-technology systems to aid the pilot in successfully performing any mission day or night, in adverse weather, while flying at low altitudes. Requests for proposals to industry will be issued by the Army during 1987. First flight of the LHX is scheduled for September 1991, with first deliveries beginning in July 1995.

According to Sikorsky President Robert Zincone, "It is widely known that the key ele-

(continued on page 2)

(LHX Team continued from page 1)

ment in the Army's LHX procurement strategy is competition, which translates to low cost. You can be certain that, despite LHX being a revolutionary aircraft, it will meet the Army's low-cost initiatives. The Boeing Sikorsky Team is using low cost as one of its most important design parameters."

The Boeing Sikorsky Team's joint program office is operating under the direction of Louis S. Cotton, Sikorsky's LHX program manager. William W. Walls, Boeing Vertol's director of LHX programs is deputy director. Technical director is James J. Morris of Boeing Vertol, and William A. Kuczynski of Sikorsky is deputy technical director. John Holden of Boeing is the team's business director.

The overall work division assigns Boeing the lead responsibility for avionics/electronics and systems integration. Sikorsky will have lead responsibility for the airframe and related systems. Both firms, however, will participate in all phases of the LHX design.

Eight principal subcontractors

According to William W. Walls, deputy director of the Boeing Sikorsky Team, one of the highest priority tasks was to assemble an avionics team consisting of eight highly qualified firms, most of which will work together in pairs to codevelop major elements of the LHX avionics system so that when the helicopter reaches the production phase, these companies will provide the competitive multiple sources needed for the all-important components. "Our team of avionics companies covers the entire range of technologies critical to LHX. We are now working together to create the total system the Army needs for the 1990s and beyond," Walls said.

These eight primary subcontractors and their responsibilities are —

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- **Boeing Military Airplane Co.**, Wichita, Kan. — systems engineering and avionics testbed integration.

- **Collins Government Avionics Division** of Rockwell International, Cedar Rapids, Iowa — cockpit multifunction controls and displays; high-speed data bus [with Harris Corp.]; integrated communication navigation identification avionics (ICNIA) [with TRW].



BLACK HAWK BECOMES "LIGHT HAWK" — The U.S. Army's Advanced Digital Optical Control System (ADOCS) research program reached a major milestone on Nov. 7th when flight testing began on the world's first fully fly-by-light flight-control system. The Sikorsky UH-60A Black Hawk research helicopter, dubbed the "Light Hawk," was flown by ADOCS prime contractor Boeing Vertol at its Wilmington, Del., test facility. A multi-axis sidearm controller is used by the pilot for command inputs, which are transmitted to the helicopter's rotor system solely by optical signal paths instead of by mechanical linkages. The modified aircraft incorporates much test equipment, including a low-speed omnidirectional airspeed system.

- **Hamilton Standard Division** of United Technologies Corp. — digital flight control avionics and wide-field-of-view helmet-mounted display.

- **Harris Corp.**, Melbourne, Fla. — digital map display and interface units coupling the avionics computer to other aircraft systems.

- **Martin Marietta Aerospace**, of Orlando, Fla. — target acquisition and recognition system [with Westinghouse Electric]; electro-optic sensors and pilot's night-vision [with Northrop Electro-Mechanical Division].

- **Northrop Corp. Electro-Mechanical Division**, of Anaheim, Calif. — electro-optic sensors [with Martin-Marietta].

- **TRW Military Electronics Division**, Redondo Beach, Calif. — ICNIA [with Collins Government Avionics Division]; very-high-speed-integrated-circuit-(VHSIC)-based computers [with Westinghouse Electric Defense Group].

- **Westinghouse Electric Defense Group**, Baltimore, Md. — target acquisition and recognition system [with Martin Marietta], and VHSIC-based computers [with TRW].

Since joining forces in June, the Boeing Sikorsky LHX Team has begun critical R&D efforts in several key areas, including the initiation of trade studies to determine the best LHX configuration that also satisfies the necessary ILS/RAM (integrated logistics support/reliability and maintainability) and cost requirements.

Boeing wind-tunnel testing

Both companies have started simulation studies to define a low-workload cockpit and to determine the feasibility of a single-pilot SCAT helicopter. The team has also begun LHX wind-tunnel testing. In November, Boeing and Sikorsky engineers successfully completed a five-week test of a one-sixth-scale model to evaluate fuselage drag and stability characteristics. A second Boeing Sikorsky LHX model, a one-quarter-scale powered model, also successfully completed tests in Boeing Vertol's V/STOL wind tunnel in December. This is the first of a series of powered model tests to assess aircraft performance, flying qualities, vibration and rotor loads.

In late December, Boeing Sikorsky received a draft LHX Request for Proposal (RFP) for full-scale development from the Army. Boeing Sikorsky is now reviewing the draft RFP and is scheduled to return formal comments to the Army by Feb. 7. Draft RFPs are new Defense Department initiative to enhance industry understanding of a program prior to its development.

Complementary programs

Both Boeing and Sikorsky have reported advances in several independent on-going technical programs complementing their joint LHX efforts.

ARTI

- In late July, Boeing Vertol completed flight testing of its Advanced Rotorcraft Technology Integration (ARTI) vehicle to validate the design of a new fixed-base single-pilot simulator featuring a sidearm controller. This simulator is now operating at Boeing Vertol and will be used to model LHX mission scenarios and measure pilot workload.

ADOCS

- As the prime U.S. Army contractor in the Advanced Digital Optical Control System (ADOCS) program, Boeing has modified an Army/Sikorsky UH-60A Black Hawk with the world's first fully fly-by-light flight-control system. The research helicopter, dubbed the "Light Hawk," made its first flight on Nov. 7th. The aircraft features a multi-axis sidearm controller linked through fiber-optic channels to the helicopter's main rotor system. This technology is critical to achieving the necessary survivability characteristics required for the LHX.

SHADOW

- An experimental research helicopter, built by Sikorsky, using a standard S-76A with a single-seat evaluation cockpit joined to the aircraft's nose, is being readied for flight testing following shakedown flights during early 1985. Also known by its acronym SHADOW (Sikorsky Helicopter Advanced Demonstrator of Operator Workload), the helicopter is now being fitted with advanced cockpit avionics to test various single-pilot cockpit concepts while in flight.

Composites

- Sikorsky has also completed flight tests of its all-composite helicopter for the U.S. Army's Advanced Composite Airframe Program (ACAP). The aircraft was designed and built by Sikorsky under an Army contract to demonstrate the feasibility of building a helicopter with an all-composite airframe that is lighter and stronger than a similarly configured aircraft with a metal airframe and skin. ■



HISTORIC FLIGHT —On Aug. 4th, 1985, a Boeing Vertol CH-47D "hooked up" to an HC-130 tanker, and for the first time ever a U.S. Army Chinook was refueled in flight.

Aerial Refueling Gives CH-47D Unlimited Range

Now anytime, anywhere, U.S. Army Boeing CH-47Ds can take on 150 gallons of fuel per minute, and be completely refueled in only six minutes.

WHEN YOU DON'T have time to stop or can't find a place for fuel, then call ahead and have it delivered — in flight. That makes good sense, even for helicopters. And to prove it, Boeing Vertol funded a program to demonstrate how well aerial refueling of the U.S. Army's new CH-47D Chinook can further expand its capabilities.

Boeing pilots Bob Gradle and Lynn Freisner made 35 successful aerial hookups to a U.S. Air Force HC-130 tanker aircraft during six days of flight tests in early August.

"This latest demonstration of the CH-47D's versatility can be added to the growing list of Chinook multimission capabilities," said Stuart D. Dodge, Boeing Vertol's manager of U.S. CH-47 military programs. Aerial refueling adds unlimited range to the helicopter that serves 15 nations, and which has accumulated well over two million flight hours during the past 20 years," he noted.

"We were very pleased with the results," said William P. Jones, Boeing Vertol's vice president of customer support and business development. "The testing showed no handling or loading problems, nor exceptional pilot skills required for aerial refueling of a Chinook. The ease with which the tests were accomplished made it seem as if we'd been

doing this for a long time.

"These tests," Jones added, "also show that self-deployability of the CH-47D can open many additional ways for the enhanced Chinook to support Army combat operations."

Aerial refueling involves more than poking one's nose into someone else's business. Much consideration must be given to the flying qualities of the refueling aircraft, how it flies in relation to the tanker, and that adequate separation of the two aircraft can be maintained. Tests showed the clearances between the CH-47D's rotor disc and the helicopter's refueling probe, and between the rotor disc and the HC-130's empennage, are greater than those offered by helicopters currently capable of aerial refueling.

To begin a hookup, the Chinook's pilot first extends the telescoping fuel probe, which is mounted on the helicopter's lower right side, to its full 38-foot length. Then he maneuvers the probe into the 48-inch-diameter paratrogue terminating the tanker's 76-foot-long refueling line. Jet fuel can then be transferred at the rate of 150 gallons per minute, or fast enough to completely refuel the helicopter in just six minutes.

The new fuel probe was fabricated by

Boeing Vertol's composite manufacturing center. It is made almost entirely of composite materials, which further illustrates the company's ability to innovatively create aircraft components by using the most modern aerospace materials.

"From a pilot's perspective, the hookup and fuel transfers went very smoothly," said Boeing's Gradle. "The operations were all performed using standard aerial refueling procedures, and the CH-47D's advanced flight-control system gave it excellent handling qualities and provided a very stable platform behind the HC-130."

In addition to Boeing's Gradle and Freisner, pilots Robert D. Robbins and CW 4 Patrick J. Sullivan from the U.S. Army's Aviation Engineering Flight Activity (AEFA), Edwards Air Force Base, Calif., and CW4 Eddie J. Hill from Ft. Campbell, Ky., also participated. The CH-47D was leased from the Army, while the HC-130 tanker came from the 6594th Test Group, Hickam Air Force Base, Honolulu, Hawaii.

The tests were flown at 5,000 feet and approximately 120 knots. The CH-47D was refueled from hose and drogue units suspended from both right and left wings of the HC-130. ■

Multiyear Contracting Builds Savings for Chinook Customers

Management of the CH-47D program continues to save money for the taxpayers and the Army, making Boeing Vertol a more efficient defense supplier.



ABC-TO-'D' FACTORY — Boeing Vertol is now under contract to modernize 328 U.S. Army CH-47 Chinooks to the new D-model standard. A \$1.17-billion five-year award for 240 of these helicopters stimulates the company's continued investment in modern high-bay assembly areas, and in machinery and methods that raise productivity.

IN APRIL 1985, Boeing Vertol was awarded the largest contract in U.S. Army Aviation history — \$1.17 billion over five years to produce 240 CH-47D Chinook helicopters. This multiyear procurement (MYP) award followed four single-year contracts totaling \$554 million, which earlier authorized building and delivery of 88 D-model Chinooks.

As a result of these combined agreements, 328 of the Army's planned force of 436 CH-47Ds are now under contract, and the Chinook modernization program has reached a point where Boeing management, in addition to meeting short-term schedule and delivery goals, is also broadening its efforts to seek out and implement new efficiencies and cost savings.

Last April, as the MYP contract went into effect, the CH-47D's production rate increased to four aircraft per month.

Through 1985 nearly 100 new Chinooks were delivered to operational units in Kentucky and Georgia, and to training facilities in Alabama and Virginia. This new fleet's flight experience is climbing rapidly and will gather momentum during 1986 as full companies of D-models will be fielded to additional operational units in North Carolina, Washington, Oklahoma, and Colorado. Of special significance, the 196th Aviation Co., 82nd Airborne Division, Ft. Bragg, N.C., will receive its complement of new CH-47Ds from Boeing Vertol in early January 1986,

thereby completing deliveries of CH-47Ds to the XVIII Airborne Corps, which is headquartered at Ft. Bragg.

"The helicopter's reliability, availability, and maintainability through its first 25,000 hours has been very, very good. We've exceeded the Army's availability standards, and we're doing significantly better than what we projected 10 years ago for maintenance man-hours per flight hour, unscheduled removal rates, and component mean-times between failures," said Stuart D. Dodge, Boeing Vertol's manager of U.S. CH-47 military programs.

Dodge believes that everybody wins as a result of program maturity and the multiyear contract. "There are considerable payoffs," he notes, "for the taxpayer, for the Army, for Boeing Vertol and its employees, and for Boeing's suppliers and their employees. The MYP program stabilizes employment and extends many benefits to people here in the Delaware Valley."

Old soldiers never die

The Chinook is a seasoned soldier. During the 1960s and '70s Boeing Vertol built 732 A-, B-, and C-models, which over the years have accumulated nearly two million flight hours, many of them flown in combat in Southeast Asia. But as these helicopters grow older, they become more and more costly to maintain, just as your family automobile does as it ages. But unlike your car,

helicopters can be totally renewed.

Modernizing helicopters begins by returning the older aircraft to Boeing's Philadelphia production line, where they're stripped to the bone, meticulously inspected and repaired as necessary, modified, strengthened and updated with advanced-technology systems like those used in the UH-60 Black Hawk or the AH-64 Apache. These Chinooks emerge from the factory as CH-47Ds that are up to twice as productive as their earlier brethren. And increased productivity is one of the reasons the Army can meet its present and future medium-lift needs with a smaller Chinook fleet.

"The five-year CH-47D MYP contract provides an immediate savings of \$123.1 million compared to a series of five separate contracts negotiated and awarded annually," Dodge said. "This savings is the equivalent of providing the Army with 32 D-models at no additional cost, enough helicopters to outfit two aviation companies."

Opportunity is the key word

If a single word could summarize the CH-47D program and its MYP contract, that one word would most likely be *opportunity* — the opportunity to invest wisely, to manage skillfully, and to save money both for the Army and Boeing Vertol. "The multiyear program gives us a production base of 240 aircraft and provides us an opportunity to really be innovative. And that's what multiyear is all about — generating savings," Dodge said.

"The question is what kind of capital investments can we make up front that will affect the nonrecurring costs and yield a savings during this 240-aircraft production run? With 240 helicopters to produce, we have a much broader base from which to recover our expenditures while driving down the cost of the product.

"Now more than ever we have to challenge the technology, the people, and the systems to continually improve a product of demonstrated high quality. Boeing and Boeing's suppliers have to work hard to generate the savings we've promised to the Army," he said.



TIME-SAVER — The U.S. Army's new CH-47D Chinook's ability to lift heavier loads than its predecessors allows heavy equipment to be carried intact, thereby avoiding costly disassembly and reassembly time.

Two years or 200 hours

Like politics, multiyear contracting also involves "practicing the art of the possible," and the stability presented by a five-year agreement makes it easier to do things that were once considered either not possible, or possible only with utmost difficulty. The CH-47D MYP complies with the 1984 congressional mandate that major weapons

systems be covered by contractor warranties. "We warrant a large number of primary and secondary components for 200 flight hours or two years, whichever comes first. We spent a lot of effort looking at the reliability of components in the 'D,' which helped us establish a fair and reasonable warranty," he said.

Class 1 and 2 savings: 50% vs. 100%

At the heart of this savings drive are Value Engineering Change Proposals, or VECPs. Some VECPs involve alternative ways of producing hardware and others involve developing alternate sources or vendors. "We have a whole program seeking alternate sources," Dodge said. "For example, we're now developing a second source for engine-combiner transmissions. This vendor will be qualified by early 1988. Competition for transmissions and other components will help to flatten any future price escalations."

What happens when someone at Boeing or one of its many suppliers comes up with a money-saving idea? Is it automatically implemented? That depends, Dodge explains.

"If a cost-saving idea requires a change to the contract, we have to present it to the Army and tell them how many man-hours we project it will save in building the aircraft. The Army will evaluate the proposal and its impact on aircraft going into the field. If it's approved, the Army gains one-half of the savings and Boeing gets the other half."

But not all changes work this way. "There's a regulation governing configuration control that says you can't change the aircraft without Army approval. These alterations are submitted to the Army as ECP or VECP Class 1 changes. By contrast," Dodge said, "we can do certain things at our own volition, such as Class 2 changes, so long as we don't change the form, fit or function of a part. Class 1 changes, which alter the form, fit, or function of a part, require an ECP or a VECP and any savings are split fifty-fifty between Boeing and the Army. Class 2 changes, which do not materially alter components, can be implemented easily and Boeing obtains 100 percent of the savings."

"An example of a VECP change is how we strip paint from aircraft being inducted into the production process. We used to remove paint by using chemicals, but that required a lot of environmental treatment. Now we use a technique similar to sand blasting, but instead of sand, we use small particles of plastic. The paint comes off the aircraft faster and more efficiently. It's safer, too."

"A Class 2 change involves *how* we make things. Let's say we invest \$1 in a multispindle machine that allows us to cut three identical parts simultaneously, whereas previously we used a single-spindle machine to produce just one unit at a time because of the lower production requirements prior to the MYP award. For example, if it costs us \$3 less to make parts and spares for 240 MYP aircraft using the multispindle machine, then that \$3 gross savings minus the \$1 machine investment yields a net \$2 savings to Boeing," Dodge said.

Potential savings are in MYP 2

Class 2 changes represent an upside reward for taking investment risks, from which the customer eventually benefits. "The Army doesn't immediately reap the benefits of Class 2 actions, however, most Class 2

changes can drive the cost of the product down. So when it comes time to consider MYP 2, the Army will ask what was the performance of MYP 1? Its personnel will examine the actual costs of building each part and will project subsequent orders based on this history," Dodge noted.

International customers benefit too

The Boeing CH-47D International Chinook is identical to the U.S. Army's Delta model in every respect except for customer-specified avionics and perhaps some small interior details.

"Anything we do to drive down the cost of the D-model makes its export version much more attractive in world markets," Dodge said. Another major benefit is that the CH-47D International Chinook is an aircraft tested and proven by the U.S. Army. Other customers can benefit by monitoring the Ar-

my's experience. They can take advantage of all that development work and buy a helicopter whose operational and support costs are fully known.

"There's also an affordability issue here. Many nations can't always afford to buy the quantities of aircraft they really require. Of course, that's where the high productivity of the CH-47D International Chinook can make a big difference. A handful of CH-47D International Chinooks can exceed a whole fleet of smaller, less-capable helicopters. It's a versatile multimission aircraft that's interoperable with the U.S. Army and, if necessary, logistically supportable by the U.S. Army," Dodge concluded.

As a direct result of multiyear contracting, the savings and benefits accrue to all Chinook customers. ■

Jones Named Vice President; Heads Marketing Organization



BUSINESS DEVELOPERS — William P. Jones (seated, center), Boeing Vertol's newly named vice president of customer support and business development, discusses strategy with Joseph A. McKeller (left), manager of H-46/107 programs, and John F. Hayden (right), director of marketing. Looking on are J. Kenneth Hancock, director of product support (standing, left), Stuart D. Dodge (center), manager of U.S. CH-47 military programs, and William J. Grant (right), manager of CH-47D international programs.

WILLIAM P. JONES last fall was named vice president of customer support and business development of Boeing Vertol. His responsibilities now include all activities related to marketing and sales, customer requirements, production management, and customer support.

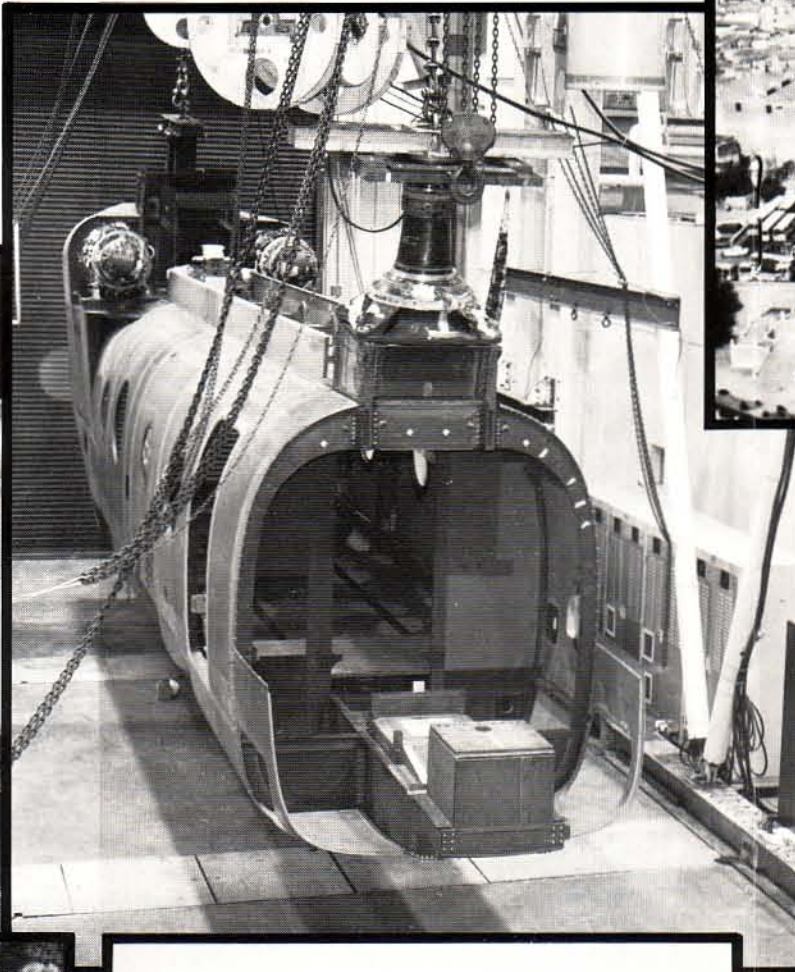
As Jones' duties expanded, so have the number of functional organizations reporting directly to him, which more adequately reflects his objective to increase Boeing Vertol's business base and strengthen its new product development. Those managers now most closely associated with Jones' leadership are John F. Hayden, director of marketing; J. Kenneth Hancock, director of product support; Stuart D. Dodge, manager of U.S. CH-47 military programs; William J. Grant, manager of CH-47D international

programs; and Joseph A. McKeller, manager of H-46/107 programs.

Jones joined Boeing Vertol in 1950 and has held various engineering and management positions. He has served as director of helicopter programs, manager for the U.S. Army CH-47 helicopter program, manager for the Model 347 helicopter flight-research program, manager of Far East technical support operations, chief of flight test operations, project engineer and design group engineer for the CH-47 helicopter. He is active in numerous military and civilian professional organizations, including the Navy Helicopter Association and the Marine Corps Aviation Association, and is currently president of the Philadelphia Chapter of the Association of the U.S. Army. ■

Wherever Important Work Is Done, Boeing Helicopters are on the Job

SHAKEOUT — Boeing's Model 360 technology demonstrator aircraft completed "shake tests" this fall while suspended by its forward and aft transmissions in a Boeing Vertol testing laboratory. The purpose was to verify the aircraft's dynamic characteristics and tune its vibration-isolation system. Prior to the year-end holidays, the aircraft was scheduled to undergo structural proofload testing. The Model 360 is a four-bladed helicopter designed for high-speed flight (200 knots) and is built primarily of composite materials. First flight is planned for late 1986.



CHINOOKS MEET IN SPAIN — A formation flight passing the Spanish Infantry Academy at Toledo marked the first official visit of a British Royal Air Force (RAF) helicopter unit to Spain. Last summer, two RAF Chinooks of No. 18 Squadron from Gütersloh, West Germany, visited Colmenar, Viejo, the main base of Spain's Army Air Mobile Forces (FAMET). Earlier, two Spanish Chinooks from Colmenar visited Gütersloh as part of a squadron exchange. Spain's FAMET currently operates 12 Chinooks and has six more on order from Boeing.



KEEP A PHROG A PHLOAT — Developmental testing of rapidly inflatable emergency-flotation bags for U.S. Navy and Marine Corps H-46 helicopters has been completed. When deflated, the bags fit into fuselage panels measuring approximately 70 inches long by 32 inches high and from three to seven inches thick. The next stage of the project will provide provisions for installing the system on all USN and USMC H-46s. Boeing will begin delivering kits in late 1987. Marine Corps crews have nicknamed the H-46 is "the Phrog" because of its resemblance to a certain green aquatic animal.



MATING TIME — Splicing of the first of seven CH-47D International Chinooks for Japanese military forces occurred on schedule at Boeing Vertol last fall. These aircraft will soon be shipped to Kawasaki Heavy Industries, in Gifu, Japan, for completion and delivery in late 1986. Currently the Japanese Defense Agency plans to acquire a total of 54 CH-47Ds, the bulk of which will be coproduced by Kawasaki from components fabricated by both Boeing Vertol and the Japanese company. Thirty-nine aircraft will go to the Ground Self-Defense Force and 15 to the Air Self-Defense force, with deliveries scheduled to continue into the 1990s.



ANOTHER CLASS ACT — A Helikopter Service Boeing 234 demonstrated its superior heavy-lifting muscle last fall during a unique operation near the Norwegian coastal city of Stavanger. This tandem-rotor helicopter, which normally transports oil workers to distant offshore platforms in the Norwegian sector of the North Sea, was called upon to lift a 115-year-old wooden schoolhouse, weighing nearly 18,000 pounds, and move it to a new location nearly 20 miles away. The Helikopter Service 234 lifted the schoolhouse from its original location on an island north of Stavanger and placed it on the campus of the city's university, where it will enter a new grade serving as a monument to Norwegian education and history.



AFRICAN FAMINE RELIEF — This fall, Boeing-built helicopters were busily fighting famine in the Sudan, which is bordered on the north by Egypt and on the east by Ethiopia and the Red Sea. The task was exacerbated by Sudan's extreme size. More than twice the size of Alaska, but with 40 times as many people, Sudan is the largest nation in Africa. In late summer, the U.S. Agency for International Development (A.I.D.) hired Columbia Helicopters Inc. (CHI), of Aurora, Ore., to transport the food to isolated villages in the country's western provinces.

In early August, a USAF C-5 transport flew three CHI Boeing Vertol 107s, 20 pilots and mechanics, and 46,000 pounds of spare parts from Oregon to Khartoum, Sudan's capital. During their 100-day stay in the country, the three 107s recorded a total of 2,600 flight hours and transported 7.5 million pounds of food and 1.3 million pounds of fuel, medical supplies, and miscellaneous equipment. A.I.D. officials indicated that the helicopter airlift was directly responsible for feeding 300,000 people, many of whom would have died had they not received emergency assistance.

LHX SIMULATOR — A new fixed-base, single-pilot simulator is now in place and operating at Boeing Vertol's flight simulation laboratory. The device, which features a sidearm controller, will be used to model mission scenarios and measure pilot workload for the U.S. Army's proposed new light helicopter (LHX). In addition to standard flight instruments, cathode-ray tubes in front of the pilot monitor essential aircraft systems — electrical, fuel, hydraulics, engines, etc. — and can provide state of the art navigation and moving-map displays. Boeing Military Airplane Co., Wichita, Kan., built the cockpit with help from Boeing Vertol engineers.



Product Support: Dedicated People Keep Boeing Customers Happy

When new helicopters roll out, the doors open to years of service — from training and publications, to spare parts and on-site technical representation, and much more as Product Support takes over.

NAPOLEON BONAPARTE once said that an army marches on its stomach. That may have been true of 19th century armies, but today even Napoleon would agree that it's not food upon which armies feed — it's paper. Sometimes, though, a leaner cuisine is called for, and in late 1985 Boeing Vertol's Product Service Department dished up some electronic links that — for the first time in the history of military contracting — permit Army purchasing specialists to order helicopter parts instantly by using computer terminals. The process strips weeks off normal spares-procurement cycles and assures high levels of performance, productivity, and efficiency.

Product support may mean many things to many people, but at Boeing Vertol it means providing the highest level of service possible to a variety of customers around the world. It's the one department where company marketing and salesmanship collide with customer advocacy and ombudsmanship, and always the goal is the same — to give the customer what he wants when he wants it, and at a fair price.

Product support is irrevocably linked with the company's future well-being. J. Kenneth Hancock, Boeing Vertol's director of product support notes, "If the product can't per-

form well, then it's not going to influence sales in the future — and that's our biggest job — to make sure the aircraft perform well. Whether that takes the right technical person, or the right part, or the right publication, we make sure it's there when needed. We have better than 97 percent on-time delivery for all our spare parts."

In addition to supplying spare parts, the department also prepares and prints helicopter-maintenance publications; trains customers' flight and maintenance crews; and provides field service and technical support, inventory management, overhaul and warranty administration, and integrated logistics support, to name a few of its most important functions.

Integrated logistics support

Integrated logistics support (ILS) is a good example of the complexity and depth of the department's activities. ILS covers six product lines, each with a specific manager reporting to Ken Hancock. These six are the U.S. Army CH-47D, the international military CH-47D, the U.S. Navy and Marine Corps H-46 (and its Model 107 variant), the Boeing 234, the V-22, and the LHX.

ILS brings together for the customer a number of essential services, such as engineering and technical support, initial provi-

sioning and an uninterrupted flow of spare parts, sharply focused pilot and mechanic training, and a continuing stream of relevant publications that allow the customer to maintain the aircraft as its builders intended.

Many of these functions could not be performed effectively without the aid of advanced computer technology and in this field Boeing Vertol has invested heavily to achieve customer satisfaction. "We're the leaders in spare parts automation," Hancock said. "We have the Mechanized Spares Management System [(MS)²], which we began designing in late 1977 and put into action in April 1981. (MS)² is a new database technology designed specifically to do automatic ordering.

"Now anyone can sit at a computer terminal and punch in the customer's order as we receive it. If the part is to be manufactured here at Boeing, its production is automatically scheduled within seconds. If the part must be purchased, (MS)² kicks out a purchase requisition, again within seconds."

Global responsibilities

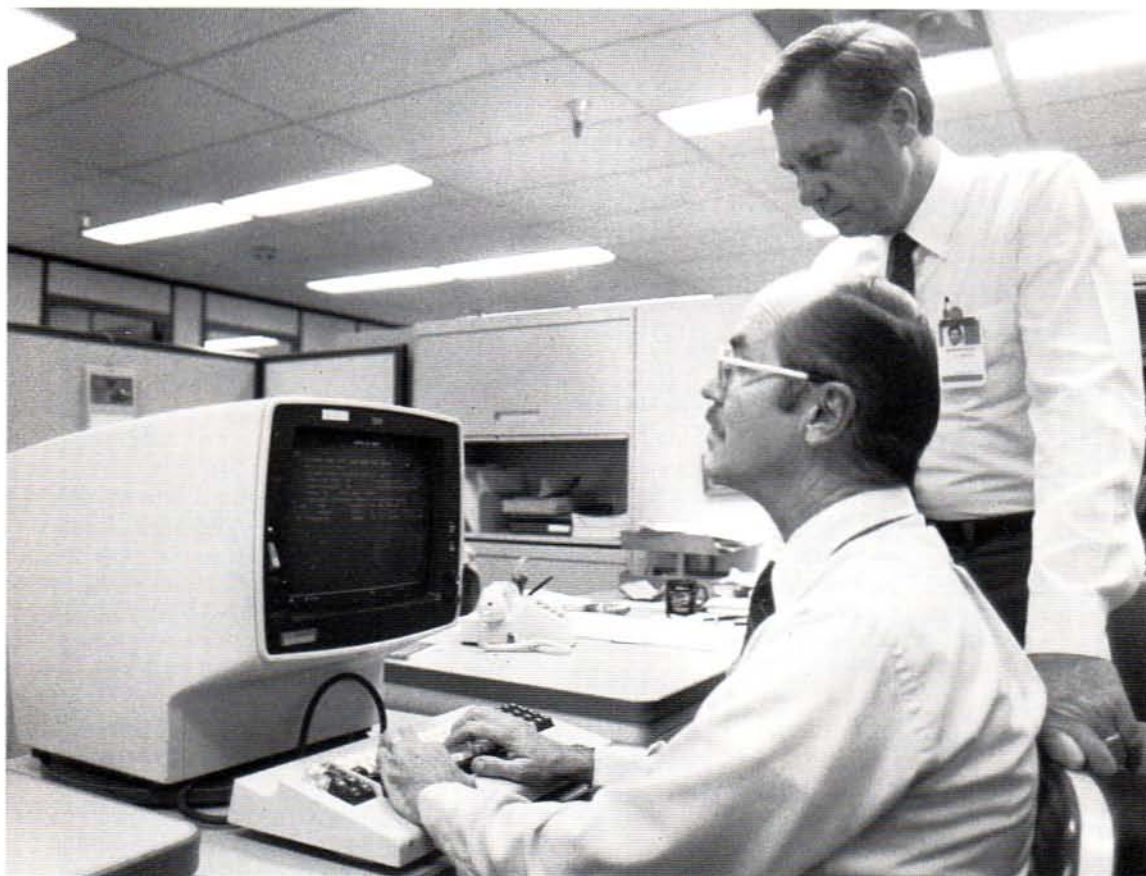
Boeing Vertol supports over 1,200 aircraft around the world, which means that wherever the helicopters go, Product Support's field service people are sure to be nearby. In early December, 40 technical representatives were scattered at some 20 sites from Australia to Korea, from England to Spain, and numerous other locations.

Keeping customers' helicopters flying requires a constant flow of materials and communications from Boeing to its representatives in the field. But communications are a two-way street and data collection is an important aspect of field support. "The gathering and computer analysis of customer flight hours, component removal rates, aircraft availability, regularity of operations, and so forth is vital in pinpointing trends," Hancock said.

Boeing Vertol has parts inventories strategically positioned in Europe, in Alaska, and in the Far East, in addition to massive stores located at the company's headquarters in Philadelphia. This investment results from Boeing's global support responsibility and from the company's pledge to meet AOG (aircraft on ground) situations with all possible speed: AOG parts are ready for shipment within two hours of the call. If parts are not on the shelf, they can be pulled from production lines and readied for shipment within six hours.

Hancock also explained that inventory is of prime importance to the military, and that Boeing Vertol placed computer terminals at AVSCOM (the U.S. Army's Aviation Systems Command) headquarters in St. Louis two years ago. "The Army can query our (MS)² system to determine the status of any parts order," Hancock said. "such as when it was placed, its quantity, description, unit prices, current location, or if it has been shipped."

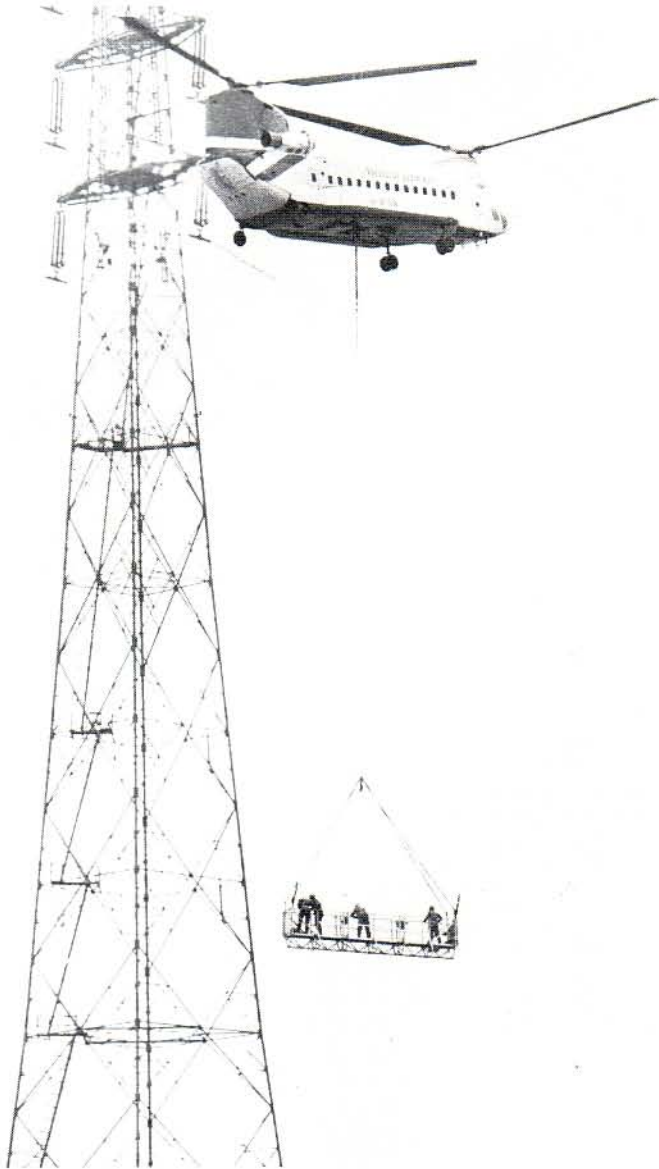
Other computer systems assist the Product Support Department in innovative ways. One example is the Vertol Automated Publications System, or VAPS for short. VAPS is tied in with the company's CAD/CAM (computer-aided design/computer-aided manufacturing) system and is all but revolutionizing the business of creating maintenance and technical publications. VAPS saves a great deal of time and cost because many graphics do not have to be redrawn to fit publications' formats. ■



IT'S ALL IN THE TUBE — Ken Hancock, Boeing Vertol's director of product support (standing) and spares order control specialist Leo J. Milligan review the status of a customer's order.

British Airways 234 Provides The Welsh a Rare Bit of Work

Four helicopter-borne workers shorten a powerline repair job 300 feet above a river from a full week's work to an afternoon's chore.



BASKET CASE — "Getting there is half the fun" could be the slogan of the repairmen riding beneath a Boeing 234 as they link up to a 275,000-volt conductor spanning the River Usk in South Wales.

GREAT BRITAIN'S electrical-distribution network differs little from those found in the rest of Europe or in the United States. Massive steel towers march across the land — from Wales in the west and southwest to Essex in the east — from Dorset in the south to Scotland in the north. Between these huge structures are suspended wrist-thick wires called conductors, supplying homes and farms and factories with that most convenient and essential of modern commodities — electricity.

In Great Britain, as elsewhere, powerline maintenance must be performed as swiftly as technology and safety considerations permit. Speed is essential. Service interruptions cost dearly in terms of money and subscriber complaints.

Power in South Wales is provided by the South Western Region of the Central Electricity Generating Board (CEGB), which has

its home in the seaport city of Bristol. Twenty miles across the Bristol Channel is the Welsh seaport of Newport, on the River Usk. And 300 feet above the river's waters stretches a 275,000-volt powerline which was in need of repair from damage caused by high winds.

The damage showed up as hot spots on infrared film when the line was routinely photographed last year. The repairs were not urgent and considered comparatively simple, consisting of attaching reinforcing wire "bandages" called preforms to the damaged conductor. The tricky part was getting to the problem. In one scenario, CEGB workers could have hauled a trolley up an adjacent transmission tower and sent out along the affected line to effect repairs. But this action would have shut down the line for at least a week and required the re-routing of power on the national grid, which

would have increased costs by as much as £40,000 a day.

Savings — £200,000 plus

The alternative — lifting a four-man repair crew in a specially designed lightweight cradle and holding them to the conductor by hovering helicopter — reduced the task to mere hours and reportedly saved more than twice the estimated £100,000 spent on operating and training costs. The job was performed on Oct. 19th using a Boeing Vertol 234 owned and operated by British Airways Helicopters (BAH). The BAH 234 was flown by Captains Peter Benson and Jim Miles, under the project leadership of BAH senior pilot, Capt. Tim Jenkins. It was the first European test of a novel technique that provides customers with an aerial elevator.

The Boeing 234's center cargo hook offers a maximum capacity of 28,000 pounds — but that is not why the big tandem-rotor helicopter was selected, for the load it carried that day was barely 2,000 pounds. What made the 234 especially attractive was its rock-steady hovering ability combined with its capacity to continue flight on one engine, if need be. Equally important was BAH's powerline construction and maintenance experience. For instance, last spring the company placed 520 electrical-transmission towers in Sweden in under 40 days [see *Transitions*, Summer 1985, p. 9].

234 flight simulator used

The extra emphasis on safety required many weeks of testing, including a full-scale "dry run" on an out-of-service 275,000-volt line near Inverurie, Scotland, just 12 miles northwest of BAH's Aberdeen headquarters. In addition to the test flying, BAH developed and evaluated special safety procedures in its Boeing 234 flight simulator, all to satisfy the United Kingdom's Civil Aviation Authority (CAA).

With full CAA approval, the actual powerline-repair flight took off from the Uskmouth power station within sight of the damaged line. In the cradle were three CEGB employees and Brian Johnstone, the BAH crewman supervisor who acted as radioman linking the team with the 234's pilot. The cradle was not hung on the line. Instead the wire was caught by two arms on the cradle and then the helicopter maintained a light upward strain to hold the platform firmly in place. First-hand examination by the crew in the cradle during the initial flight revealed other damaged areas, and by the end of the afternoon, four sets of preforms had been fitted to two conductors.

"We'll do it again"

John Glover, transmission manager for the CEGB's South Western region, said: "The day went better than we had dared to hope. Confidence built up so fast that it was as if the technique went from an experiment to a standard operation all in the space of one afternoon.

"There were risks attached to running a trolley along a damaged line such as this. We would have had to load-test it, and if that caused the line to break, then the repair would be very costly indeed.

"The entire cost of the flight has been more than paid for by the savings we are making by getting the job done quickly. We will certainly be using it again." ■

The CH-47D: Progress Worth Waiting For

Those who fly the new Chinook at Ft. Campbell, Ky., believe the officers and men at Hunter Army Airfield, Ga., are about to get what they deserve.

MISSIONS WILL BECOME easier for the pilots and soldiers who will fly and maintain the new U.S. Army CH-47D Chinooks that were delivered in September to the 132nd Aviation Co., 24th Infantry Division, Ft. Stewart and Hunter Army Airfield, Ga.

That's the message from the officers and men of the 159th Aviation Assault Battalion, 101st Airborne Division (Air Assault), Ft. Campbell, Ky. The 159th was the first Army unit to achieve initial operating capability with the CH-47D, in February 1984. Two months later Lt. Col. Richard R. (Rick) Walker became the 159th's commander. Since then the battalion has been flying its D-model Chinooks with notable success and has surpassed 10,000 flight hours.

More hooks, more lift; delivery PDO

At Ft. Stewart, the 132nd, commanded by Maj. Phil D'Amico, until recently has been flying A-model Chinooks, the earliest production version of this tandem-rotor aircraft. As the 132nd transitions to the newest D-model Chinook, the men and women of this battalion and the 24th Division will discover many welcome improvements. Col. Walker, drawing from his 16 months experience operating the CH-47D highlights some of these benefits:

"The most obvious difference between the D-model and the rest of the Chinook fleet — and it will be especially obvious to Maj. D'Amico and the pilots of the 132nd — is that they'll have a significantly greater lift

capability," said Col. Walker. "Our planning criteria for the 'D' is 15,000 pounds, and we can take that up to 19,000 or 20,000 pounds, and sometimes higher, depending upon the weather and altitude restrictions and on how much fuel we need. If we have to breach an obstacle, for example, we can exceed 20,000 pounds as long as fuel was readily available.

"In addition to the gross-weight changes, the D-model's triple-hook system allows external loads — such as 155-mm howitzers and bulldozers and so forth — to be carried much faster because they are much more stable. Just how much faster they can be carried of course depends on the individual load. We've found, for example, that the 155 howitzer is a good load at 80 knots on single-point sling, but on a double-point sling, it's good out to 120 knots," Col. Walker said.

The key word is reliable

What really makes Col. Walker smile — and is sure to please Maj. D'Amico and his troops — is the CH-47D's increased reliability. As Col. Walker puts it: "The best thing about the aircraft is that it is more *reliable*. We've been flying it with internal extended-range tanks we've purchased locally and we can now put six or seven hours of fuel in the 'D'. And it's nice to know you can take off with a very good expectation of flying five or six hours without having something go wrong with the aircraft before it's time to refuel."



CH-47D HELPS ITSELF — *The commander of the first Army unit to field the new Chinook says: "The best thing about the aircraft is that it is more reliable." That means the helicopter will spend less time in the hangar and more time flying.*

Col. Walker has discovered there are two ways to achieve a high degree of readiness: make sure aircraft are ready but keep them on the ground — or switch to aircraft rugged enough to fly under a wide variety of conditions without developing maintenance problems. The CH-47D is proving it can do the latter. And with the battalion about to surpass the 10,000-flight-hour mark, it's clear no one has been getting D-models ready to fly and then chaining them to the flight line.

CH-47D and UH-60: proven partners

The CH-47D is so capable that it is being exploited in selected combat assault operations. "When the tactical mission requires putting a large number of people on the ground very quickly in an unopposed, or at least initially unopposed, environment, the CH-47Ds have been successfully integrated into UH-60 formations both day and night to meet surge requirements effectively and rapidly," Col. Walker said.

"Our experience shows that the CH-47D and the UH-60 have many compatible missions and that the CH-47D can perform every mission the Black Hawk can," he said.

"The 'D' is now a much more capable instrument aircraft," Col. Walker noted. "It has a Doppler navigation system and radar altimeters, along with a command instru-



PREFLIGHT RITE — *While his crew chief awaits engine start, Lt. Col. Richard R. Walker, commander of the 159th Aviation Assault Battalion, 101st Airborne Division, Ft. Campbell, Ky., performs cockpit checklist procedures before a routine training flight last fall. The 159th was the first Army unit to achieve CH-47D initial operational capability.*

mentation system that integrates the instrument-flying business and makes the job a lot easier for the pilot. Lower workload is a big benefit.

"The CH-47D's cockpit is also designed for use with night-vision goggles and this allows us to fly most of our operations at night. Here at Ft. Campbell we do a considerable number of nighttime operations. About 20 to 25 percent of our missions are flown under the goggles, and that's how we're going to survive on the battlefield in the future.

"The CH-47D also has provisions for survivability equipment: the M-130 flare dispenser and the ALQ-156 missile-warning device — and these two items together will also give us an increased survivability capability," Col. Walker said.

Top marks from a top instructor

CW4 Bill O'Halloran is the 159th Battalion's Standardization Instructor Pilot and it's his job to train every new pilot coming into the unit. Mr. O'Halloran echoes Col. Walker's comments about the NVG cockpit in the CH-47D. "This thing is terrific," O'Halloran said, "you get very little glare off the windshield with the NVGs."

Additional training is an integral part of conversion to CH-47D Chinooks. "Because the D-model is new," O'Halloran said, "everyone who comes to us must undergo a 10-hour D-model transition, which is normally a five-day program. Very, very few pilots come to us NVG qualified, and so we must put them through a 25-hour program which typically runs from 45 to 60 days. So right away every pilot receives 35 hours of dedicated training just to get the minimum qualification on the D-model — and that's a tremendous amount of training time.

"But the CH-47D is a tremendous machine. With it we do everything faster — multiple loads, multiple destinations — and loads ride better, too," O'Halloran reported.

Everything's better with the new AFCS

A visitor asks O'Halloran if there are any noticeable differences in flight characteristics between the D-model and its predecessors.

"Oh, yes," O'Halloran said, "and you'll hear pilots talking a lot about that. The new AFCS is a big step up. The aircraft in turn is so much more stable and the increased flight envelope on bank-angle limitations increases our ability to do everything better. Our maneuverability is going to make a big difference in combat in that survivability will be enhanced through improved maneuverability with the D-model."

"Sure, there are some things that slow us down right now, such as dual-hook configurations," O'Halloran said. "It takes us longer to effect a hookup when flying with night-vision goggles. It's difficult to hold the aircraft over the one spot under goggles when you have two hooks to load instead of just one. But we're working a solution to that problem.

"Everybody looks at Campbell to see what we're doing because we've got the equipment and we're doing things before other people. We've been talking to the pilots of the 132nd. They call us practically everyday. We've sent them our NVG training programs and they're going to send some of their instructors here and we're going to train them. The 132nd's pilots have many good things to look forward to," O'Halloran concluded. ■

Second Combat Unit Receives Full Complement of CH-47Ds

The 132nd Aviation Co. is an experienced Chinook customer — but its commander anticipates triple effectiveness due to the large number of product enhancements built into this helicopter.

HISTORY sometimes repeats itself in unexpected ways.

In late 1967, the U.S. Army's 132nd Aviation Co. received a full complement of 16 new Boeing CH-47 Chinook helicopters. These were B-models and in May 1968 the unit deployed from Ft. Benning, Ga., to Chu Lai, Vietnam. During the next 42 months, the 132nd's Chinooks took part in 12 major campaigns, flew 34,410 combat hours, transported 200,125 tons of cargo and 925,898 troops, and recovered more than 300 downed aircraft.

Then, following a four-and-a-half-year period as a "zero strength" unit, the 132nd arrived at its new home at Hunter Army Airfield, Savannah, Ga., to support the 24th Infantry Division (Mechanized) at neighboring Ft. Stewart — but this time flying A-models, the oldest Chinooks in the Army's inventory.



CH-47D: "MANAGEMENT TOOL" — Maj. Phillip J. D'Amico, commander of the 132nd Aviation Co., Ft. Stewart, Ga., believes the new CH-47D will ease the heavy management burden shared by all Chinook company commanders.

But by the end of 1985, the 132nd had turned in the last of its CH-47As and had — for the second time in its existence — received another full complement of 16 brand-new Chinooks — this time the advanced CH-47Ds.

To some, such a changeover might appear as uncomplicated as trading in last year's Chevy for this year's model. After all, a Chinook is a Chinook, isn't it? Not quite. The Chinook's silhouette remains the same, but inside is another matter. Hundreds of internal improvements make the CH-47D two to three times more productive than the earlier models it replaces.

Because the CH-47D is a new machine, nearly everything at the operational level requires painstaking attention early on to assure the right people and the right elements are at the right place when the new aircraft finally arrives. These considerations include

such mundane things as publications, training schedules, and the stocking of spare parts and special tools.

To those who fly and maintain the new Chinook, the beauty of the CH-47D is more than skin deep. Internally it's more advanced. The aircraft incorporates mechanical systems that are of later design than even the UH-60 Black Hawk or the AH-64 Apache. These and other improvements make the CH-47D the Army's fastest helicopter and enable it to carry the highest payloads at the lowest cost per ton per nautical mile. So it would not be an exaggeration to suggest that the 132nd's 16 new CH-47Ds have the potential to do the work of 30 or more older machines.

This promise of increased productivity will have a profound effect on the 132nd as well as other Chinook company commanders. "Something tells me that the 'D' is going to allow me to be three times as effective," said Maj. Phillip J. D'Amico, commanding officer of the 132nd Aviation Co. "And that's good news, because a Chinook company commander has to be a total manager. Our training load is heavy — from common-soldier skills up through pilot train-

(continued on page 12)

Born-again Chinook

The first of the new 16 CH-47Ds fielded to the 132nd Aviation Co., Hunter Army Airfield (AAF) was the object of a formal delivery ceremony on a hot September morning in Savannah, Ga. Following service traditions, Maj. Gen. Andrew J. Cooley, commanding general of the 24th Infantry Division, Ft. Stewart, and Hunter Army Airfield, handed over the logbook of CH-47D S/N 84-24165 to Maj. Phillip J. D'Amico, commander of the 132nd.



S/N 84-24165 — Same aircraft, new life.

S/N 84-24165 has a history almost as distinguished as the 132nd's. It had previously been a CH-47A, then identified as S/N 64-13126, which was first delivered to the Army in 1965. Over the next 19 years, this helicopter accumulated 3,554 flight hours, including 2,560 hours in combat in Vietnam, and its last assignment was with the 49th Transportation Co., Stockton, Calif. ■

(132nd continued on page 11)

ing — and we also have a very complex maintenance mission. So the more effective we can be with our personnel, the better we can perform our jobs."

The training schedule emphasizes the fact that the CH-47D is a totally new machine, and because of this it is essential that training must occur well in advance to synchronize with the fielding of the helicopter.

"We train all our new mechanics by sending them to resident schools at Ft. Eustis, Va., or Ft. Gordon, Ga., or Ft. Rucker, Ala. And we began by sending people in October and November of 1984 — almost a year before we received our first new CH-47D," he said. Maj. D'Amico stressed that careful planning assured these newly qualified D-model mechanics would remain with the 132nd for at least a year, even if a soldier had already been with the unit for as long as two years "Having well-trained people with the right attitudes is essential. The attitudes of the soldiers in this company are super and always have been. I'm very proud of them," he said.

The 132nd is the second combat unit to field the CH-47D. The first was the 159th Aviation Battalion, 101st Airborne Division (Air Assault), at Ft. Campbell, Ky.

When asked how the 132nd's CH-47Ds will be utilized in supporting the 24th Division, compared to how Ft. Campbell's 159th's CH-47Ds support the 101st, Maj. D'Amico replied: "Our Chinooks have to be employed in a different manner due to different tactics. The need for fuel and vehicle spare parts, for example, are a lot higher within a mechanized division such as the 24th, which looks toward a faster moving battlefield situation. It takes a lot more support and a lot quicker support." ■

Norway's Helikopter Service Buys Third Boeing 234 Airliner



MODEL CUSTOMER — Joseph Mallen, president of Boeing Vertol, holds a model of a Boeing 234 in the livery of Helikopter Service, A.S., Norway's largest helicopter operator. With Mallen is Emil Gamborg, managing director of Helikopter Service, which purchased its third Model 234 from Boeing Vertol on Dec. 3, 1985.

HELIKOPTER SERVICE A.S., Oslo, Norway, one of the world's leading commercial helicopter operators, purchased its third Boeing 234 from Boeing Vertol on Dec. 3, 1985. Helikopter Service has been using this particular aircraft under lease from Boeing Vertol since the summer of 1984 in regularly scheduled revenue-passenger service supporting oil and gas operations in the Norwegian sector of the North Sea.

"Helikopter Service is a highly valued customer who has successfully operated Boeing 234s in the demanding North Sea market since July 1983, and with our airliner-type helicopters, they have built an

enviable record of on-time performance," said Boeing Vertol President Joseph Mallen.

Helikopter Service currently operates three Boeing 234s to support Phillips Petroleum in the Ekofisk oil field, which is located approximately 165 nautical miles southwest of the Norwegian coastal city of Stavanger, where most of Helikopter Service's offshore support activities are located. In addition, Helikopter Service Boeing 234s support operations of the French oil company Elf Aquitaine in the Heimdal gas field, which is located approximately 115 nautical miles northwest of Stavanger. ■

Boeing Program Highlights

Boeing H-46

Customer: U.S. Navy and Marine Corps

Current Program: Production of 354 Safety, Reliability and Maintainability (SR&M) improvement kits for installation by Navy personnel in Boeing-built H-46 helicopters.

Current Schedule: Deliveries of SR&M kits to the Naval Air Rework Facility (NARF) in Cherry Point, N.C., and to the NARF in North Island, Calif., began at a rate of five per month in July 1985. Kit deliveries will increase to 10 per month in February 1986 and continue through 1988. Deliveries of H-46 helicopters containing SR&M improvements began in December 1985 from the Cherry Point NARF.

Boeing CH-47D

Customer: U.S. Army

Current Program: Modernization of 328 early model CH-47 Chinook helicopters to the advanced CH-47D standard.

Current Schedule: Through December 1985, Boeing Vertol has delivered nearly 100 CH-47Ds to the U.S. Army. The CH-47D fleet has now recorded over 25,000 flight hours. During 1986 D-model Chinooks will be delivered to operational units in North Carolina, Washington, Oklahoma, and Colorado. Current Army plans are to modernize 436 Boeing-built Chinooks. The program is expected to continue through 1993.

International Military Chinook

Current Customers: British Royal Air Force (RAF), Japanese Self-Defense Forces, and the Spanish Army

Current Program: Previously known as the Boeing 414, all new production helicopters beginning with the Japanese aircraft have been redesignated the CH-47D International Chinook.

Current Schedule: Shipments of Chinooks to the RAF at a rate of one aircraft per month began in September 1985 and will conclude in January 1986, bringing to 41 the total number delivered to the service.

First flight of the initial production CH-47D International Chinook, which is destined for Japan, will occur in early January 1986. Boeing Vertol and Japan's Kawasaki Heavy Industries will coproduce Chinooks for the Japanese Air and Ground Self-Defense Forces. This spring, Boeing will begin deliveries of the first seven aircraft to Kawasaki, where they will be readied for final delivery to the Japanese military, which currently plans to acquire as many as 54 Chinooks.

The Spanish Army, which currently operates 12 Boeing-built Chinooks, has ordered six more. Deliveries at a rate of two aircraft per month will occur in May and October 1986, and April 1987.

Boeing 234

Current Operators: In airline and commercial service — British Airways Helicopters (U.K.), Helikopter Service, (Norway), and Columbia Helicopters, and ERA Helicopters (U.S.). In governmental service — a Far Eastern nation.

Fleetwide Statistics: (commercial services through December 1985)

| | |
|----------------------------------|----------------|
| Total revenue flights | 9,188 |
| Total revenue flight hours | 41,352 |
| Total revenue passenger miles | 165.12 million |
| Total revenue passengers carried | 702,639 |
| Total revenue miles flown | 4,338,725 |
| Average load factor | 38 |
| High-time aircraft | 6,581 hours |

V-22 • LHX • Boeing 360

V-22: The Bell-Boeing team is proceeding toward a U.S. government decision on the award of a full-scale engineering development fixed-price contract early in 1986. The value of this contract to Boeing Vertol is \$1.8 billion.

LHX: The Boeing Sikorsky Team has added these new members: IBM's Federal Systems Division, Owego, N.Y., and the team of Singer Aerospace and Marine System's Link Flight Simulation Division, Binghamton, N.Y., and Boeing Simulation and Training Systems (STS), Huntsville, Ala. IBM will codevelop the aircraft survivability equipment and common signal processor. Singer-Link and Boeing STS will design a total flight- and maintenance-training system during the development phase.

Boeing 360: This all-composite, high-speed, tandem-rotor helicopter has completed shake testing to verify the airframe's dynamic characteristics and to tune its vibration-isolation system. First flight is planned for late 1986.