

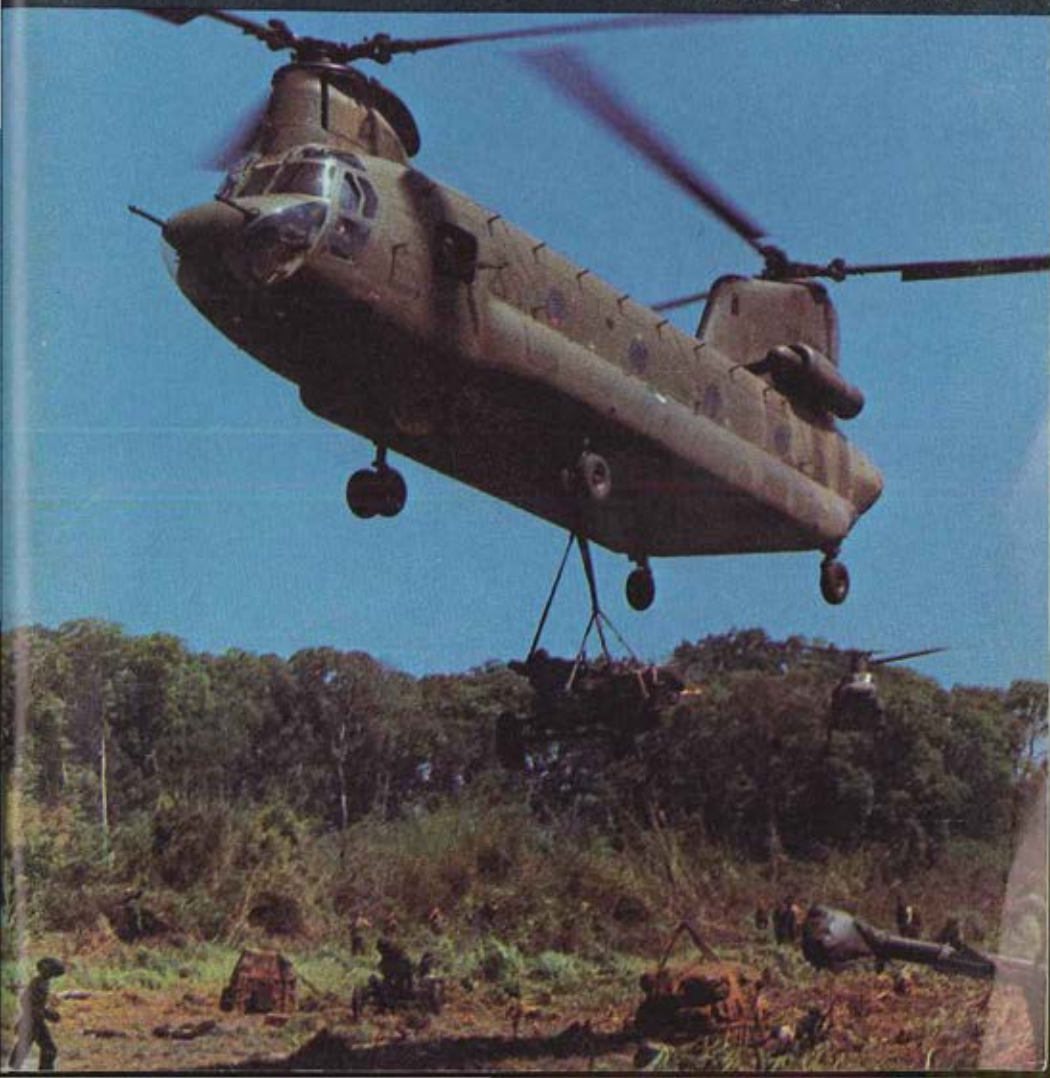
Army Aviation

**SPECIAL
ISSUE '78**

MAY 31, 1978

The Army's CH-47D Fleet Modernization Program

The Boeing Vertol Chinook





**Now another go-anywhere transport
from de Havilland joins the U.S. Army...**

the UV-18A Twin Otter.

The U.S. forces had already chosen the Beaver, the Otter and the Caribou—more than 1,300 go-anywhere planes from de Havilland. They knew our performance first hand. And they had a very demanding order to fill, selecting transports for "command administrative, logistical and personnel flights from battalion headquarters to remote village sites throughout western and northern Alaska on a year-round basis."

It's no wonder they chose the Twin Otter. With their de Havilland experience. Plus these Twin Otter features:

It converts readily from wheels to wheel-skis, floats or high-flotation tires. (The U.S. is equipping each Twin Otter with all of these.)

It carries 19 troops in and out of rough, makeshift 300 m (1,000 ft) strips with room to spare.

In 15 minutes, two men can change

it to a cargo plane that will carry a payload of more than two tons.

On a hundred-mile-radius reconnaissance or search and rescue mission, it can stay aloft for more than 6 hours because of its exceptional fuel economy.

It cruises at 182 knots at 10,000 feet. Or handles easily at 70 knots for pin-point paratropping of men or supplies.

The de Havilland Twin Otter. The go-anywhere plane that has proved its dependability, versatility and economy with 18 other defence, police and government organizations. And with 135 civil operators.

*The de Havilland Aircraft of Canada Limited,
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**Twin Otter: the standard of dependability
and versatility in more than 50 countries.**

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The Army's AAH is the most advanced helicopter ever built. Ahead of time in technology, performance, survivability and mission capability.

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ARMY AVIATION

The Second of Six "Theme Issues"

Following three months after our January-February "Black Hawk Issue", this oversized special issue dedicated to the "CH-47 Modernization Program" is a major effort by the various military and industry officials involved with the "D" to give you the full details of this important fleet modernization program.

Again, the issue is enriched by the editorial contributions of many distinguished authors. Their specific comments — plus the numerous illustrations, charts, and photos devoted to the "D" — update the reader on all pertinent facets of this current program, and make this May 78 issue a "should read" item for all who'll be involved in the Army Aviation Program in the '80's and '90's.

The issue's 104 pages bring our January-May page total to 328. That's 156 more pages than we published in the same Jan.-May period in '77.

Behind the scenes

Pictured below is Captain James E. Verity who carries the title of Aircraft Maintenance Officer in the CH-47 Mod PMO. "Jim" was the on-the-spot expeditor/coordinator who kept the copy and photos coming. A soft-spoken young man with a wonderful sense of humor, he charmed all of us into quicker action. The result: An "on time" issue.



VERITY

Volume 27

May 31, 1978

Number 5

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It's Time to Nominate for AAAA National Awards

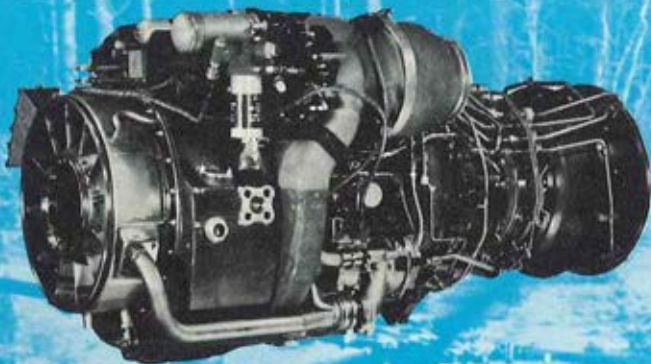
Nominations citing CY 77 accomplishments are due at AAAA 1 July. 10

Lights! Actions! Camera! ARNG-style.

by Col. John J. Stanko, Jr., Chief, Aviation Division, ARNG. 101

ARMY AVIATION is published monthly, except February and December by Army Aviation Publications, Inc., Westport, CT 06880. Editorial and Business Offices: 1 Crestwood Road, Westport, CT 06880. Phone: (203) 227-8266 or 227-0948. Subscription rates for non-AAAA members: \$9, one year; \$17, two years; add \$7.50 per year for foreign addresses other than military APO's. The views expressed in the publication are not necessarily those of the Department of the Army or of the staff of the publication. Cost of individual May, 1978 issue is \$2 postpaid by Second Class Mail to any CONUS address. Second class postage paid at Westport, CT.

You know the features you'd like to have in an Army helicopter engine.



You'll like the T700.

The Army combat environment is rough . . . particularly rough on helicopter engines. Vietnam showed that. Foreign object damage that caused more than half of all unscheduled engine removals. Heat that made it a struggle for helicopters just to carry their own crews. There was a lack of sophisticated maintenance equipment in remote areas. And helicopters were vulnerable to ground fire.

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lets the Army's UH-60A carry its crew and eleven combat-equipped soldiers on a 95 degree day at 4000 feet. With fuel consumption that is 25 to 30% lower than other engines in the same horsepower class. With ease of maintenance in the field that requires only ten simple tools. And with design features like top-mounted accessories and controls to enhance survivability.

For the Sikorsky UH-60A Black Hawk and Hughes YAH-64 AAH, we're building the T700 tough.

The T700

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**The one helicopter
that's built today
to survive in tomorrow's
hostile environment.**

Sikorsky's Black Hawk.

There's no doubt that the Sikorsky Black Hawk is survivable.

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- The aircraft is designed and built for the high threat environment.

And when things get rough, this is the kind of aircraft any soldier wants to fly or fly in. Sikorsky Aircraft, Main Street, Stratford, CT 06602.



Division of

**UNITED
TECHNOLOGIES**





The Quest for Flight - Part III The Conquest!

BY LIEUTENANT COLONEL E.J. EVERETT-HEATH
British Army Liaison Office, Fort Rucker, Alabama

The year 1876 saw the invention of the four-stroke petrol engine by the German engineer **Otto** and within nine years the first practical engine had been built to power the successor to the horse. Aviation was to owe much to the automobile business.

The 1880's proved to be the lull before the storm of the next decade. It was in 1884, however, that **Horatio Phillips** took out a patent in England on his double-surfaced, cambered aerofoils. Through exhaustive wind-tunnel tests he demonstrated that the curvature of the upper surface of a wing created a partial vacuum and thus lift; less lift was generated by the pressure of the air on the flatter lower surface.

Three types of "pioneers"

By 1890 three recognizable types of pioneer had emerged: the 'academic' inventors with their outlandish designs which never got beyond the drawing board; the 'model-makers' who experimented in miniature; and the 'fool-hardy' who were prepared to risk life and limb in full-size adventures.

The 'foolhardy' could be divided into two sub-groups: the 'drivers' and the 'riders'. The 'drivers' regarded the flying machine as an automobile with wings, simply to be driven into the air by brute force. They were concerned with power and lift. Their success rate was depressingly low: total failure. The 'riders' had more finesse, wanting to ride their machines like a horse. They were concerned with control and stability.

Otto Lilienthal was a 'rider' and the foremost practitioner of 'controlled' flight. Starting out as a latter-day Tower Tumbler, he then turned his attention to the flight of birds. In

1889 he published a 'learned tract, 'Der Vogelflug als Grundlage der Fliegekunst' (Bird Flight as the Basis of Aviation), which became a literary landmark in the history of flight - for those who could read it.

Two years later he built a biplane glider. This had armrests to carry the weight of his body while his legs were free to dangle below. Longitudinal control was effected by moving his body backwards and forwards while lateral control was achieved by swinging his undercarriage from side to side.

Lilienthal first tried out this contraption in his garden before taking it to the nearest hill. From here he launched both his glider and his career. His career lasted longer. As he learned to make use of air currents his hops became glides. In 1895, bearing in mind the proclamations of **Cayley**, **Phillips** and others, he built another cambered-wing, glider with an 18-foot wing-span and a wing area of 200 square feet. A year later he built yet another glider that was driven by a cylinder of compressed carbon dioxide gas. This "motor" was linked to hinged wingtips, rather than a propeller.

(Continued on Page 12)



OCTAVE CHANUTE'S HANG-GLIDER

Teamwork.

The foundation of effective EW systems integration.

At Beech Aircraft, we have a philosophy about integrating sophisticated EW systems with airframes. To be 100% effective, everything—from the people involved to the system components—must work as a team.

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manufacturer of corporate-size airframes that has the capability for total EW system integration, design and installation, plus EMC/EMI TEMPEST testing.

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Beechcraft



It's time for AAAA

AWARDS PRESENTATION

AAAA National Awards will be presented at the **Annual Honors Dinner** to be held at the **1978 AAAA National Convention** in Washington, D.C., Oct. 15. The Secretary of the Army normally makes the award presentation to the "Aviation Soldier of the Year," with the Army Chief of Staff presenting the awards to the outstanding aviation units. The "Army Aviator of the Year" award is presented by the Vice Chief of Staff while a representative of the McClellan Memorial Foundation makes the safety award presentation. The Commander of DARCOM is invited to present the "Outstanding DAC of the Year Award."

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NOMINATION FOR THE AWARD TO THE "ARMY AVIATOR OF THE YEAR"

BACKGROUND: This award is sponsored by the Army Aviation Association, and is presented "to the Army Aviator who has made an outstanding individual contribution to Army Aviation during the previous calendar year."

NOMINATION FOR THE AWARD TO THE "ARMY AVIATION SOLDIER OF THE YEAR"

BACKGROUND: Sponsored by the AAAA, this award is presented "to the enlisted man serving in an Army Aviation assignment, who has made an outstanding individual contribution to Army Aviation during the awards period ending the previous calendar year."

ELIGIBILITY: A candidate for either of the above awards must serve in an Army Aviation assignment in the active U.S. Army or its Reserve Components. Membership in AAAA is not a requirement for consideration.



e to nominate A Nat'l Awards!

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NOMINATION FOR THE "OUTSTANDING (ARMY AVIATION) DEPARTMENT OF THE ARMY CIVILIAN OF THE YEAR"

BACKGROUND: This AAAA-sponsored national award is presented annually to a Dept. of the Army Civilian who has made an outstanding contribution to Army Aviation during the previous calendar year. A nominee for this award must have been a DAC for the awards period, and must have made an outstanding individual achievement.

NOMINATION FOR THE "JAMES H. McCLELLAN AVIATION SAFETY AWARD"

BACKGROUND: Sponsored by the McClellan Memorial Foundation and the many friends of Senator John L. McClellan in memory of his son, James H. McClellan, an Army Aviator who was killed in a civil aviation accident in 1958, the award is presented "to an individual who has made an outstanding contribution to Army Aviation safety during the previous calendar year.

ELIGIBILITY: Any individual - military or civilian - is eligible as a nominee for this award. Membership in AAAA is not a requirement.

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NOMINATION FOR THE AWARD TO THE 'OUTSTANDING ARMY AVIATION UNIT OF THE YEAR"

BACKGROUND: Sponsored by the Hughes Helicopters Division, this award is presented "to the aviation unit that has made an outstanding contribution to or innovation in the employment of Army Aviation over and above

the normal mission assigned to the unit during the period ending the previous calendar year."

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NOMINATION FOR THE AWARD TO THE "OUTSTANDING RESERVE COMPONENT AVIATION UNIT OF THE YEAR"

BACKGROUND: Sponsored by the AAAA, this award is presented annually "to the Reserve Component aviation unit that has made an outstanding contribution to or innovation in the employment of Army Aviation over and above the normal mission assigned to the unit during the awards period ending the previous calendar year."

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DOCUMENTATION FOR AWARDS

ACCOMPANYING DATA: Documentation should include the name and address of the individual or unit, and the name of the present commander. A cover sheet should provide a brief outline of not more than 100 words citing the main reason(s) for the nomination. Additional supporting information should be attached as inclosures and is limited to 1,500 words or three pages (whichever is greater); and be typed.

SUSPENSE DATE: Nominations should be mailed on or before July 1 to: AAAA, ATTN: National Awards Committee Chairman, 1 Crestwood Road, Westport, CT 06880.

**Suspense Date:
July 1, 1978**

Quest for Flight

(Cont. from Page 8)

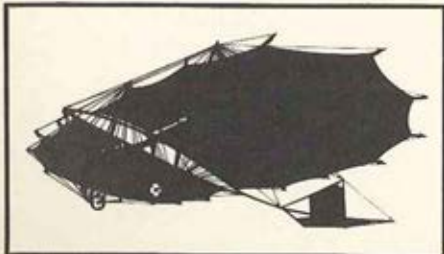
Before flying his new glider for the first time, **Lilienthal** wanted to try out his novel form of control in one of his standard monoplane hang-gliders. On 9 August 1896 he took off into a gusty wind but when at fifty feet the wind seemed to drop, and the glider to stop and shudder as if the wrong control had been used. It then plunged to the ground.

Lilienthal was removed from the wreckage with a broken spine and died the next day with the words "Sacrifices must be made" on his lips. He had made over 2,000 flights, one over a thousand feet long.

One of **Lilienthal's** disciples was an Englishman, one **Percy Pilcher**. Having built his own glider in 1895 he went to Germany and was allowed to make a few flights in one of the master's gliders. Dripping with inspiration, he returned to England, convinced that he could apply power to a glider. But no engine was light enough so **Pilcher**, with praiseworthy perseverance, built his own. It was a fine engine but quite unsuitable for his airframe. So **Pilcher**, undaunted, set about building a bigger glider to take it.

The first powered flight

On 30 September 1899 he was ready to make man's first powered and controlled flight but now the weather had conspired against him and was unsuitable for such an attempt. **Pilcher**, however, was a man of iron nerves. In order not to disappoint the crowd, hungry for history, he elected to make a flight, not in his new aircraft, but in his most successful machine, the "Hawk".



PERCY PILCHER'S GLIDER, THE HAWK

Towed behind a team of unwilling horses, he just could not whip up enough enthusiasm (or speed) in them. The horses were invited to re-double their efforts. This time **Pilcher** made it but at thirty feet a bracing wire snapped. He crashed and died two days later.

Pilcher was at one time an assistant to **Hiram S. Maxim**, an American by birth who emigrated to England in 1881, having had a slight difference of opinion with the US Government over purchase of his famous machine-gun. **Maxim** will not go down in history as an introvert; indeed, he fondly believed that his departure was an irreparable loss to American society and culture. The British agreed and gave him a knighthood.

The new **Sir Hiram** studied mousetraps for a period before turning his attention to inhalers for bronchitis and aviation. He was soon in a position to declare modestly that "nearly all of the mathematicians are radically wrong" and to prove it he constructed the first jumbo aeroplane. A biplane with a span of 104 feet, its steam engine developed 300 HP and was geared to two pusher propellers. It ran on rails with a second set of guard rails above to prevent the machine rising more than two feet. Gross weight was approximately 5,000 lbs.

After a number of trial runs, **Maxim** gunned the engine rather more than usual on 31 July 1894 and the machine left the track although still retained by the guard rails. After a moment the leviathan went berserk, tearing itself free of the running gear. **Maxim**, frightened that he might actually fly, shut off the steam. With its life-blood denied it, the monster collapsed. **Maxim**, the 'driver', announced in ringing tones to anyone who would listen that "propulsion and lift are solved problems; the rest is merely a matter of time."

Having pointed the way to lesser mortals, he returned to mousetrap design, his venture into aviation history having no influence save an entry in the history books.

The "ultimate glider"

While **Henry Ford** was developing his 'tin Lizzy', **Octave Chanute**, born in France but brought to the United States at the age of six, published in 1894 his 'Progress in Flying Machines'. One of America's most eminent (QUEST/Cont. on Page 92)

A special 79-page report



The CH-47D Chinook Program

A major
U.S. Army
modernization
and production
effort . . .



DEPARTMENT OF THE ARMY
DEPUTY CHIEF OF STAFF FOR LOGISTICS

Highly effective and responsive logistic support on the battlefield is an absolute necessity for conducting successful air mobile operations. This became evident in Vietnam and has been confirmed by follow-up field tests and studies -- the most recent being ARCSA III in 1977 when the Army completed HELILOG, a detailed evaluation of helicopters in the logistic role.

The CH-47D CHINOOK will give the Army a modernized and standard 1980's state-of-the-art medium lift helicopter to meet these requirements. The CH-47D will have greatly improved Reliability, Availability and Maintainability around the clock and be able at normal cruise speed to carry payloads from 15,000 lbs at 4000 feet 95° to 23,000 lbs at sea level standard. This capability can be used in many ways in support of tactical operations as well as logistics.

Logistics on the battlefield has always presented a tough challenge -- made tougher by air mobility. The CH-47D will play a highly important role in meeting this challenge.

A handwritten signature in dark ink, appearing to read "Eivind H. Johansen".

EIVIND H. JOHANSEN
Lieutenant General, GS
Deputy Chief of Staff for Logistics



Overview

(Cont. from Page 15)

meets our desired reliability and maintainability values.

Costs

The modernization research and development program remains within program costs and the future remains optimistic. While remaining within program R&D costs we are ahead of our contract schedule allowing time to improve on systems which do not originally meet our mutually established values.

We're proud of the fact that we're the

PAYLOAD LB. THE CH-47D WILL CARRY MORE — FARTHER!



first major modernization modification program that "bit the bullet" voluntarily to "design to a cost," thereby insuring that both the contractor, Boeing Vertol, and the Army have mutually agreed to a production cost ceiling.

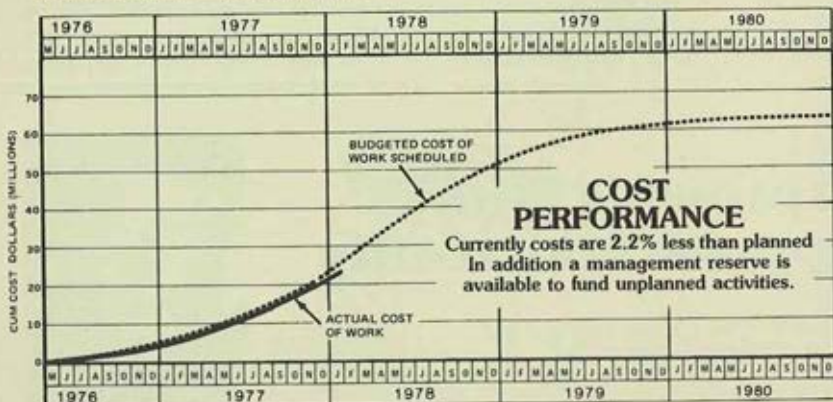
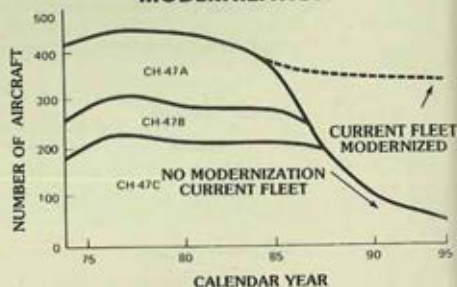
A team effort!

We are progressing toward the goal of providing the soldier in the field with a more responsive, more reliable, and more maintainable medium lift helicopter at the best overall cost to the Government.

This effort requires many team players represented in part by the articles in this dedicated issue.

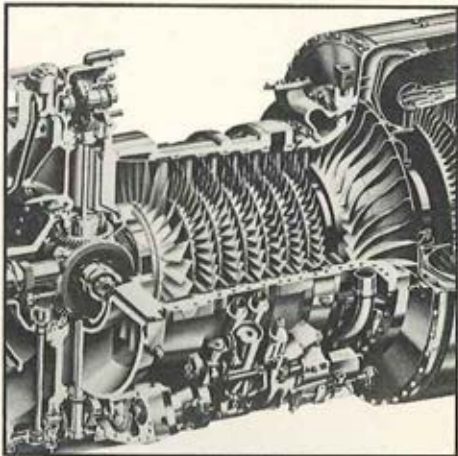
Through a total team effort we will continue to support the prudent modernization decision.

LIFE EXTENSION BY MODERNIZATION



COST PERFORMANCE

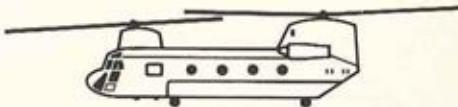
Currently costs are 2.2% less than planned. In addition a management reserve is available to fund unplanned activities.



Reliability Revisited.

Chinooks CH-47's earned their reputation. They put in more than ten years service as the largest capacity helicopters in the U.S. Army. They're the Old Reliabiles.

Now Old Reliabiles can do the job better than ever. With Avco Lycoming's new T55-L-712 turboshaft engine. Under the the RAM-D program, the latest T55 increases Reliability, Availability, Maintainability, and Durability. Designed to log up to 2400 hours between overhauls (while delivering up to 3750 shp, with an emergency rating of up to 4500 shp), the T55 makes Old Reliabiles easier to maintain, with less time on the ground. And more time in the air.

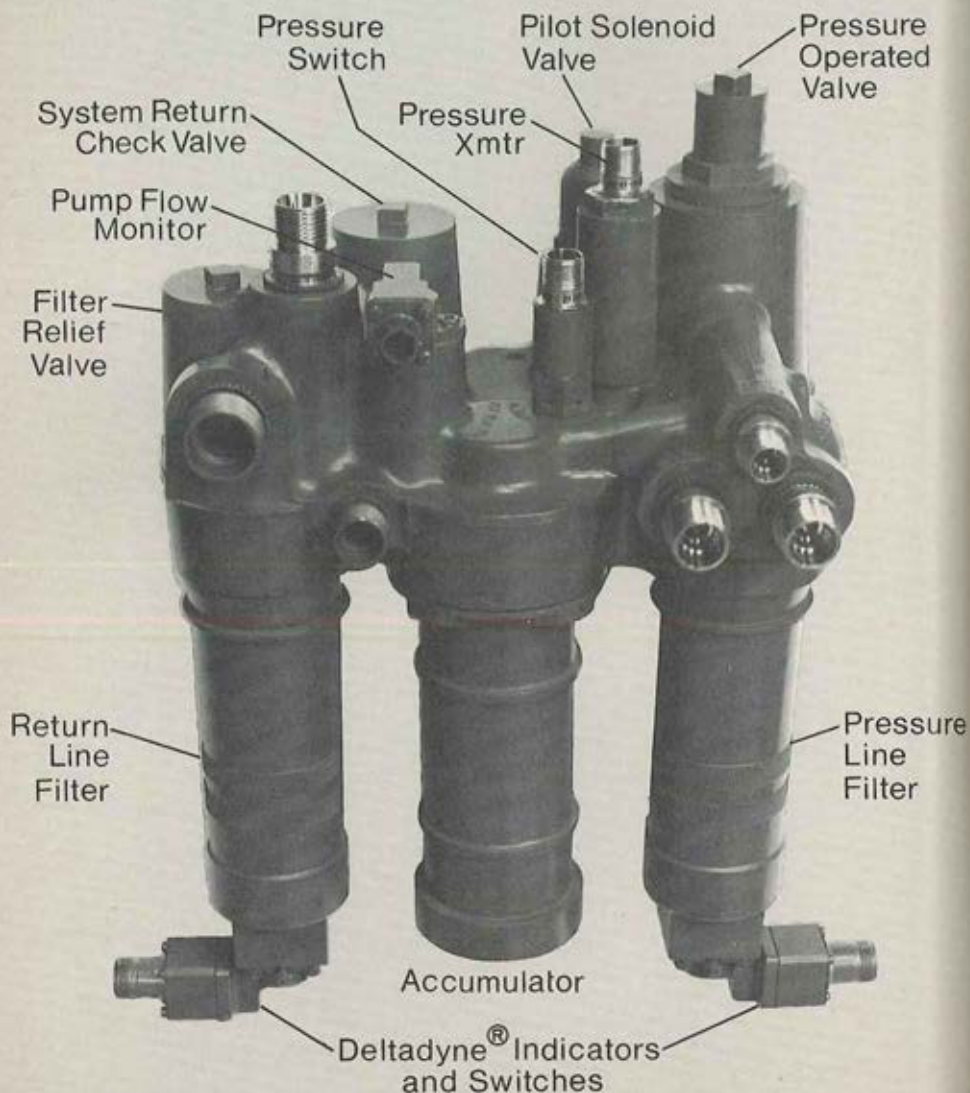


And the proven core engine just keeps on proving itself, day after day. Because at Avco Lycoming, we work to do a good job even better. Avco Lycoming, 550 South Main Street, Stratford, CT 06497.

AVCO LYCOMING DIVISION

APM Filter Modules: 1

Hydraulic and Transmission Sy



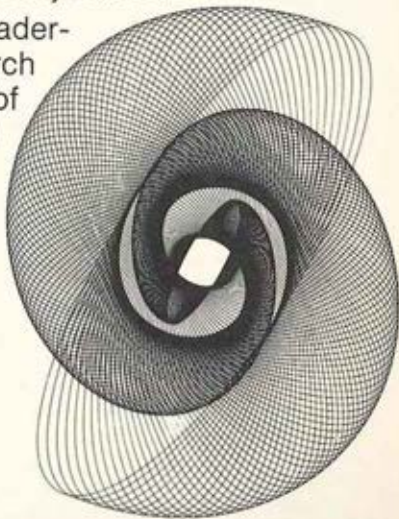
Power Control Module — Just one of seven APM Filter Modules on board the CH-47D

Important Protection for the Systems on Boeing-Vertol's CH-47D

APM Technology Selected for Modernization Program

APM has made continuous contributions to aerospace filtration and contamination control by designing filters that demonstrate ease of use, economy of use, safety and efficacy. That's why Boeing-Vertol selected APM for the CH-47D Modernization Program. APM filter modules *combine* the latest state-of-the-art ultrafine filtration to combat component wear *with* a variety of fluid system components to increase operating reliability, reduce maintenance, minimize weight and eliminate system leakage points. This was accomplished while meeting the Army's service and design-to-cost objectives.

APM maintains technological leadership with high emphasis on research and development. From a bank of knowledge unequalled in the field we can grasp the subtleties of your applications. Our experienced staff of scientists and engineers stands ready to work with you.



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Helicopters need an APU they can trust. Because you never know where they'll take off from next.

That's why not one of the thousands of production U.S. military cargo helicopters has ever flown with any turbine APU other than our *Titan*® APU.

And the modernized CH47D Chinooks will take to the air with an improved *Titan* APU. With both hydraulic and generator drive plus the very latest in state-of-the-art electronic sequencing.

Which proves that in APU's we'll make the best better for you.

Of course, reliability is just

one reason so many helicopters use our APU. It's also lighter than competitive units. Its ability to cope with sand, dust and salt spray is combat proven. And its life cycle costs are low.

If you're in the market for an APU, write Solar Turbines International, an Operating Group of International Harvester, Dept. A-168, San Diego, CA 92138. We'll tell you about the best APU you can buy. And why it's even better now.



SOLAR TURBINES INTERNATIONAL



The CH-47D Need (Cont. from Page 21)

ed unit and fleet effectiveness, reduced operating and support costs and, most importantly, enhanced readiness. The prime benefit to the unit commander, maintenance officer, and mechanics will be a helicopter which is easier to maintain and to troubleshoot, and have a high probability of mission accomplishment.

Reduction in downtime

The increase in time before overhaul for major components will significantly reduce scheduled maintenance downtime required in the unit. The improvement of existing T-55 engine to T-55-L-712 RAM-D configuration will incorporate the latest turbine engine technology and will greatly enhance reliability. The new engine will provide an emergency single engine capability at a max gross weight of 50,000 lbs. In the terrain in which we operate today, this capability is the essential margin of safety we must provide to our aviators.

Designed for survivability

A matter of major concern to everyone in Army Aviation is survivability and vulnerability in a high threat environment. In addition to survivability equipment which

will be added to the CH-47 to counter specific threats, there are basics in the design of the subsystems and components which will greatly enhance the CH-47D.

Some are as simple as separating the wire bundles down the cabin area for the number 1 and 2 electrical systems. Others, such as the redundant lube systems and dry run capability for the transmissions, involve major reworking of existing components. The fiberglass rotor blade is the most significant improvement in safety reduction of vulnerability. For a rotor blade to take a direct hit from a 23mm HEI and retain enough strength and structural integrity for a pilot to safely land the aircraft, particularly if he should have 33 troops on board, is a dramatic improvement over metal spar blades.

An added benefit

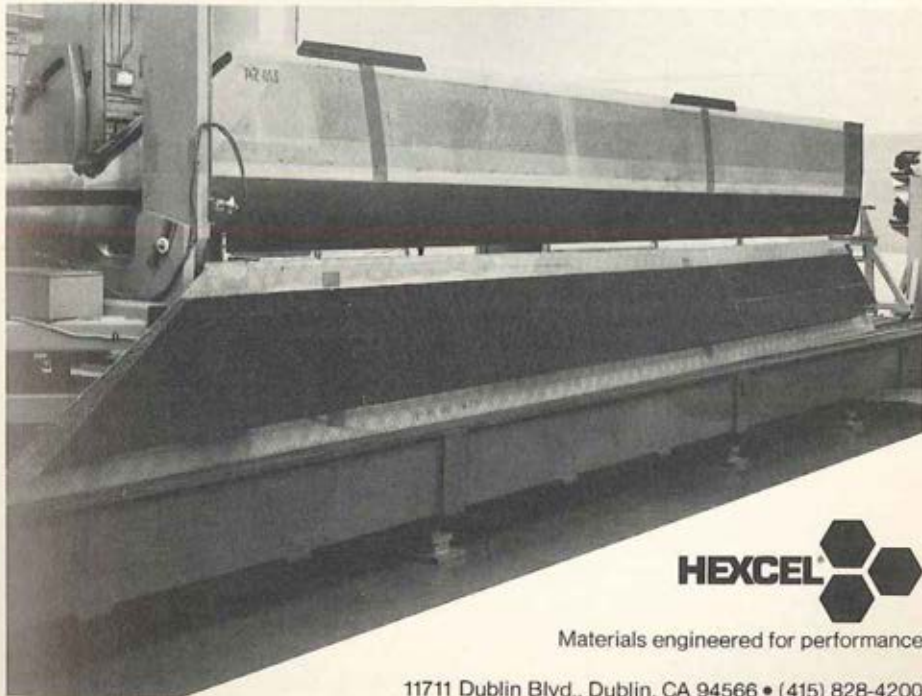
An added benefit of the fiberglass blade is that it will cost less to produce and have a higher time between depot overhaul than the present blades. As we know it, there will be no such thing as a crack in the spar of a fiberglass rotor blade. With these improvements, and by increasing the in-service life of the CH-47 through the modernization program, we will be able to provide the field commander with a rapid, reliable aerial transportation system through the 1990's. ★



THE CH-47

For the CH-47 Modernization Program, Boeing Vertol sought to pioneer a fiberglass rotor blade. They've achieved it. From Hexcel, Boeing Vertol sought fully-machined blade cores, delivered ready for final skin bonding. They're getting them. Matched to the requirements of a new generation in complex blade designs, Hexcel offers five-axis, numerically-controlled machining capabilities which are unmatched in the industry. Complex-contour blade core shapes, machined to exacting tolerances, demonstrate Hexcel's commitment to meeting the demands of the Army's new aviation programs.

A finished CH-47 blade (top) and the blade core, as received from Hexcel.



Materials engineered for performance

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Life-line at the Front Line



Breeze Rescue Hoist on the Boeing Chinook pulls personnel from tight predicaments

A compact Breeze Rescue Hoist, housed in a pod, provides one more area of action for the versatile Boeing Chinook assault-support helicopter.

Added to the Chinook's capacity for mass-moving troops, firepower, and supplies into action wherever needed, is the life saving ability to reach down

where nothing else can go to rescue personnel.

Over the years, Breeze has worked closely with Boeing and other airframe manufacturers to provide the extra measure of utility afforded by a hoist — and which has resulted in thousands of rescues around the world.



BREEZE CORPORATIONS, INC.

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Makers of Airborne Hoists & Winches & Controls, Radar Antenna Drives, Turret Drive Systems,
Tractor/Trailer JackKnife Controls, Automotive & Industrial Equipment

IN our visits to locations where the audience is mainly non-defense related people, we have a difficult time explaining what "modernization" is all about.

The solution has been to draw an analogy to their automobile. When asked if they would want their older car totally rebuilt, using new technology in material, new engines, transmissions, axles, wiring, upholstery, etc., and the body retrimmed to a "like new" condition at a dramatic dollar savings over a 1978 model, the answer is consistently "Yes."

The 55 mph speed is equivalent to our 15,000 lift requirement. That's what we need and this is what we are developing, too! While visually the same aircraft in flight, a closer scrutiny reveals that the CH-47D is a brand new helicopter. These changes are to ratify to the Army's need for a 15,000 pound lift capability. Let's look at the changes.

"New technology" rotorblades

The first change will be to new **fiberglass rotor blades**. These will be constructed using technology and knowledge gained from previous aircraft programs, plus some updated manufacturing methods and modern technology. Going to a fiberglass blade gives significant improvements in **Reliability, Availability and Maintainability (RAM)** and eliminates the problem of metal blade corrosion.

The use of fiberglass blades also eliminates the need for the **Integral Spar Inspection System (ISIS)**. The most significant feature of the fiberglass is the

ability of the fiberglass spar to tolerate damage up to and including direct hits from a 23 mm round, the metal blade just cannot take a hit like this because it cannot resist crack propagation like fiberglass.

The second improvement is the **drive system**. The transmissions have been redesigned keeping the key factors of RAM, safety, and survivability as the foremost considerations. Improvements to all of these have occurred, while still keeping the same basic exterior dimensions and using most of the existing aircraft mounting points.

Upgrading to 7,500 hp

One of the main things was the upgrading of the transmissions from the current 6,000 horsepower rating to 7,500 horsepower. This upgrading was for three reasons. First, at the design criteria of 4,000 feet, 95°F, the two T55-L-11 engines produce a total of 5,925 horsepower. At this point the CH-47 is engine-limited; the 6,000 horsepower rating is adequate; and the lift capability is comparatively good.

However, at sea level, on a standard day, the engine can develop 7,500 horsepower. Under these flight conditions this created an aircraft that was transmission-limited, or engine/transmission mismatch that can cause significant damage is there was an over torque.

The second reason for increasing the rating is for reliability, availability, and maintainability purposes. By qualifying the transmission at 7,500 horsepower rating it will preclude pilot induced over torque and

Systems description: A look at the changes

[illegible]

**By JOHN P. CLARKE, Deputy Project Manager,
CH-47 Modernization Project Manager's Office**





Systems Description (Cont. from Page 25)

when operating below 6,000 horsepower will result in lower stress loads and, therefore, less wear.

The third purpose of the redesign was to accommodate some of our other new systems, like the new electrical, hydraulic, and APU systems.

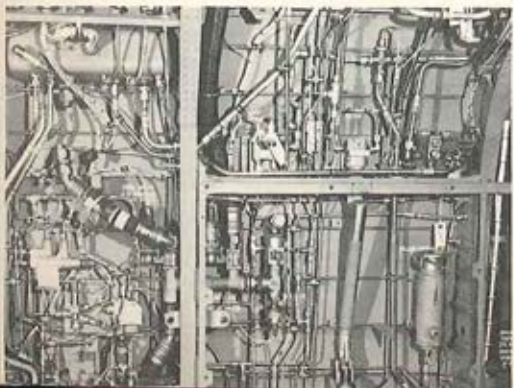
A new lubrication system

Another big improvement in the transmissions is a new integral lubrication system. This definitely eliminates some of the past maintenance problems. For example, the leak points have been reduced from 116 in the older CH-47s to 28 in the modified version. Another big plus is the reduction of components from 210 to 90. These are going to be a bonus, not only because of the obvious reduction of maintenance, but also the reduction of vulnerability to enemy fire with fewer lines to get severed.

However, if the aircraft should happen to take a hit in one of the lubrication systems, each transmission has a built-in sump with enough oil to stay in operation for two hours, and if that should go dry it is designed to fly 30 minutes without any lubrication at normal cruise power.

With these changes and the 7,500 horsepower for the transmission, the Army can accommodate the RAM changes, improve safety, and reduce vulnerability.

FIG. 1—THE WAY THE RIGHT SIDE OF THE CH-47 RAMP AREA USED TO LOOK.



The third system that has been improved is the **hydraulic system**. For the **Chinook** crews and passengers they will be happy to hear there has been a significant reduction in the number of leak points in the aircraft. The number of hoses and tubes have been drastically reduced from 520 to 140 and the leak points have been reduced from 1,040 to 219.

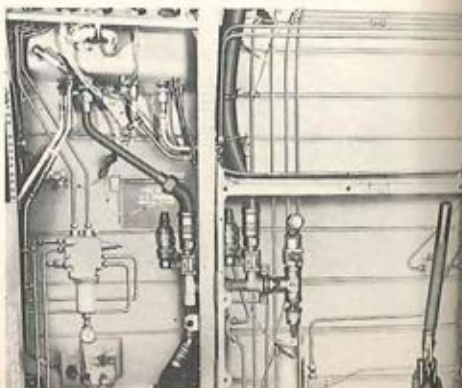
Just like the transmission, with the reduction in number of lines, the reduction in hydraulic hoses and tubes gives greatly decreased vulnerability. The best illustration of what's happening is shown in two pictures. Remember what the right side of the ramp area used to look like? **Figure 1**, look at it now, **Figure 2**.

APU modification

The fourth change the **Auxiliary Power Unit**. Probably the biggest change that is readily noticeable is that the APU is no longer connected to the **Accessory Gear Box (AGB)** on the aft transmission. No longer will the crew have to worry about shearing the AGB drive shaft. The drive shaft will be replaced by a right angle gearbox mounted on the front of the APU, thereby eliminating the possibility of a quill shaft failure.

An APU-mounted starter/pump, in the pump mode, will provide all of the direct hydraulic power required for ground operations, systems checkouts, and main engine starting. The starter/pump, besides providing the utility hydraulic system, will power

FIG. 2—THE REDUCTION IN HYDRAULIC HOSES AND TUBES AS VIEWED NOW.





Systems Description (Cont. from Page 26)

ide power for each flight control hydraulic system by means of a motor/pump transfer unit connected in parallel with each flight control pump.

The APU will also provide electrical power by having a 20 KVA generator mounted on the APU. This will provide all the electrical power necessary for ground operations and electrical subsystem checkouts.

The fifth improvement is another plus for the reduction of vulnerability. Previously, the main electrical wire bundle ran through the drive shaft tunnel and as the old infantry saying goes "one round could get them all". Now, there are **two redundant wire bundles**, each for complete systems support, placed along the sides of the cabin ceiling.

There is also a provision for increased electrical loading so the aircraft will have power for improved avionics, aircraft survivability equipment, and blade de-icing, if required. This will be provided by two 30/40 KVA oil cooled, brushless generators mounted on the aft transmission.

Reducing pilot workload

The aircraft is going to have an **Advanced Flight Control System (AFCS)**. This will aid in reducing pilot workload in the cockpit. This system is designed to improve stability, maneuverability, and, of course, of most importance, safety. The

current CH-47 fleet exhibits some stability problems when it is under heavy load or high density altitude conditions.

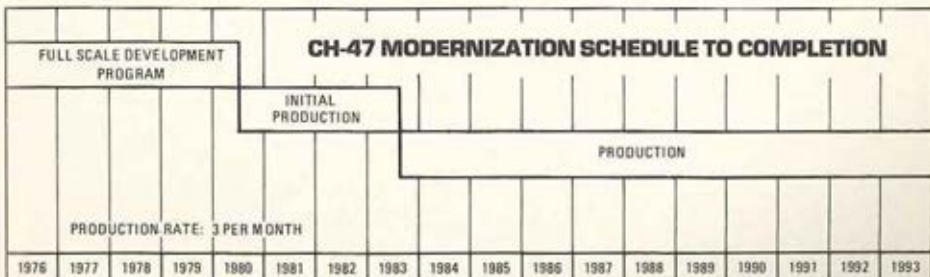
The AFCS will improve load acquisition time, confined area operations, adverse weather flights, and night and low level flight capabilities.

The seventh modification is the **multi-cargo hook**. The triple hook configuration has many benefits. It will allow flights with external loads at much greater speeds, thus increasing the amount of cargo moved in a given period of time. It'll also provide much greater stability and more diversified cargo handling, and give the aircraft much more flexibility in the types of loads it can carry.

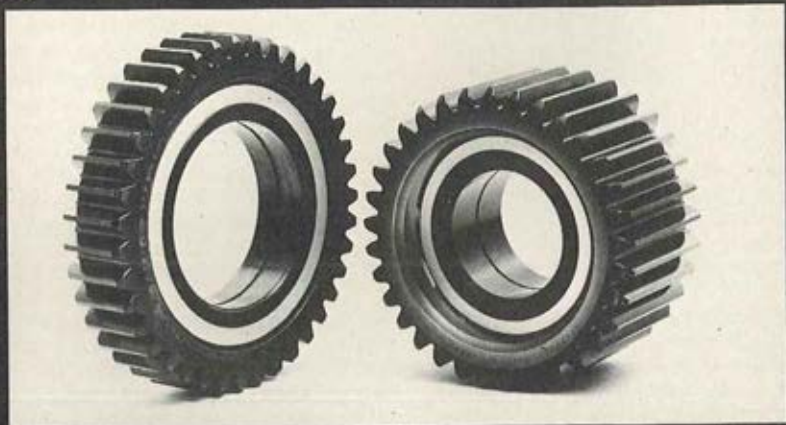
The new T55-L-712

Another item that is not a part of the modernization R & D program, but will have a big impact on the flying capabilities is the **new T55-L-712 engine**. The aircraft will have an engine with a very high degree of reliability and, the biggest bonus of all, contingency power. Contingency power of about 4,500 shaft horsepower gives the aircraft the capability to fly for 30 minutes at max gross weight with one engine gone.

The aircraft may look a lot like its predecessors, but it has changed in places where it really counts. The modernized Chinook will be able to operate more efficiently for much longer periods of time with less maintenance required. This means the CH-47D will be able to better provide the support that the ground commander needs. ★



SKF bearings help Boeing gear-up Chinook.



These unique SKF bearings are integrally geared spherical roller assemblies for the Chinook planetary drive system.

They are just one of 11 new precision aircraft bearings SKF is making for the new CH47D Chinook helicopter.

Why SKF?

SKF produces more bearing sizes and types than any other manufacturer.

Backs each one with advanced technology and outstanding quality.

These are the reasons why Boeing has worked with SKF on Chinook development right from the start. And why you can count on SKF, too.

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SKF

Our people make the critical difference.

SKF INDUSTRIES, INC.



Technology

(Cont. from Page 29)

The methods of applying these materials to rotor blade structures were developed during the **Heavy Lift Helicopter (HLH)**, **Advanced Technology Component (ATC)**, and the **Utility Tactical Transport Aircraft System (UTTAS)** Programs. A new series of rotor shapes were designed to improve lift characteristics over the previous CH-47 airfoils. The efficient manufacture of these rotor blades required the development of a means to position fiberglass tape with precision.

Enter ATLAS!

Our manufacturing methods and technology (NM&T) group kicked off a program in early 1970 to build the equipment we needed. A prototype, commonly called the **ATLAS (Automatic Tape Layup System)**, proved that it was possible to rapidly build rotor blade components and at the same time avoid human error.

ATLAS was the prototype of follow-on production equipment to manufacture our new rotor blades (**Figure 1**). The automated blade layup, combined with precis-

ion tooling, is the reason we expect to manufacture our blades at less cost.

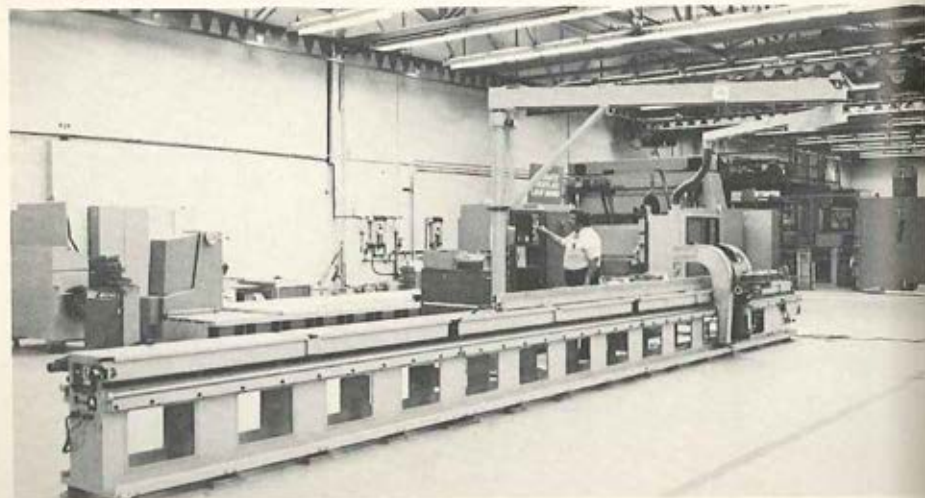
A new drive system

The modified **Chinook** will employ a broad range of advanced technology in its integrally cooled drive system. The new drive system is rated at 7,500 horsepower when under full power from both T55 engines. The five transmissions required to operate the aircraft are: forward, aft, combining, and one for each engine. The transmissions feature technology developed and tested in earlier programs.

The benefits we get from this system will be expressed in terms of improved reliability and maintainability. This occurs due to the better matching of transmission rating with engine power and the use of improved high temperature, long life gear material. We have added individual oil coolers on each of the three main transmissions eliminating a great deal of plumbing.

Another innovation in the drive system is the use of fiberglass sumps. The use of these sumps reduced weight and increased ballistic tolerance.

FIGURE 1: THE AUTOMATIC TAPE LAYUP SYSTEM (ATLAS) THAT HAS SPED THE MANUFACTURE OF CH-47 BLADES.



A major step forward was the elimination of bolted gear and shaft joints. We now use one piece prime gears to avoid the problems that occurred with bolted connections. Improved micro-miniature strain gauge installations now permit these instruments to be used on developmental gear teeth. They can actually measure gear stresses while the transmission is operating. The long life steels used in the drive system gears and rotor shafts will be subjected to improved ultrasonic quality inspection.

This is a continuous process from the time of their initial forging to final delivery of the finished product. The transmission cases are made of an improved magnesium alloy and coated with a corrosion inhibiting jacket. This overcomes a problem common to existing transmission cases, and holds great promise in extending case life.

Modularized design

The hydraulic system we are putting in the modernized CH-47 is the product of multiple technology sources. The flight control and utility hydraulic systems will be of a self-contained, modularized design and located in the forward and aft pylons. The remaining subsystem components will also be modularized and connected to a centrally located hydraulic service panel. This easy availability is going to account for a real reduction in maintenance tasks.

Improvements in flight control system survivability have been achieved. This advantage was gained through the use of newly designed, integrated, lower control actuators and jam-proof upper boost actuators. The entire hydraulic system is designed to use the new fire retardant hydraulic fluid (MIL-H-83282). The system will provide reliability and maintainability improvements most visible to the man in the field; namely, the elimination of numerous leak points and greatly simplified troubleshooting.

The CH-47D capitalizes on the tremendous advancements made in the electronics industry. Previously an automatic flight



FIGURE 2 — THE CH-47D'S NEW MULTIPLE HOOK SYSTEM IS SHOWN DURING FLIGHT.

control system, developed by Boeing, was refined for installation in the Canadian CH-147 in 1972. Further advancements have allowed us to cut the size in half and at the same time, improve producibility, reliability, and maintainability. Added to these highly desirable qualities is an increase in system capability and precision.

The electrical generators for the CH-47D will have parts designed with improved industry standards and technology. These result in added generating capacity, higher efficiency, and increased reliability.

Multiple hook system

Last, but certainly not least, the modified Chinook features a new multiple hook system (Figure 2.) A forward and aft external cargo hook will be added to the existing single hook configuration. The additional equipment will increase the external load stability and flexibility for cargo delivery.

These two additional hooks are rated at 20,000 pounds each and the center hook has been uprated to 28,000 pounds. The added hooks will provide the capability to transport multiple loads of varying types



Technology

(Cont. from Page 31)

and densities at speeds up to the CH-47D power limit airspeed.

Additionally, loads can be delivered to one or more field units with a significantly shortened turnaround time. The multiple hook concept, as developed by Boeing Vertol, was based on extensive analytical and wind tunnel model testing, and finally was verified in actual flight test. The system was field tested by our U.S. Army Aviation Engineering Flight Activity at Edwards Air Force Base. Two CH-47C aircraft equipped with the triple hooks are currently in service with the 101st Airborne Division at Fort Campbell.

One of the more exciting new features being investigated is the gondola that can be used for rapid loading and transporting break-bulk cargo or special mission equipment. A good example would be the equip-

SFTS'S ON TAP!

The CH-47 Synthetic Flight Training Systems will be activated at Ft. Campbell in Jan 82; USAREUR in Mar 82; Ft. Sill in Jan 83; Ft. Bragg in Mar 83; and Ft. Lewis in May 83.

ment needed for an airmobile forward area refueling and rearming point. The gondola concept was an engineering achievement of our Applied Technology Laboratory at Ft. Eustis, VA, and is evidence of our broad research and development effort.

The CH-47 Modernization Program could not have been undertaken without the combined and dedicated work of both Government and industry research and development personnel many years ago. Funding of our aviation research and development efforts will continue so that technology can be advanced and the benefits provided to the field soldier and commander. ★

cost effective flight control

for the U.S. Army/Boeing Vertol

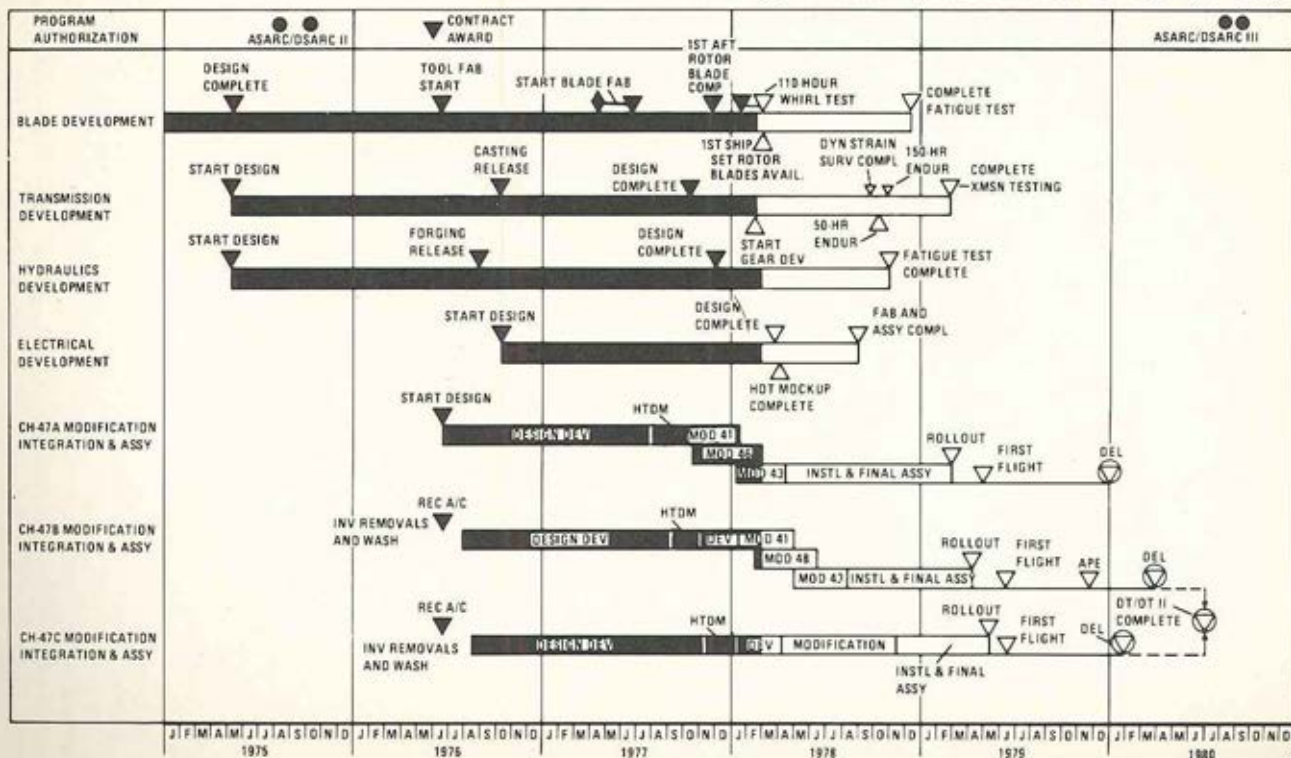
Chinook modernization program

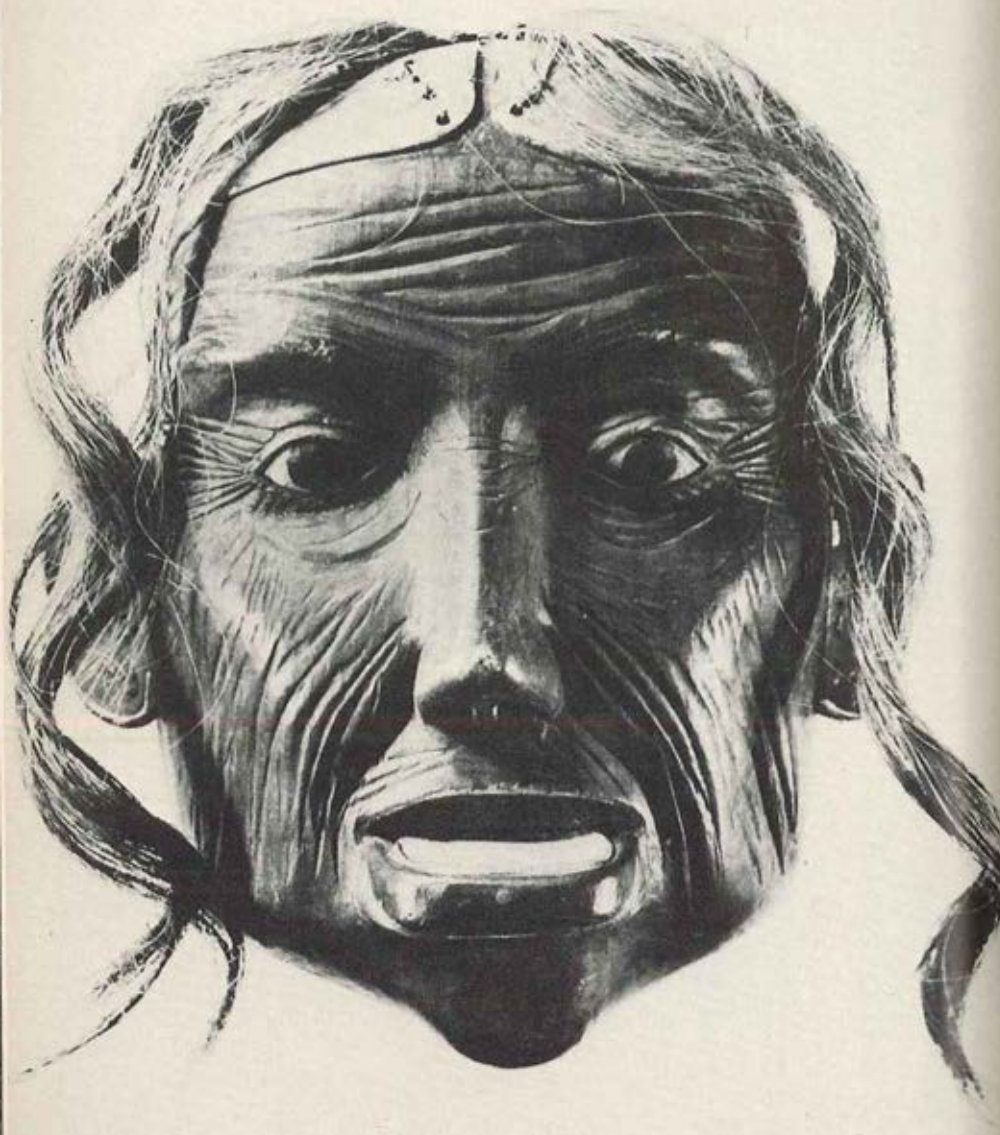
Honeywell

AVIONICS DIVISION

SCHEDULE PERFORMANCE

Costs and schedules are tracked using the Triservice validated cost/schedule control system. To date, the full scale development program is proceeding on schedule and is below target cost. (Cost data is on p. 16).





What is a Chinook?

THE CH-47 "Chinook" takes its name from a fascinating tribe of Indians whose simple fishing villages once lay scattered along the banks of the lower Columbia River from the Cascade Mountains down to the Pacific.

The Chinook were short people with artificially flattened foreheads, crooked legs, thick ankles, and broad, flat feet.

As peaceful fishermen, they were superb canoe handlers and excellent swimmers who lived bountifully off the Columbia River salmon which returned from the sea each year to spawn in the upland shallows of the river.

They also hunted for deer, elk and other inland game; gathered roots, berries and acorns and would occasionally go out to sea to hunt for seals and whales.

These pagan people revered the tammawis — the guardian spirits of the volcanic Cascade peaks — and Mentonee, the mythical high priestess of the Great Oversoul whose altar, they believed, had once been on an ancient stone bridge which stretched over the Columbia from Mt. Adams in Washington to Mt. Hood in Oregon.

Chinook society

Their villages were usually nestled quietly among the fir trees near the mouths of the sparkling tributary rivers and streams which flowed into the Columbia. The villages usually contained several large communal dwellings solidly built of wooden planks with interior walls of woven mats.

Three or four families lived in each of these homes, and there was a sunken fire pit in the middle of each building. Smoked fish and

game would invariably be hanging from the rafters.

Chinook society was based on these small, independent villages, each of which had a head man or chief whose influence rested on the strength or soundness of his personality. No formal tribal structure existed beyond the village level, but informally, the Chinook traded extensively among them-

selves, and for several thousand years they prospered at the hub of a vast network of intertribal trade and travel. This area stretched from California to Alaska and went far inland to the western edges of the Great Plains.

At one time, the high-prowed seagoing canoes of the great northern tribes, the Haida and the Tlingit - manned by as many as 50 warriors and

packed with barter goods - would glide ashore on the sandy beaches of the lower Columbia alongside the smaller canoes of the Pacific coastal tribes.

Wheeler-dealers

The Klamath, Modoc, and Yakima would travel overland from the interior of Oregon and Northern California, and these beaches in the heart of the Chinook homeland became crowded trading centers for goods such as animal furs, stoneware and copperware, woven baskets and blankets, domestic tools, dried fish and game, sea salt, dried seaweed, and a great variety of sea shells - particularly the highly valued white dentalium, a tusklike shell which was used as money in the region.

The Chinook acted as hosts, middlemen, and shrewd bargainers. Their language was

WHAT IS A CHINOOK?

- (a) A Columbia River salmon?
- (b) A warm Pacific wind?
- (c) A tribe of American Indians?
- (d) A medium-lift cargo helicopter?
- (e) An Alaskan mountain goat?
- (f) A town in the State of Washington?
- (g) An acorn ripened in a damp pit?
- (h) None of the above?
- (i) All of the above?



spoken by thousands of Indians belonging to the Chinookan family of tribes, and was also the foundation for the Chinook Jargon, a combination of several tongues which was spoken as a second language by Indians throughout the Pacific Northwest trade area.

In the midst of all this, a lively trade in slaves existed. The Chinook usually acquired slaves in barter from the southern tribes and would then trade them for a profit in the north or inland. Occasionally, however, they would launch their own slave raids against the distant villages of another tribe.

Lewis and Clark estimated that there were about 16,000 Chinook when their cross-country expedition reached the mouth of the Columbia in 1805.

Good neighbors!

The tribe quickly developed good relations with the traders at Ft. Astoria, which was established on the southern bank of the Columbia in 1811, and they got along very well with the British and American hunters, trappers, traders, and settlers who soon began to flow into their region.

The Chinook Jargon picked up a few words and phrases from several European languages and then remained the "lingua franca" of the Pacific Northwest.

In 1829, a terrible epidemic swept the tribe, killing four out of every five people, and only a few hundred of the Chinook survivors made it into the 20th century. Those few were dispersed onto several different reservations where they were assimilated almost entirely into the population of several other tribes.

Over the years, the tribe has lent its name to:

- the Chinook salmon — great silvery monsters weighing up to 80 pounds each, which the Chinook were wise to catch for themselves since salmon now costs close to \$5 per pound.
- the Chinook wind, which flows down the slopes of the Rocky Mountains from the Pacific, melting the snow and bringing mild, springlike weather,
- the Chinook helicopter with which the readers of this journal are familiar.
- the town of Chinook, Washington, which used to be the principal village of the tribe, and
- Chinook olives, which are — according to an old Indian recipe — acorns ripened in a urine-soaked pit.

To the best of our knowledge, however, the name of the Chinook has never been applied to an Alaskan mountain goat.

— Dale Kesten



Training Readiness

(Cont. from Page 37)

Cost effective training

Key factors in cost effective training are the reduced manpower and improved equipment reliability. Both of these critical factors weighed heavily in the improved design of the CH-47.

The CH-47 Modernization Program will eliminate the numerous inadequacies in the current medium lift helicopter fleet which adversely affect mission performance and training. Improvements are being made in flight safety, reliability, availability, maintainability, vulnerability, and survivability. These advancements will enhance the training aspects significantly for both the unit and the institutional training commander.

It is necessary that the Aviation Center's training of CH-47 aviators complement the requirements of the field commanders since the CH-47 is the keystone to successful airmobile operations. The commander's ability to carry out airmobile operations effectively is linked directly to the availability of his medium lift helicopter assets.

Plans and operations for airmobile warfare are centered around realizing the maximum effectiveness from the CH-47 aircraft, especially in terms of rearming and refueling scout and attack helicopter tank-killing teams employed en masse.

Continuous combat support

A successful battlefield operation requires continuous combat service support to sustain the effectiveness of the firepower of the combat elements which is essential in maintaining the momentum of the attack. Unless the firepower and staying power of the combined arms team with its anti-tank aviation forces are sustained through a responsive resupply system, we may lose the first battle.

The present CH-47 fleet has suffered from low availability and low mean time between failure, requiring a high number



THE 2B31 SIMULATOR

of maintenance man-hours per flight hour. Since institutional training utilizes contract maintenance, the advent of the **Modernized CH-47D** should increase savings in maintenance and facilitate an expansion of the training program, if required.

A favorable influence

Numerous improvements in the CH-47 will certainly have a favorable influence upon training, such as the redesign of systems to increase flight performance and ease of maintenance.

Modifications which reduce failure rates and increase reliability in the combat environment improve maintainability significantly in the peacetime environment. Among these are the extended life of the rotor blades (through use of composites) and increased reliability of the aircraft engines. In addition, redundant and simplified hydraulic and electro-mechanical systems should reduce the number of mechanically-related accidents.

The improvements in adverse weather capability will facilitate not only combat operations but also the training program when adverse weather is encountered in the training environment. The improvements in aircraft instrumentation which includes a pilot-assist system for altitude and heading hold as well as a radar altimeter, will facilitate flights in close proximity to the terrain, essential for survivability

HIGH PERFORMANCE COOLING



Sundstrand provides all the high performance cooling fans for the YCH-47D Helicopter; three shaft-driven fans used in transmission cooling and three electric motor-driven fans used for hydraulic system cooling. These fans are designed for high performance and high efficiency in a smaller, lighter package. More importantly, reliability and maintainability have been improved by design.

Sundstrand's proficiency in designing high performance fans has been refined by the acquisition of Task Corporation. With expertise in Army programs ranging from vehicles to aircraft, Sundstrand has the know-how to meet your requirements and assure program success.

SUNDSTRAND 

Committed to aerospace growth.



Training Readiness (Cont. from Page 38)

in a high threat environment.

The improved multihook stabilizes external loads and allows them to be carried closer to the aircraft, thereby enhancing terrain flight. The CH-47 cockpit has been reconfigured to enhance night operations which will also facilitate night training in a more realistic environment.

Simulator now in use

The present CH-47 aviator qualification course is being revised currently to include the CH-47 flight simulator, which recently completed operational testing, and was expected to be fully integrated in the aircraft qualification course in the latter part of March, 1978.

The CH-47 flight simulator, which was designed to simulate both instrument and visual flight conditions through the use of

a terrain model board, will increase the cost effectiveness of aviator training significantly.

Other proposed revisions in the training program include emphasis on night and terrain flying. The CH-47 initial entry training program should start in FY 80 under the aegis of the multi-track training program.

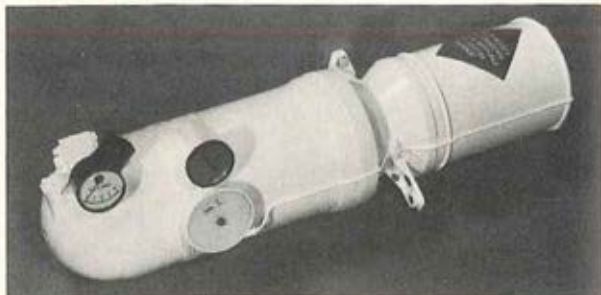
In mid FY 82, the Aviation Center will receive one of the first **Modernized CH-47D** aircraft off the production line. The modernization program, which extends over a relatively long period of time, will upgrade the institutional training fleet at the same time as the total fleet.

Just as the airmobile commander must get the maximum utilization and effectiveness from his limited number of CH-47 aircraft, so must the training center. The **Modernized CH-47** will allow the Aviation Center to be more responsive to the demands of the Army to train the trainers and produce well-qualified CH-47 aviators. ★

LIGHTWEIGHT HYDRAULIC ACCUMULATORS

—LIKE THE ONE USED IN THE CH-47 CHINOOK HELICOPTER

- Capacities up to 500 cu. in.
- Self-contained
- High-cycle life
- Fragmentation proof
- Self-displacing
- High reliability



One of the many outstanding product lines—including aircraft fire detection and extinguishing systems, pneumatic compressors, spacecraft flight controls, and aircraft pneumatic valving—from the experienced Aerospace team at

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Much has been said about the CH-47 Modernization Program that has been oriented toward the maintainability and reliability improvements that will be made.

So that the pilot will not think he has been forgotten, I will discuss the improvements as the pilot will see them. I'll use an imaginary flight to describe the operation of the modernized CH-47D.

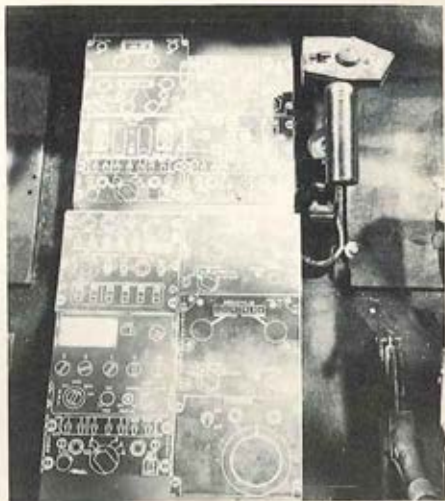
Having finished the preflight inspection and crew briefing we are ready to go. Battery switch on; Interphone checks good; "Ready on the APCU"? "Fire guard is posted; ready on the 'P' sir."

You move the **Auxiliary Power Unit (APU)** switch to the start position momentarily and release it. Everything else is automatic. An **Electronic Sequencing Unit (ESU)** has been installed that incorporates **Built-in Test Equipment (BITE)**.

If the APU fails to start, there is a visual code display on the ESU that will tell the crew chief what component to troubleshoot. As the APU comes up to speed you note that the APU tachometer is no longer installed and the overtemp, overspeed, and oil pressure warning lights have been removed as the ESU monitors all of these functions.

A visual code display

When the flight control hydraulic warning lights go out you turn on the APU generator to supply AC and DC power for ground checkout. On the CH-47D the auxiliary gear box has been eliminated. The aft transmission still has two generators and one flight boost hydraulic pump installed;





The Pilot's View (Cont. from Page 41)

The engine condition controls have been moved to the overhead console with the exception of the engine trim disable switches and the emergency beep which have been retained on the radio console for better accessibility.

The new family of more reliable radios replaces the old remoted ones. There will be an AN/APX100 Transponder and the KY58 will replace the KY28. The AN/ARN123 receiver will provide a full ILS capability.

Continuing the ground checkout you see that the hydraulic pressure gauges have been moved to a maintenance panel located in the right rear ramp area of the aircraft; however, all of the failure warning lights have been retained on the master caution panel in the cockpit.

Ready to "Start"

You are ready to start the engines. "Fire guard is posted; ready on Number One" reports the crew chief. On the overhead console start panel one finds a single switch for each engine. There are three position switches labeled **OFF-MOTOR-START**.

The co-pilot moves the number one start switch to **start** and then at 15% N, the pilot moves the number one condition lever to **ground**. At 45% N, the co-pilot moves the switch to **off** and the start is completed. In the event of a hot start the co-pilot would simply release the spring-loaded start switch to return to the motor position which allows motoring the engine for cooling.

With both engines started and stabilized the co-pilot reaches up to the engine condition control levers and slowly moves them forward to the flight position. The rotor RPM is beeped up to 225 RPM which will be constant for all gross weights.

The instrument panel has two new items: the **Cruise Guide Indicator (CGI)** and the radar warning receiver. The CGI



PILOT'S INSTRUMENT PANEL

will give the pilot an indication of the actual dynamic loads imposed on critical components in flight so that he can utilize the aircraft to its maximum capability. This was installed in the newest "C" models and is being retrofitted to other CH-47C aircraft. The radar warning receiver will indicate to the pilots the bearing and distance from where they are being painted by radar.

The advanced flight control system (AFCS) is located on the canted console control panel. Prior to take off the pilot checks to ensure that the coupled heading and altitude hold switches are **off**, that the Stability Augmentation System (SAS) are both **on**, and that the speed trim system is in the **automatic** mode.

After take off and on reaching in-level flight we can turn on the AFCS altitude and heading hold and set the heading "bug" to the desired heading. As the aircraft rolls itself out on the set heading, we note that we are at 130 knots airspeed. By beeping the "cooley hat" switch on the cyclic forward, the **differential airspeed hold system (DASH)** accelerates the aircraft to 160 knots, and altitude remains constant.

To assist in navigation we can utilize the Doppler Navigation System. The Doppler system is capable of giving bearing and distance to any of ten pre-selected check points and is independent of any ground signal. To assist in terrain clearance we can set the radar altimeter warning alarm to a desired absolute altitude.

If our cargo were a milvan with the total weight of 15,000 pounds, we can handle it even at a density altitude of 4,000 feet and 95° temperature.

The aircraft is capable of hovering out of

ground effect at these conditions and climbing at 200 feet per minute with this selected load. At a sea level standard day we can lift over 22,000 pounds and still hover out of ground effect and climb.

For a load of this kind we would use the forward and aft hooks due to the increased load stability and higher airspeed capability. The forward and aft hooks are rated at 20,000 pounds each and the center hook is rated at 28,000 pounds. For external loads we have a great deal of flexibility because we can carry loads with any of the three hooks or in tandem.

Avoiding hostile fire

If we are in a hostile environment the terrain is still our ally. If we know where the enemy is located we will use our Doppler navigation to best avoid hostile areas. However, if we are detected by radar the radar warning indicator will give us a relative bearing to the radar so that we can avoid it.

If the worst happens and we come under fire, we know that the vulnerable areas of the aircraft have been reduced significantly. Notable is the capability to run the transmission for up to 30 minutes with no oil. Also, the fiberglass rotor blade will be capable of withstanding a hit from a 23 MM HE1 and survive.

Night flying aids

For better night flying ability, the cockpit will be painted black and a new plastic overlay will be installed on the radio console to prevent light from being reflected on the windshield.

For instrument flying the AFCS and DASH systems will provide an extremely stable platform. Together with a full ILS capability and a radar altimeter the instrument capability should be greatly improved. The reduced pilot workload and increased performance will result in a far more productive helicopter at reduced operating costs. ★

Congratulations...

*to the U.S. Army/Boeing Vertol Company
on the success of the CH-47 Modernization
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CONSOLIDATED CONTROLS CORPORATION





Mechanic's View (Cont. from Page 44)

For example, the new fiberglass blades actually look different than the metal blades. By different, I mean **better** because they are going to be stronger, last a lot longer, and be easier to fix.

They won't corrode like the metal blades and won't have as many problems with **Foreign Object Damage (FOD)**. Boeing talked about how they can repair the blades and it sounded simple with a lot being done right on the airplane. They look safer, too, because even when they are damaged they can fly a long time before they break.

A "beefing up"

The engines, transmissions, and power train has been beefed up to take stress and still last longer between changes. The transmissions have new materials and each one will have its own lubrication systems

so if one fails it won't contaminate all the other ones. They also will be removed "on-condition" instead of "time change". With good troubleshooting procedures and some diagnostics like the Vibrex system, downtime is really going to be reduced.

A lot of changes are being made in the hydraulics, particularly in reducing the number of lines and leak points. Most of the hydraulics are going to be modules and easier to troubleshoot and replace.

The fittings are rosan-type which require only one wrench to replace. Another good change is having a "fill module" so a mechanic can service and add fluid to any reservoir from one place.

A big help to the maintenance of hydraulics is going to be the maintenance panel in the aft cabin. With this panel the crew chief will be able to see the status of key things in the flight control and utility hydraulics systems. It will show pressure, temperature, and fluid levels and warning lights will show when filter or pump replacement is needed.

Easier troubleshooting

The APU is also being improved and changed by mounting the existing generator on it and adding **Built-In Test Equipment (BITE)** to it. This will let the crew chief check out all the systems on the ground without starting the main engines. The **BITE** will make it a lot easier to troubleshoot the system.

The engineers are moving a lot of components around and making them easier to get at to repair, replace, and service. This is what the engineers call **accessibility**, but to me it means I can get my hands and tools in to work on components without skinning my knuckles and banging up other components in the process. They are using the soft-core mockups to work out these problems and it is really paying off.

I know all of the mechanics at Bragg are really looking forward to the first **D** model like a kid looks for a new bike at Christmas. Overall, the CH-47D looks real good as the Chinook of the future and it was certainly designed with us in mind. ★



POWER SERVICE—PVT Donald Skulich (sitting) and SP4 Roger Anderson wait for PVT Michael Bailey to put the finishing touches on a Chinook's port engine so they can remount it on the bird. The men of Co C, 158th Avn Bn serviced the CH-47 from stem to stern during a phase maintenance operation. The 101st Abn unit did the "switch" during an April 3-14 field exercise near Russellville, Kentucky.



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That's why the Army's Modernization Program relies on Clifton actuators to help extend the CH-47 Chinook's life to the year 2000. Why Clifton's Attitude Director Indicator was chosen for the AH-1S Cobra Program. And why there are no less than five Clifton avionics components as part of the CH-46-E Modification Program.



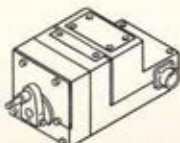
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**Electromechanical
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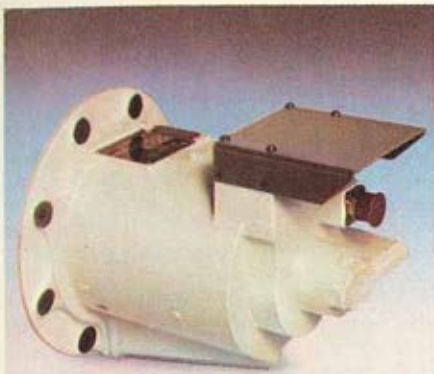


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The electronic generating control unit contains all the elements necessary for the full control and protection of the system.

Just some of the reasons Boeing Vertol chose Lucas for the YCH-47D Chinook.



Lucas Aerospace. A partner in today's international aviation industry meeting the challenge of tomorrow.

Setting the pace into the '80s. And beyond.

Lucas Aerospace



USAREUR Report (Cont. from Page 49)

ed reliability and maintainability features built into the aircraft which will provide more flight time for fewer maintenance manhours.

The specific improvements we're looking forward to seeing, and some of which we need right now, are:

- ... the multi-hook system with its capability to stabilize outside loads;

- ... an advance flight control system and related navigation systems which will permit low level precision navigation in very marginal weather while substantially reducing pilot fatigue;

- ... the integrated aircraft survivability equipment (ASE) suite which enhances the built-in survivability features when operating against modern threat weapons;

- ... and improved single engine capability provided by the product-improved T55-L-712 engine.

Multiple FARPS supported

Forward Area Refuel and Arming points (FARPS) can be configured to support specific attack helicopter missions. With the new CH-47D and the external gondola the sortie can deliver the basic load of fuel and ammunition to re-supply an AH-1 heavy fire team.

This capability will enhance the mobility of the attack helicopter teams greatly for the attack helicopter will not be tied to ground transportation for fuel. Multiple refuel and arm points can be employed giving the commander a high degree of flexibility.

Another plus is the ability to move these points very rapidly, and the ability to establish new points just by agreement over the radio or by prearrangement. All of this gives the attack helicopters the ability to stay much closer to the FEBA and this provides much better support for the ground commander.

Infantry, Armor, and Artillery will also benefit from the modernized Chinook.



They'll not only receive better, closer support from attack helicopters, but they'll benefit directly. The modernized Chinook is envisioned having an internal cargo loading system, one that will allow for the direct transfer of more than 4,500 lbs. of palletized cargo from USAF transports to the CH-47D.

This loading system will give the Chinook a much faster turnaround time in that loading and unloading will be simplified. A unit with an urgent need for resupply will now be able to expect a much faster response. Also, by using the external load gondola, one CH-47D company can easily supply the daily needs of a 155mm self-propelled howitzer company in under ten hours.

Pinpoint deliveries

With the capability to tailor its payloads, the modernized CH-47D will be able to pinpoint deliveries down to the squad level.

To more realistically support the corps now, and in preparation for the 1980 time frame when each will have their own aviation group with two assault support helicopter companies, each corps currently has the dedicated support of an assault support helicopter company.

These CH-47 assets are actively supporting current training needs and high-priority transportation requirements. As our capability increases we will be able to fully support each corps, as well as USAREUR, and ultimately free the anti-tank helicopter from its surface-bound logistic support. ★

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Chinook- support for the ground commander.

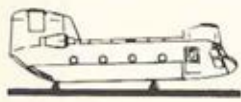
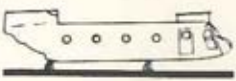
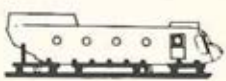
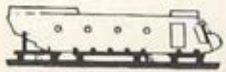
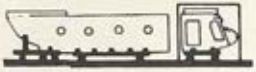
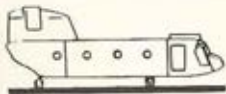


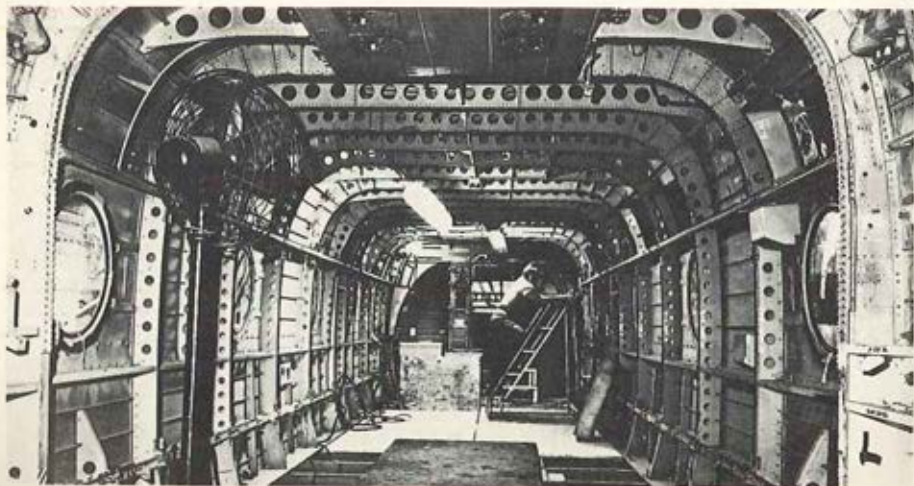
As an assault-support, medium-lift helicopter, the Boeing Chinook has displayed legendary airlift capabilities, whether taking in firepower, troops and field supplies or taking out recoverable equipment and the wounded.

Currently in production, the Chinook is serving the U.S. Army and military forces in seven other nations. At the same time, ongoing fleet modernization programs are utilizing advanced technologies to standardize the Army's fleet to the CH47D configuration...to reduce life cycle costs...and to assure continuous ground force support into the 21st century.

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4  ENGINEERING DESIGN DEVELOPMENT	5  STRUCTURE MODIFICATION - DESPLACE COCKPIT SECTION AND LOAD IN MAJOR JIG - INCORPORATE STRUCTURAL MOD ECPs - INCORPORATE "D" MODEL STRUCTURE MODIFICATIONS	6  STRUCTURE MODIFICATION - RESPLACE COCKPIT - SPLICE AFT PYLON - INSTALL LANDING GEAR AND REMOVE CRADLES - STRIP AND PRIME AIRCRAFT EXTERIOR - PAINT AIRCRAFT INTERIOR



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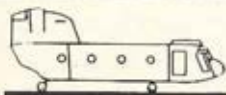
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CH-47 MODERNIZATION PROGRAM

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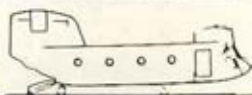


7

COMPONENT INSTALLATION INSTALL:

- ELECTRICAL EQUIPMENT
- HYDRAULIC EQUIPMENT
- CONTROLS
- DRIVE SYSTEMS

REVIEW INSTALLATION



8

SYSTEMS DEVELOPMENT INSTALL:

- ELECTRICAL WIRING
- TUBING



9

FINAL ASSEMBLY INSTALL:

- DOORS
- PODS
- RAMPS
- GLASS
- FAIRINGS
- SEATS
- FLOORS



10

FUNCTIONAL TEST

- PROOF LOAD
- SHAKE TEST
- RAIN TEST
- PAINT AIRCRAFT EXTERIOR
- INSTALL INSTRUMENTATION



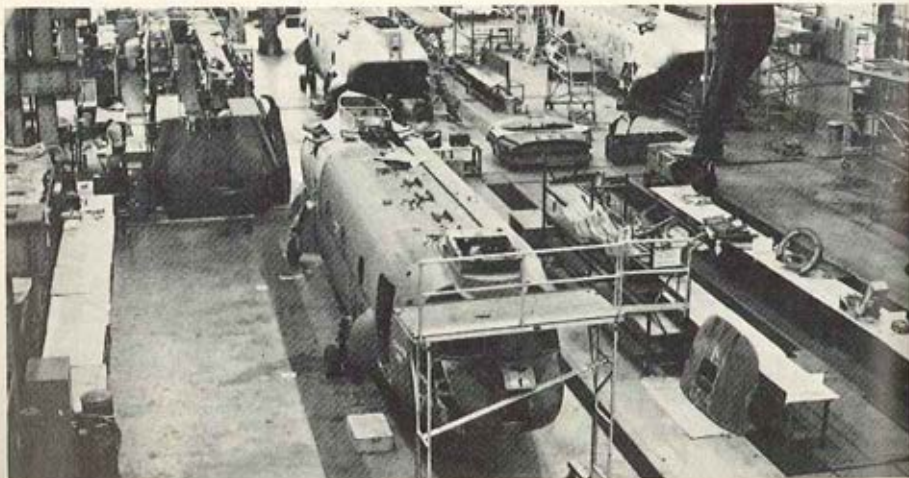
11

PREFLIGHT



12

FLIGHT





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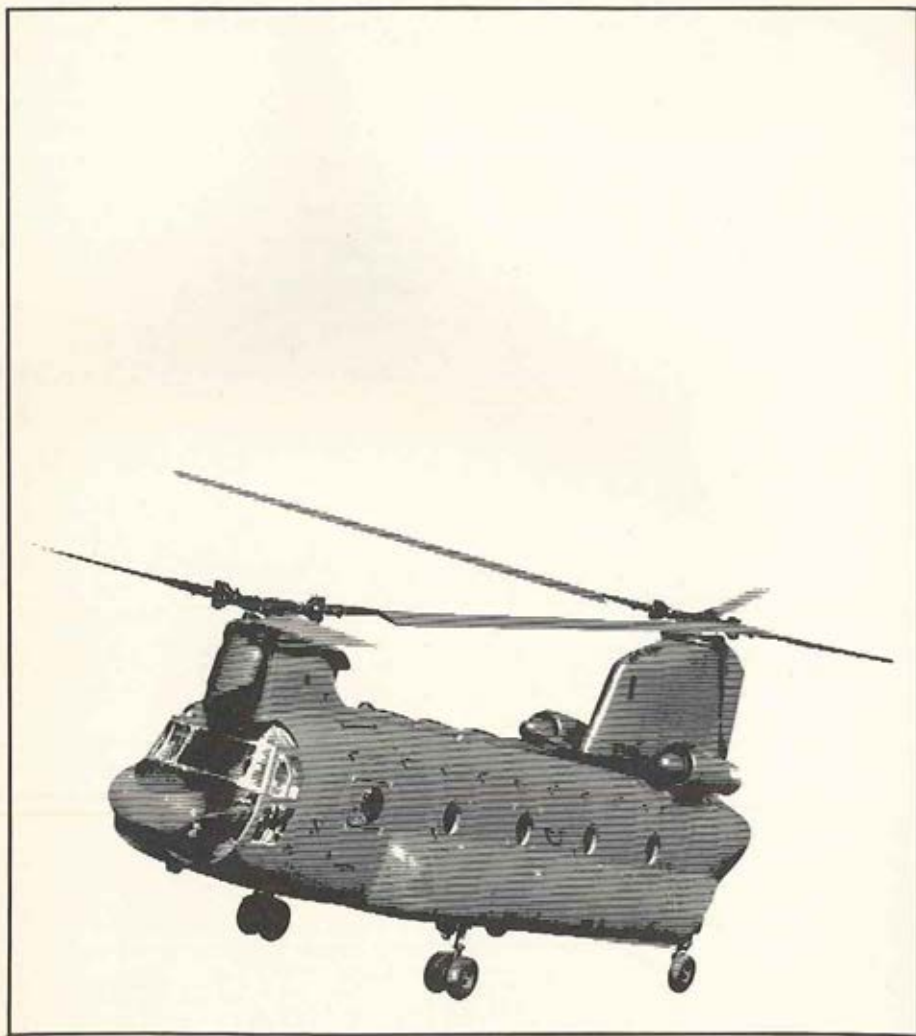
The Boeing Vertol CH-47 medium lift helicopter is among many aircraft taking advantage of the reliability of castings by Wellman Dynamics Corporation. Wellman has produced 24 various configurations for the Chinook, including the Combiner Housing, Aft Housing, and Forward Transmission Housing in AZ91 T6 magnesium alloy to specification QQ-M-56. We specialize in high integrity aluminum and magnesium castings for the aircraft, missile and aerospace industries. This experience and intense technology contributes to the reliability of our castings and translates into cost-effectiveness over the life cycle of these programs. For information call:



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CH-47D Testing (Cont. from Page 59)

vides some visibility on the extent of Boeing subcontractors' component testing.

At Boeing's facility, component testing is concentrated on the structural qualification of dynamic components. Rotor blade fatigue testing, initiated in January 1978 on specimens sectioned from the new fiberglass rotor blades, is currently at its peak. Fatigue testing verifies the structural integrity of components under the severe alternating loads encountered during flight.

Simulated flight conditions

The test setup simulates flight conditions by simultaneously applying axial load (centrifugal force), flapwise bending, chordwise bending, torsional moments and lag damper loads. Blade testing has demonstrated the fail-safe characteristics of fiberglass rotor blades compared with metals.

Visual indications and gradual loss of stiffness provide an easily detectable warn-

ing long before fracture. Sections from all areas of the blade are fatigue tested and static tests are conducted on an entire blade.

Fatigue test fixturing

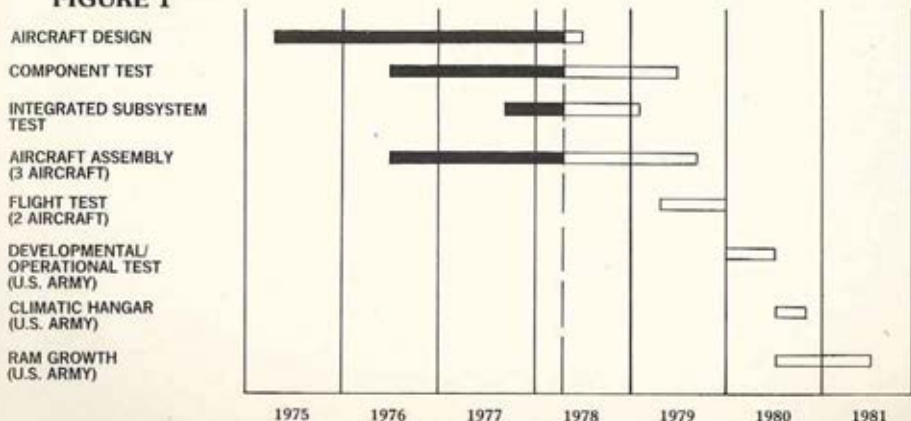
Fatigue test fixturing is being fabricated and assembled to conduct tests on the control system (actuators, drive collar, and slider) drive system (synchronizing shaft details, cross shafting, forward and aft rotor shafts, forward transmission cover) and rotor hub (pitch housing) components. These components have been redesigned for the YCH-47D and will undergo the structural testing required for fatigue substantiation.

Integrated subsystem testing was initiated with the 110-hour whirl test (Figure 2). Fiberglass rotor blades were tested with a CH-47 rotor hub. Instrumentation on the blades and the whirl tower provided technical data on rotor blade stresses, dynamic characteristics, and performance.

The technical data verified analytical predictions and provided the first measurements of rotor blade aerodynamic performance. The data, corrected for whirl tower ef-

MODERNIZED CHINOOK DEVELOPMENT QUALIFICATION TEST PROGRAM

FIGURE 1





CH-47D Testing (Cont. from Page 61)

fects and evaluated for aircraft installation, show a positive lift margin for the YCH-47D mission requirements. The 110-hour whirl test was completed 7 March 1978, three weeks ahead of schedule.

Subsystem integration testing will continue with qualification testing of the forward, aft, combining, and engine transmissions. The transmission improvements include a change to VASCO X-2 steel for gears and a single piece gear design for the spiral bevel ring gear in the forward, aft, combining, and engine transmissions. Gear ratio changes have been made to provide optimum performance at 225 rotor RPM operation.

130% factor

The qualification program includes 950 hours of test time in three test cells at Boeing. Loads up to 130% of twin engine h.p. will be applied. In addition, testing will demonstrate the auxiliary lubrication system and the transmissions will be run with lubrication systems inoperative.

The gears for the engine/combiner transmission testing have all been received from Litton Industries. Engine/combiner transmission assembly is now in work and testing will start in May 1978.

An Avionics Integrated Test Facility (Hot Bench) has been constructed, debugged, and functionally checked. Its purpose is to provide an avionics system check prior to aircraft installation. The design, i.e., physical clearances, connector compatibility, mounting provisions, and functional characteristics, is confirmed and any problems resolved to minimize the impact on the program schedule.

"Black Boxes"/The Iron Bird

One shipset of "black boxes" that has been operated satisfactorily in the facility is shown in **Figure 3**. The physical arrangement is in accordance with the aircraft installation. The facility was used in March by the Army Avionics R&D Agency of Fort Monmouth, to verify aircraft compatibility with the KY-28 Secure Voice System.

The Flight Controls Integration Test Facility (Iron Bird) (**Figure 4**) provides a capability to confirm the functional characteristics of the flight controls/hydraulics/wiring systems. This capability will resolve any interface problems in advance of aircraft installation.

The Iron Bird contains flight control components (bellcranks, linkages, and actuators), hydraulic modules, and the necessary electrical connections. It comes complete with pilot's and copilot's controls. Functional and system testing will begin in August of this year.



62

Figure 2



Figure 3



Figure 4



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CH-47D Testing (Cont. from Page 62)

Functional and system testing will begin in August of this year.

Flight testing will be conducted by Boeing Vertol utilizing two of the three YCH-47D helicopters in late 1979. The program contains the essentials for aircraft qualification: Flight Load Survey, Structural Demonstration, Vibration Survey, Propulsion Survey (Engine/Airframe), and Mechanical Instability Testing. Also, Performance Demonstration, Electrical System Demonstration, Hydraulic System Demonstration, Flying Qualities Evaluation, and Maintenance Demonstration.

Over 400 data channels will be recorded during the program which includes approximately 170 flight hours. The flying program will provide the flight envelopes necessary to release the aircraft for U.S. Army testing.

Flight program preparations

In preparation for the flight program, 85% of the instrumentation drawings required have already been released and long lead items ordered. Fixturing for calibration of instrumented components is currently being fabricated. The flight test data display and reduction capability is in place and operational. Flight safety will be monitored using data telemetered to the ground station during flight.

In conjunction with the Boeing Vertol flight tests in the fall of 1979, the Government testing will begin with 25 hours of **Preliminary Airworthiness Evaluation (PAE)** testing to verify flight safety and performance requirements. In addition to PAE tests, the Government will conduct icing, military utility, operational, climatic hangar, and RAM verification tests.

The **icing test**, which will provide the data to substantiate aircraft flight in icing conditions, will be conducted in artificial icing provided by the **Helicopter Icing Spray System (HISS)**. The Aviation Engineering Flight Activity will conduct the

test in the winter of 1979-1980 using one YCH-47D prototype aircraft.

TECOM will conduct military utility and RAM supportability tests at Fort Rucker to demonstrate the adequacy of training and maintenance support; to evaluate safety, human factors and supportability; and to assess RAM characteristics. In the two-aircraft program, one aircraft will be used for military utility and both to produce reliability and maintainability data. The four-month program will entail 280 hours of flying.

Climatic testing

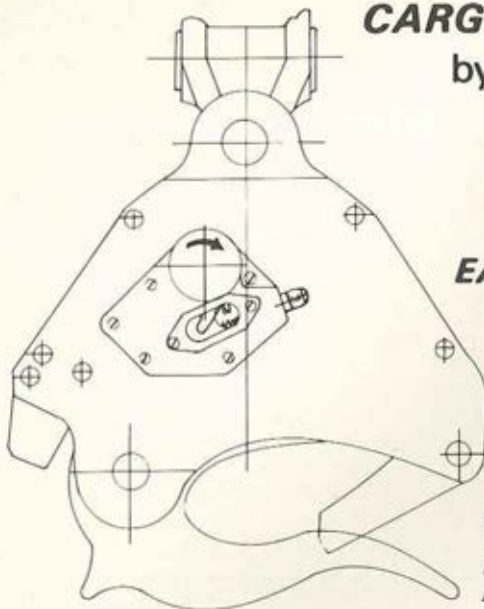
Testing covering -50°F to 125°F will be conducted in the Climatic Hangar at Eglin AFB. The three-month program will involve 30 hours of tiedown tests on all aircraft systems excluding rotor blades.

RAM growth tests will be conducted at Fort Rucker (temperate), Yuma Proving Grounds, AZ (desert), Fort Carson (high altitude), and Fort Greely, AK (Arctic) by TECOM. This extension of RAM-S testing will accumulate 700 flight hours.

Operational Test II (OT II) will involve typical Army flight crews on both CH-47C and YCH-47D aircraft. The two-aircraft, two-month program is based on logistical supply support, artillery movement, engineer movement, troop movement, and battlefield recovery missions. Supportability and aviation unit maintenance will be evaluated using manuals, tools, and test equipment in the maintenance support package. Currently, OTEA proposes the OT II testing at Fort Bragg.

In summary, the YCH-47D test program is a coordinated effort between Boeing, AVRADCOM, TECOM, OTEA and AM-SAA. The total program includes component tests, integrated subsystem tests, contractor flight tests, and U.S. Government testing of the YCH-47D at a variety of locations under the extremes of the operational environment.

In short, we are on course with the test program, satisfied with our progress to date, and optimistic as we approach the flight test phase. ★



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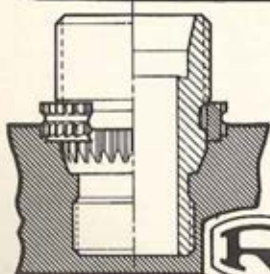
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The U.S. Army CH-47D Modernization Program Project Management Team



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BURG
3805/3806



ACTING CHIEF PROPULSION- DYNAMIC SYSTEM

MR. RON E.
HEITER
3805/3806



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MR. FRED
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The CH-47D Industry Team





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A DIVISION OF THE BOEING COMPANY
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PHILADELPHIA, PENNSYLVANIA 19142

HOWARD N. STUVERUDE
PRESIDENT

The U. S. Army's new CH-47D Medium Lift Helicopter employs the most advanced technology available today in the helicopter industry. The CH-47D program as envisioned by the Army in 1975 called for the application of advanced technology systems and equipment together with utilization of the substantial residual value in existing fleet airframes; the result to be a cost effective alternative to a new development program. Boeing Vertol, which has been the Army's supplier of medium and heavy lift technology and aircraft for over twenty-five years, was ready to perform to the Army objective.

New technology components for improved reliability, availability and maintainability are continually evolving at Boeing Vertol. This evolution has been accelerated in recent years with development, testing and demonstration on the YUH-61A (UTTAS) and YUH-62A (HLH). The CH-47D incorporates these advanced technology components in its hydraulics, avionics, flight controls, electrical and drive systems and rotor blades.

To assure meeting the Army's development schedule and to increase confidence in the new dynamic systems performance goals achievement, we have improved the Army's schedule by over four months at Boeing Vertol. All contract milestones have been met and the overall program cost target is being underrun. Performance on the CH-47D development was judged superior in the Army's latest evaluation of our attainment of design-to-cost targets. This performance is due in part to our supplier team which was selected because of its proven track record in providing highly reliable equipment on time at competitive prices. The new "Chinook" will be demonstrated in flight early in 1979. I am confident that the performance it will display will reflect the achievement of the Army's program objectives.

H. N. Stuverude

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Banning...Deutsch/Electrical Components
Brea.....Kirkhill Rubber Company
Burbank.....Bandy Hinge, Inc.
Burbank.....Sunbank Electronics
Canoga Park.....L.A. Aircraft
Costa Mesa.....Narmco Materials, Inc.
Costa Mesa.....Standford Applied Engrg.
Culver City.....Collins Engineering Corp.
Duarte.....Ronson Hydraulics
Dublin....Hexcel Structural Products (23)
El Segundo.....Crissair, Inc.
Gardena.....Rubber Teck, Inc.
Gardena.....Teledyne Linair
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Los Angeles...Aeroquip Marmon Division
Los Angeles.....Allen-Fry Steel Company



CH-47D Chinook involvement is national!

The U.S. Army - Boeing Vertol CH-47D Modernization Program provides jobs on a national basis with employees in 20 states and the United Kingdom taking part in the program. The following three pages list more than 138 of the program's major CH-47D sub-contractors. The number appearing in parentheses indicates the page number on which the firm's tie-in message to the US Army/Boeing Vertol Chinook Program may be found.



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Newbury Park.....Symetrics, Inc.
Newport Beach.....Rosan, Inc. (66)
Paramount...Weber Metals & Supply Co.
Pittsburg....Dexter Corp. Hysol Division
Redondo Beach...Tiernagel Metals & Supply
San Diego.....Solar Turbines Int'l (20)
San Marcos.....Teledyne Aero
Santa Ana.....ITT Cannon Division
Santa Ana....Lear Siegler Transport Dyn.
Santa Ana.....Standard Pressed Steel
Santa Ana.....U.S. Polymeric, Inc.
Sylmar.....Valley Todeco, Inc. (66)

CONNECTICUT

Bethel.....Consolidated Controls (45)



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CONNECTICUT (Continued)

Bristol.....Associated Spring
Farmington.....Connecticut Spring(88)
Naugatuck.....Lewis Engineering & Mfg.
New Britain.....Fafnir Bearing Company
New Britain.....Fenn Manufacturing Co.
Stratford.....Avco Lycoming Div(17)

FLORIDA

St. Petersburg.....Aircraft Porous
Media (18-19)

ILLINOIS

Bellwood.....Borg Warner Spring Div. (77)
Broadview...Amphenol Connector Division
Chicago.....Litton Precision Gear (79)
Elgin.....CR Industries (58)

St. Paul.....Minnesota Mining & Mfg. Co.

MISSISSIPPI

Jackson.....Sperry-Vickers Aerospace (89)

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NEW JERSEY

Belleville.....Kidded-Belleville Div. (40)
Bellmawr.....Tube Sales, Inc.
Hillside.....Plessey Dynamics Div. (63)
Linden.....Bowstell Corporation
Lyndhurst.....Benedict-Miller, Inc.
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Rockleigh.....Arwood Corporation
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CH-47D Chinook involvement is national!

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ILLINOIS (Continued)

Rockford...Barber-Colman Aircraft Prod.
Rockford...Sundstrand Aviation Mech (39)
Wheeling.....Smalley Steel Ring Co. (83)

IOWA

Creston.....Wellman Dynamics Corp. (57)

KANSAS

Wichita.....Associated Company (70)
Wichita.....Globe Engineering Company

KENTUCKY

Louisville.....Chemtron Tube Turns Div.

MARYLAND

Baltimore.....M & S Supply Company

MASSACHUSETTS

Boston.....First Electronics Corp.
Marlboro...A&M Engrg. Composites Corp.
Southwick.....B & E Tool Company
Springfield.....Titeflex
Taunton.....Hercules, Inc.
Waltham.....W.H. Nichols Company (90)

MICHIGAN

Jackson.....Aeroquip Aerospace Division
Madison Heights.....Facet Filter Products

MINNESOTA

Minneapolis.....Hitchcock Industries (66)
St. Louis Park.....Honeywell,
Inc. Avionics (32)

NEW YORK

Brooklyn.....Lee Spring Company
Clifton Springs...Wright Components, Inc.
East Aurora.....Moog, Inc.
Farmingdale...General Mechatronics (84)
Plainview.....General Aerospace (89)
Glen Cove.....Limeo Manufacturing Co.
Hauppauge.....Generation Metals Corp.
Jamestown...Marlin Rockwell Corp. (43)
Lindenhurst...Russell Plastics Tech. (87)
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Maspeth.....S & L Metal Products Corp.
New Rochelle.....Teledyne Hydra Power
Ozone Park.....Ozone Industries, Inc. (51)
Smithtown...Gull Airborne Instruments (77)
Watertown.....New York Air Brake, Inc.
Westbury.....Arkwin Industries, Inc. (55)

NORTH CAROLINA

Gastonia.....Garlock, Inc.

OHIO

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Cleveland.....Alcoa
Dayton.....United Aircraft Products (79)
Niles.....RMI Company (60)
Painesville.....Fluid Regulators Corp.
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- McDonnell F-15
- General Dynamics F-16
- Lockheed S-3A
- Boeing-Vertol CH47C
- Douglas A4/TA4, DC-8, DC-9, DC-10
- Boeing 747
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United Aircraft Products will supply five of these plate-fin coolers for each Boeing Vertol CH47 Chinook Helicopter being modernized by the Army. The coolers use fan air to cool transmission oil for the forward and aft rotor transmissions, the combiner transmission, and two engine gearboxes.

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ARPRO Engineers Messrs. D. Scartelli, P. Kambies, and A. Paranch discuss future reviews of 984 drawings prior to production.

Regulations (ASPR) which have been delegated by the PCO.

In a nutshell, the Division insures that the prices paid to the contractor are fair and reasonable. There is currently very little pricing support required for the CH-47 Mod Program since it is an RD&E contract; however, the ACO must stay abreast of progress and any modifications to the contract. He is the on-site representative for the PCO and must protect the government's interest.

Engineering Division

Concurrent with the development of the prototypes, the Engineering Division assures that the contractor complies with the engineering and technical requirements of the contract in accordance with U.S. Army procedures and regulations.

Army Office engineers attend design review meetings and program management meetings at the contractor's facilities. Reviews are made of the engineering drawings and changes, material substitutions, contractor's material standards, manufacturing processes and technical publications for approval or other actions required. Material Rejection Reports and the proposed engineering disposition on manufactured components are reviewed for approval or correction as part of the local Material Review Board Requirements.

The contractor's **Design-to-Cost (DTC)** trade studies are also reviewed and comments provided to the **Program Manager's Office (PMO)**. The contractor's DTC pro-



ARPRO-BV Inspectors Mr. Kirchhoff and Mr. Carey accomplishing inspection of modification rework on cockpit section of 001 aircraft.

gram is evaluated and his performance rated in the areas of management of the program, technical content, early incorporation into prototype, accurate submission of baseline cost data and timely identification of reliability and maintainability commitments. Although it sometimes does not appear so, there are people in the procurement cycle who are interested in preventing design errors which impact unfavorably upon the cockpit and maintenance environment. The engineering division functions in this capacity and although they don't win all battles, at least they raise the issue for further review.

Production/Industrial Division

It may come as a surprise to personnel who have never been at a contractor facility, but the U.S. Government provides much of the plant equipment, materials, and components used by the contractor. Consequently, the plant office is responsible to maintain surveillance of the contractor's control and use of accountable government property. These items can vary from major items of plant industrial equipment to small avionics components.

A **Government Property Unit (GPU)** is established to secure and account for supply items used by the contractor and functions very similarly to military supply systems. All items are accountable to a specific contract and on a monthly basis the Division reviews and certifies DD Form 610 (Government Furnished Equipment/ Government Furnished Material) requirements. It maintains daily communications with the Government Property Custodian



ARPRO-BV (Cont. from Page 81)

in regard to rejects, shortages, and/or other discrepancies on the DD Form 611 (Monthly Status - Shortage Report) and maintains follow-up to supply depots on critical items and shortages.

The Division assists the contractor and PMO in the requisitioning of replacement items as appropriate. The Division is also responsible to monitor the contractor's production schedule and in those instances where delivery dates are not met must notify the contractor in writing of the discrepancy. These procedures are very important as they are used in determining contractor compliance and fiscal compensation.

Quality Assurance Division

The Quality Assurance (QA) Division insures that the contractor produces a product which complies with all appropriate specifications. This is accomplished through a combination of process and procedure reviews, sampling inspections, and surveillance activities. When the three CH-47 prototypes were delivered to the contractor, QA personnel closely monitored all phases of contractor disassembly to assure the validity of work statements and procedures.

During the development of the airframe overhaul procedures, QA personnel verify critical points of modification so that when

the aircraft is ultimately reassembled those areas which are covered meet specifications.

An Army QA plan is concurrently being developed to identify key inspection requirements for use when the CH-47 Modification Program comes on line. The individual inspector works much as a military technical inspector, stamping the contractor's Operation and Inspection Record cards to indicate the specified repair/assembly has been approved.

As a consequence, by the time the item is ready for final acceptance there has been continuous quality verification. However, in addition to the concurrent inspection, each aircraft receives a thorough final inspection prior to first government flight. The excellent aviation safety record maintained by the Plant Office is a testimonial to the value of a thorough quality program.

Cost/Schedule Monitor

In line with DOD's emphasis upon contractor cost controls, the Cost/Schedule Control System Criteria (C/SCSC) of DOD Instruction 7000.2 has been included as a contractual requirement on the CH-47 Modification Program. A full-time Industrial Cost/Schedule Monitor, who is team leader, is assigned the overall responsibility for the coordination and accomplishment of the total C/SCS surveillance function. However, since C/SCS surveillance requires participation of the varied expertise of the Plant Office, collateral assignment



COL LUSTER, LTC WEAVER, MAJ THOMPSON, AND CW3 GREGORY (ARPRO-BV) IN FRONT OF THE 725TH ARMY CH-47C, THE LAST ON THE CURRENT PRODUCTION CONTRACT.



ARPRO-BV INSPECTORS, MR. WELSH AND MR. TASKER, ACCOMPLISHING AN INSPECTION ON THE CH-47D COMPOSITE BLADE FOR CONDUCTOR STRAP BONDING.

are made to specialists within the functional divisions to serve on the Surveillance Team.

The Surveillance Team is charged to perform surveillance on the accepted Boeing Vertol management system, monitor and evaluate the Cost/Schedule Control effort, and report findings to the Project Manager's Office.

To achieve the objectives the Surveillance Team evaluates the maintenance of the C/SCS System and renders an in-depth evaluation of C/SCS data generated by the contractor. They maintain a continuing program of review and analysis of current progress and effectiveness of program activities accomplished in relation to the CH-47 Modernization Program objective, budgetary limitations, schedules, and scope of work

Summary

In summary, the Plant Representative Office is tasked to provide a full range of

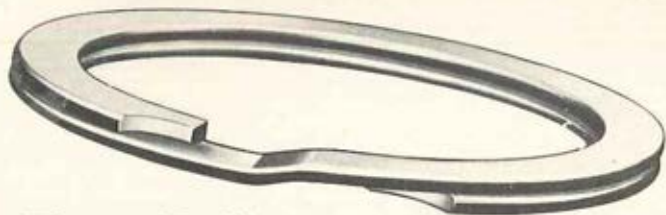
NEXT MONTH

The June, 1978 issue of ARMY AVIATION will devote a major part of its 96-odd pages to the general subject of "Aircraft Survivability Equipment (ASE)." Colonel Jack L. Keaton, ASE-PM at DARCOM, will present a comprehensive "editorial package" of 17 articles to update our readers. □

support to the PMO. Through close and constant scrutiny of the contractor's operation, it is possible to insure contractor compliance while keeping dollar expenditures to the lowest level consistent with developing and producing a quality product.

The final test is the fielding of an aircraft which will accomplish operational requirements while providing the best return for the dollar. You, as the consumer/operator, will render the ultimate judgment as to the effectiveness of the Plant Representative Office.

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GENERAL MECHATRONICS



CORP.



Today & Tomorrow (Cont. from Page 85)

The best use of this inherent characteristic has taken place in Europe; primarily in NATO but also in the providing of the Spanish Army CH-47's to support French Army maneuvers. In NATO the Chinook is an excellent example of an item of equipment that meets the intent of rationalization, standardization, and interoperability.

The Chinook has been selected by four NATO countries; Canada, Italy, United Kingdom, and the United States, and by C.A.G. Agusta in Gallarate, Italy. The T55-L-11 engine is manufactured by both Avco Lycoming and Rinaldo Piaggio S.p.A. of Italy. In addition to the obvious advantage of standardization, the Chinook is used throughout the National Forces of NATO to increase their interoperability.

Within the past year CH-47's from USAREUR have supported the 1st Belgium Paratroop Battalion, 4th Canadian Mechanized Brigade, 3/251 Airborne Battalion of the West German Army, and the 21st SAS Regiment of the British Army. Another aspect of interoperability is the

Mission loads suited to CH-47C and D, but not to the A or the B.

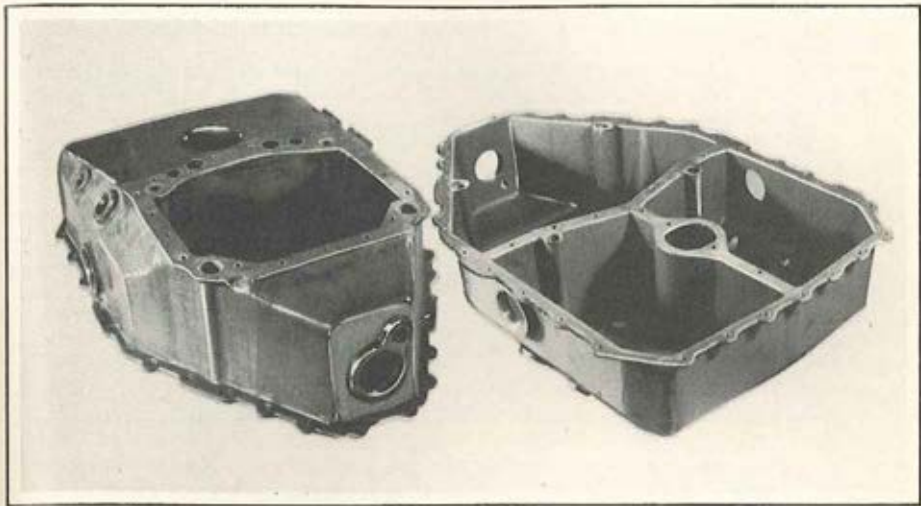
	M55 5 TON TRUCK (XLWB)
	CH-47 (SELF RETRIEVAL)
	5 TON TRUCK
	M577 TRACKED CARRIER
	XM106E1 SP MORTAR
	M113 PERSONNEL CARRIER
	D6B TRACTOR DOZER
	HD6M TRACTOR DOZER
	2½ TON SHOP VAN TRUCK
	XM198 (155 HOW)
	2½ TON TRUCK
	M114A1 (155 HOW)
	FLOATING RIBBON BRIDGE
	UTTAS (RETRIEVAL)
	AAH (RETRIEVAL)

use of bi-national formations of helicopters. U.S. CH-47 and FRG CH-53, to move troop units of both the U.S. and West German Army.

WORLDWIDE DEPLOYMENT OF CH-47



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Today & Tomorrow (Cont. from Page 86)

my. Problems have been few and the conduct of the operation has been reduced to a Standard Operating Procedure.

Today the Chinook program is at its midpoint. Able to look back at the first production aircraft, SN61-2408, which was delivered in 1962, and note that it is still operating in California, to have learned the lessons provided from over 1,550,000 flying hours of which over 900,000 were in support of ground combat operations, to reflect on the lowest accident rate of all Army rotary wing aircraft and to look forward to another twenty years of continued operation of today's fleet and an even better Chinook, the CH-47D.

The success of the CH-47 in providing support to the ground commander can be attributed to two key elements. First is the willingness of the Army Aviator, regardless

of the operating unit, to fly the aircraft where the support was needed, when it was needed, often disregarding the ground threat and his own personal safety, and second, the continual improvement of its capabilities by the U.S. Army, international users and Boeing Vertol.

Further improvements needed

However, as the threat increases, further improvements are required if the CH-47 is to continue its unqualified support of ground combat operations, whether the aircraft is operated as an integral part of the 101st Airborne Division or the 6th Cavalry Brigade (Air Combat) or as a Corps element in support of the 3rd or 8th Infantry Divisions, the 2nd Armored Cavalry Regiment, or the 4th Transportation Brigade.

To continue providing priority resupply of ground combat units, maximizing the capability of the Cobra and AAH, and battlefield recovery, the Army is improving the CH-47 in several ways. First, items



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Today & Tomorrow (Cont. from Page 88)

Aircraft Survivability Equipment (radar warning receiver, flare dispenser, missile warning detector, and low reflectivity paint) are being procured and will be installed on the **Chinook**; second, installation of a radar altimeter and doppler navigator as well as improvements to internal and external cargo handling are being developed to facilitate terrain flying and; third, the vulnerability/ survivability features of the CH-47D.

Tomorrow, after the build-up of the CH-47 fleet in U.S. Army Europe, the delivery of the current backlog of 104 CH-47's to international customers and the start of CH-47D deliveries, the CH-47 will still provide priority movement of troops, equipment, and supplies throughout the area of operations teamed with the **Black Hawk**, **Cobra**, and **AAH**.

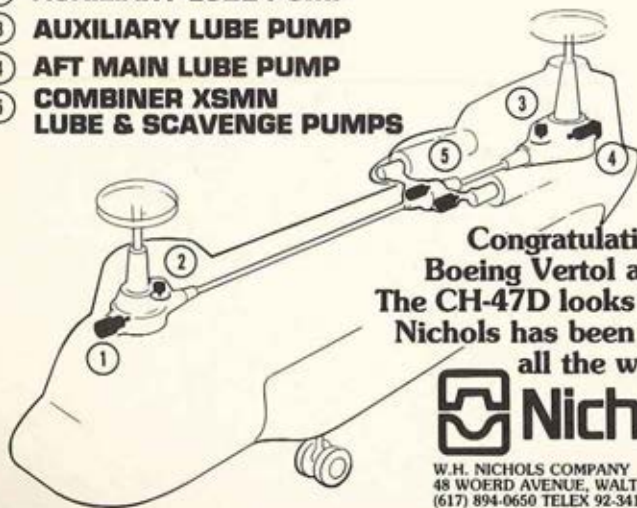
The advanced proven technology of the CH-47D will further facilitate terrain flying through improved aircraft control and load stability. If hit the **Chinook** will be more survivable against threat weapons through use of the fiberglass rotor blades, systems redundancy, and reduction in vulnerable area.

A promising tomorrow

Standardization and interoperability will be enhanced since the D model, with its increased productivity and lower operating costs, will enable all CH-47 users to meet their MLH fleet requirements with their present aircraft through the 1990's.

The soundness of the **Chinook's** original requirements and the helicopter produced in response, plus the policy of constant improvement followed by the U.S. Army, international customers, and Boeing Vertol and the dedication of Army Aviation personnel to mission accomplishment, make tomorrow very promising. ★

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Quest for Flight

(Cont. from Page 12)

engineers, it was not until he was over 60 that some thought they detected signs of senility: **Chanute** began gliding experiments on the sand dunes near Chicago.

Much influenced by **Lilienthal**, he had a fertile imagination. He built biplane, triplane and even quinqueplane gliders. All flew with varying degrees of success. But **Chanute's** greatest contribution to aviation was his work on stability and control. Not keen to throw himself about inside his glider, he designed movable control surfaces. In doing so he brought the glider to the limit of its usefulness. At the age of 70 in 1902 he suddenly saw the error in his ways, henceforth remaining firmly earthbound. By this time, however, he had become a firm friend of **Orville** and **Wilbur Wright**.

Man-carrying "Aerodromes"

Samuel Pierpoint Langley, the third distinguished secretary of the Smithsonian Institution, was an astronomer, mathematician, and inventor. In the 1890's he built a number of model aeroplanes, which he called 'aerodromes', which flew successfully. In December 1898 with the United States engaged in a little fracas with Spain over Cuba, the War Department, casting its collective mind to a recent local conflict, gave **Langley** \$50,000 with which to construct a man-carrying aerodrome. Not for the first time, the major hurdle to be overcome was the acquisition of a suitable engine, and this was not forth-

coming until the spring of 1903 when his principal assistant, **Charles Manly**, built an engine himself. Weighing 187 lbs, it developed 53 HP a remarkable achievement.

Headlong into the river

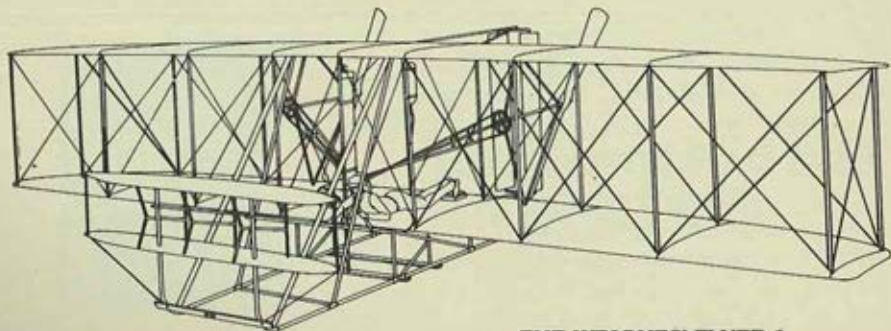
By early October the machine was ready for its first flight. Instead of running it along a rail **Langley** decided, to the later discomfiture of his assistant, to put **Manly** at the controls and catapult his machine off a houseboat moored on the Potomac River. On 8 October 1903 **Manly** applied full power, the catapult was released, and the aerodrome plunged headlong into the river.

The **Washington Post** reported in its inimitable way: 'It simply slid into the water like a handful of mortar'.

Manly was unhurt and the wreckage was salvaged. On 8 December **Manly** tried again. With the engine straining, he waved to indicate that he was ready to go. He was released; the rear wing structure collapsed; and the luckless **Manly** was again unceremoniously deposited into the chilly waters of the Potomac, this time tail first.

Langley's efforts were greeted with howls of derision from the Press. A Congressional investigation into the waste of public money was demanded, and Government funds were cut off. **Langley** morosely joined the long list of heart-broken pioneers (although with all his arms and legs intact) and died three years later. Nevertheless, nobody had pursued the subject of aeronautics more carefully or scientifically than he or left such voluminous notes.

Nine days after **Langley's** second disaster,



THE WRIGHTS' FLYER 1

Orville Wright made man's first powered, sustained, and controlled flight in an aeroplane.

"SUCCESS FOUR FLIGHTS THURSDAY MORNING ALL AGAINST TWENTY-ONE MILE WIND STARTED FROM LEVEL WITH ENGINE POWER ALONE AVERAGE SPEED THROUGH AIR THIRTY-ONE MILES LONGEST 57 SECONDS INFORM PRESS HOME CHRISTMAS OREVELLE WRIGHT"

This telegram to his father in Dayton, Ohio had another error besides the misspelling of **Orville's** name: the actual flight time was 59 seconds.

Enter the newspaper publishers!

The **Wright** brothers' interest in aviation was awakened in 1878 when their father gave them a toy helicopter. Their first business venture, however, was printing and the publication of a newspaper. They then turned to building and repairing bicycles.

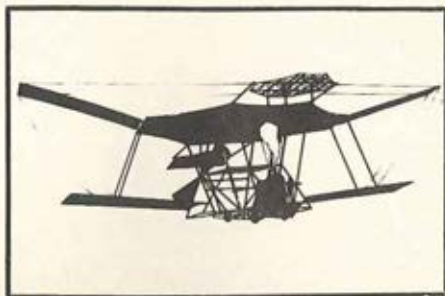
In 1899 they read about **Lilienthal's** exploits which fired their imaginations and started them off on serious work on the problems of flight. They did not succumb to the temptation, like many before them, to try powered flight before they had learned to fly. Their first tests in 1899 and 1900 were made with kites followed by tethered gliders.

In 1901 and 1902 they progressed to free glider flight. Their major problems were "those relating to the balancing and steering of the machine after it is actually in flight." But after much research, and trial and error, and the observation of birds, they hit upon the idea of warping the wings by means of control cords. This allowed the pilot to increase the lift on one wing while decreasing it on the other in order to hold the wings level or to bank the aeroplane for a turn.

The vertical fin, however, still caused the glider to wallow and skid and so it was converted into a movable rudder and connected to the wing-warping controls. Over 1,000 glides were made during this period.

The "Do-it-yourselfers"

With the problems of balance and control more or less solved, the next step was to build a new machine with an engine. They could not find any manufacturer willing to try and build an engine of 8 HP and not weighing more than



SIR HIRAM MAXIM'S FOLLY

180 lbs. So they, too, built their own — one of 179 lbs. that delivered 12 hp. By November, 1903 the biplane with two pusher propellers, a front elevator, and rear rudder, was ready. It weighed about 750 lbs. and had a wing span of 40½ feet.

Kitty Hawk, NC, according to the U.S. Weather Bureau, was one of the windiest places in the country. The nearby Kill Devil Hill area contained mile upon mile of sand dunes and flat areas - ideal for both gliding and powered flight. And so in November 1903 the **Wrights** laboriously moved their machine down to Kitty Hawk.

On 14 December **Wilbur** was at the controls for the first flight. Unhappily he over-controlled the elevator at lift-off and a wing was slightly damaged. It was quickly repaired. On 17 December 1903 it was **Orville's** turn to lie flat on the lower wing of the 'Flyer 1' (later renamed **Kitty Hawk**).

59 seconds!

Five men and a boy braved the biting cold wind as **Orville** nonchalantly took her off the launch track covering about 120 feet in twelve seconds. The next two flights were nearly twice as long. On the fourth flight the **Flyer** was airborne for 59 seconds, covering 852 feet but, because of the head wind, a distance equivalent to half a mile.

This flight time was not to be exceeded, except by the **Wrights**, for nearly four years. While waiting for the fifth flight a gust of wind overturned the machine, severely damaging it. It never flew again and now hangs proudly in the National Air and Space Museum. The conquest had at last been achieved!

months takeoffs

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THE AAAA IN ACTION — MARCH-JUNE, 1978

- ☐ ☐ MAR. 30 — CORPUS CHRISTI CHAPTER. Professional luncheon meeting with COL Jack L. Keaton, Project Manager-Aircraft Survivability Equipment, guest speaker. Tides Club. Members and guests.
- ☐ ☐ APR. 1 — TAR HEEL CHAPTER. After dinner professional-social meeting with COL John J. Stanka, Jr., Chief, Aviation Division, ARNG, guest speaker. Greensboro, NC National Guard Armory. Members and guests.
- ☐ ☐ APR. 5 — WASHINGTON, D.C. CHAPTER. Joint Reception and Professional Luncheon Meeting with ANS, NAA, and AWA. Gerald J. Tobias, President, Sikorsky Aircraft Division, guest speaker. National Aviation Club. Members and guests.
- ☐ ☐ APR. 11 — PERSIA CHAPTER. Professional dinner meeting with MG James C. Smith, CG, USAVNC & Ft. Rucker, guest speaker. Election of '78-'79 Chapter Officers. Tehran Officers Club. Members and guests.
- ☐ ☐ APR. 18 — MAINZ CHAPTER. Late afternoon professional meeting with Bell Helicopter Textron representatives providing AH-1S update briefing. Finthen NCO Club.
- ☐ ☐ APR. 20 — AIR ASSAULT CHAPTER. Professional luncheon meeting with MG John N. Brandenburg, CG, 101st Abn Div (ASLT), guest speaker, and top junior enlisted aviation soldiers and junior NCO's as Chapter luncheon guests. Top Six Club.
- ☐ ☐ APR. 20 — LINDBERGH CHAPTER. Professional luncheon meeting with COL Jack L. Keaton, Project Manager-Aircraft Survivability Equipment, guest speaker. Engineers' Club. St. Louis. Members and guests.
- ☐ ☐ APR. 21 — DAVID E. CONDON CHAPTER. Professional luncheon meeting with COL George W. Shalcross, TRADOC Systems Manager for the ASH, guest speaker. Ft. Eustis Officers' Club. Members and guests.
- ☐ ☐ APR. 21 — PIKES PEAK CHAPTER. Professional luncheon meeting with COL Clarence L. Palnode, Project Officer for Advanced Optics, guest speaker. Ft. Carson Officers' Club. Members and guests.
- ☐ ☐ APR. 21 — FT. BRAGG CHAPTER. Professional meeting and "Aviation Dinner-Dance" with BG Joseph L. Kastner, ADC, 101st Abn Div (ASLT), guest speaker. Ft. Bragg Officers' Club. Members and guests.
- ☐ ☐ APR. 24 — RHINE VALLEY CHAPTER. Professional luncheon meeting with MG James C. Smith, CG, USAVNC & Ft. Rucker, guest speaker. Bergbrau Brewery-Leinen. Members and guests.
- ☐ ☐ APR. 25. MONMOUTH CHAPTER. Professional luncheon meeting with COL August M. Cienciala, Project Manager-SOTAS, guest speaker. Ft. Monmouth Officers' Club. Members. \$4; Non-members. \$5.
- ☐ ☐ APR. 26 — CONNECTICUT CHAPTER. Professional dinner meeting with COL Richard L. Kenyon, Project Manager-Black Hawk, guest speaker. Connecticut ARNG Army Officers' Club. Hartford, Conn. Members and guests.
- ☐ ☐ MAY 4 — SOUTHERN CALIFORNIA CHAPTER. Professional dinner meeting with MG Joseph H. Jagers, Jr., Commander, TRADOC Combined Arms Test Activity, guest speaker. Pacifica Hotel, Culver City.
- ☐ ☐ MAY 10-11 — 1978 AAAA PRODUCT SUPPORT SYMPOSIUM - Sponsored by the Lindbergh Chapter with Joseph P. Cribbins, Special Asst for Aviation Logistics, ODC-SLOG, Moderator, and MG Richard H. Thompson, CG, USA ISARCUM, Dinner Guest Speaker. Red Carpet Inn, St. Louis. Members and registrants.
- ☐ ☐ MAY 16 — COASTAL EMPIRE CHAPTER. Late afternoon "social" and briefing on "Savannah 1978" plans for First Region-AAAA Convention. Hunter AAF Officers' Club.
- ☐ ☐ MAY 17 — BOHN AREA CHAPTER. Professional dinner meeting with DOD representative as guest speaker. American Embassy Club, Red Godsberg.
- ☐ ☐ MAY 17 — DAVID E. CONDON CHAPTER. Late afternoon informal gathering with free beer and nibbles. Ft. Eustis O-Club. Members only.
- ☐ ☐ MAY 19 — FRANCONIA-MARNE CHAPTER. Professional luncheon meeting with COL Amadeo Arzel, Cdr, French Army Aviation, French Forces-Germany, guest speaker. Kitzingen O-Club.



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- ☐ ☐ MAY 19 — GRAND CANYON CHAPTER. Chapter re-activation meeting and elec-
tion. Happy Hour - late afternoon. Ft. Huachuca LakeSide Officers' Club.
- ☐ ☐ MAY 20 — ALONIA CHAPTER. Birthday Ball and Chapter Awards Night. Presenta-
tions to "Aviator and Aviation Soldier of the Year" and "Outstanding Aviation Unit"
Scholfield Officers' Club. Members and guests.
- ☐ ☐ MAY 25-28 — FIRST REGION-AAAA CONVENTION with Coastal Empire Chapter
as "Host Chapter." Professional sessions: First Region-AAAA Awards to "Aviator and
Aviation Soldier of the Year" and "Outstanding Aviation Unit" (Active Army & Reserve
Components), Desoto Hilton Hotel, Savannah, Ga. Members, wives, and registrants.
- ☐ ☐ JUNE 2 — CORPUS CHRISTI CHAPTER. Professional dinner meeting with Philip C.
Norwine, VP-Government Marketing, Bell Helicopter Textron, guest speaker. Awards &
Officer Installations. O-Club Ballroom. Members and guests.
- ☐ ☐ JUNE 10 — ARMY AVIATION CENTER CHAPTER. Birthday Brunch with free cham-
pagne and birthday cake. 116 Harry W.O. Kinnard, Ret., guest speaker. Non-members
signing up at the door brunch free.
- ☐ ☐ OCT 13-15. 1978 AAAA NATIONAL CONVENTION. Professional sessions: AAA
General Membership Meeting - Elections; Annual Honors Banquet. Stouffer's National
Center Hotel, Arlington, Va.

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Colorado Springs, CO 80909

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40 Ave of Common-No 202
Shrewsbury, NJ 07701

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LIGHTS! ACTION! CAMERA!

THESE are the bywords used in the offices of the ARNG Aviation Division's Multi-Media Group located at Fort Rucker. The Media Group is organized to support the individual aviator proficiency training program throughout the Army National Guard by developing audiovisual packages composed of all available Multi-Media material in the DOD structure.

In addition, the Group supplements the program by producing audiovisual material for ARNG peculiar requirements which cannot be satisfied by other sources.

This mission is possible due to the Group's media-oriented staff and in-house television, slide, and audio recording production capability. The acquired or developed material is distributed to ARNG Learning Centers established at each AASF, AAFA, and TARS. During CY 77, over 4,000 individual lessons covering every aspect of aviation training were furnished to those Learning Centers.

Learning Center Network

During 1973, 80 standardized "Mini-Learning Centers" were physically incorporated into the ARNG aviation facility structure. These small learning centers have been provided the necessary audiovisual equipment and guidance to operate, with each learning center having a complete sound slide and closed circuit television capability. All adopted audiovisual equipment meets the DA audiovisual standard.

By providing individuals an area designed for study incorporating considerations as to size, shape, and contents of the area, an environment that promotes learning has been created. Users are able to order individual media programs to suit training requirements via a reprogramming redistribution system managed by the Multi-Media Group at Ft. Rucker.

Lesson Changeout Program

To support the Learning Center network lessons pertaining to Aviation and Safety are stocked at the Ft. Rucker based Media Group. Lesson material is updated continually to provide the ARNG crewmember with the latest in training doctrine and technique. The lesson material is made available to the aviation facilities in one of three formats; audio tape, sound slide, or television cassette. The lessons are designed to be used as an adjunct to local area ARNG facility training, or the NGB monitored Additional Flight Training Program.

Through the use of provided indexes facilities are able to request support to meet ARNG peculiar requirements. Lesson request process time has been averaging five work days. Constant liaison is maintained with the aviation facilities to insure that the material used is timely and effective.

Responsive AV Support

The Group has produced several audiovisual packages in support of current ARNG training programs. Working with the Deputy for Training Developments at Ft. Rucker, a videotape was produced for ARNG commanders providing an overview on the use of Aircrew Training Manuals. Incidentally, the videotape was provided to the ARNG aviation commanders four days after the draft TC 1-134 was published.

Reacting to a shortage of training material covering the M-5, M-21 and M-22 weapon systems, a program has been developed that covered the systems in an exportable television videotape format.

ON GUARD!

By COLONEL

JOHN J. STANKO, JR.
CHIEF, AVIATION DIVISION,
ARMY NATIONAL GUARD

U-8 training in the ARNG has been enhanced by the development of a 35mm slide and audio tape program that covers all major systems. The program is being made available to states with U-8 assets.

One on-going effort has been the Nap-of-the-Earth audiovisual ground school. The color television package, consisting of ten individual parts, covers all aspects of NOE flight. The ground school is being distributed by the Media Group.

The timing, subject matter, and responsiveness of the programs developed by the Media Group become extremely important when viewed with the fact that aviation units and facilities are now sharing more of the training load.

Safety Receives Emphasis

Having succeeded in organizing a close knit Learning Center network, the Group has taken a new and interesting direction, that of audiovisual innovator. Working in concert with USAAVS and the Directorate of Evaluation and Standardization at Ft. Rucker, the Group has fielded an audiovisual safety tips program.

The program consists of short safety messages, ten minutes or less that are recorded on videotape and provided to the flight facilities. To date five tapes entitled **Engine Compressor Stalls, Engine Failure at Low Altitude, Engine Failure During Flight With Altitude, Underspeeding N₂ Governor, and Overspeeding N₂ Governor** have been sent to ARNG aviation facilities. The content points out the emergency procedures that must be



The ARNG aviation flight facilities have been provided the required TDA audiovisual equipment, taken in each case while stressing the dangers of instrument mis interpretation.

A spin-off safety program consists of short preflight highlights designed by the Group to keep the pilot informed on proper inspection procedures. Thus far, individual components of the UH-1 helicopter, such as the short shaft and tail rotor, have been examined. The intent of the total program is that these short presentations will be incorporated into the pilot's brief ing before flight.

An Eye to the Future

An abundance of guidance, information, and lesson material has been released since the implementation of the Multi-Media Program. The overall objective of the Multi-Media Group will be to provide the latest innovations in the instructional process coupled with quality instructional material to meet ARNG peculiar training needs.

The dual requirement of premobilization readiness and individual aviator proficiency offers a challenge that Multi-Media willingly accepts.

The Los Alamitos, Calif., AASF Learning Center, one of the 80 standardized Learning Centers incorporated into the ARNG facility structure since 1973.



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