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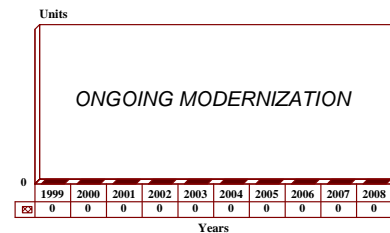
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Boeing Helicopters CH-46/Kawasaki KV-107 - Archived 10/99

Outlook

- CH-46Ds in VERTREP role slated for early retirement
- CH-46E SLEP may be necessary but its scope and funding availability remain unresolved

10 Year Unit Production Forecast
1999-2008



Orientation

Description. Twin-engine, medium-lift military and commercial transport helicopter.

Sponsor. US Navy Air Systems Command, Washington, DC.

Contractors. Boeing Helicopters, Philadelphia, PA, USA.

Licensee. Kawasaki Heavy Industries Ltd, Aircraft Group, Gifu, Japan.

Status. Modifications of CH-46 in the United States. Production in Japan terminated in 1988.

Total Produced. Boeing Helicopter produced 664 through 1971. Kawasaki produced 160 through the end of 1988, delivering the final four units to the Japanese Defense Agency that year.

Application. Airborne assault and bulk cargo transport. Commercial applications include offshore oil and gas support, fire-fighting, and general external lift such as utility power line construction.

Price Range. Last known unit flyaway price for JASDF KV-107/IIA-5, \$6 million in 1987 dollars.

Technical Data

(Kawasaki KV-107)

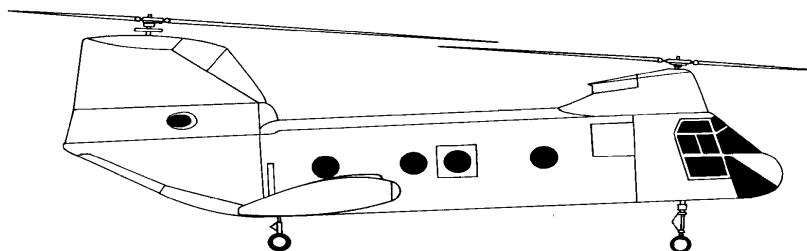
Design Features. Tandem-rotor helicopter with three-bladed rotors and twin turboshafts mounted below the aft rotor pylon. Fixed tricycle-type landing gear with twin wheels on each unit.

	<u>Metric</u>	<u>US</u>
Dimensions		
Length overall ^(a)	25.40 m	83.333 ft
Fuselage length	13.59 m	44.583 ft
Height ^(b)	5.13 m	16.833 ft
Max width	4.42 m	14.5 ft
Rotor diameter	15.24 m	50 ft
Distance between rotors	10.16 m	33.333 ft
Weights		
Basic empty weight	4,819 kg	10,623 lb
Empty, equipped:		
II-2	4,868 kg	10,732 lb
IIA-1	4,589 kg	10,118 lb
IIA-2	5,250 kg	11,576 lb
Capacities		
Standard fuel	1,324 liters	350 gallons US
Max fuel	3,785 liters	1,000 gallons US
Internal cargo volume	24.5 cu m	865 cu ft
Seating: Airliner version seats 25 passengers.		
Performance		
Vne	270 km/h	146 kt
Cruise speed ^(c)	241 km/h	130 kt
Max climb, S/L	625 mpm	2,050 fpm
Service ceiling	5,180 m	17,000 ft
Hover ceiling		
IGF	3,565 m	11,700 ft
OGE	2,680 m	8,800 ft
T-O to 15 m (50 ft)	131 m	430 ft
Range,		
standard fuel	357 km	192 nm
max fuel	1,097 km	592 nm
Propulsion		
CH-46E	(2)	GE Aircraft Engines T58-GE-16 axial-flow free turbine turboshaft engines rated 1,394 kW (1,870 shp) each.
KV-107/IIA	(2)	Ishikawajima-Harima Heavy Industries Ltd CT58-IHI-140-1 turboshaft engines rated 1,044 kW (1,400 shp) each.

^(a)With both rotors turning

^(b)To top of rear rotor head

^(c)At 1,525 m (5,000 ft)



BOEING CH-46

Source: Forecast International

Variants/Upgrades

CH-46A. Initial USMC/USN version. Powered by General Electric T58-GE-8B turboshafts rated at 932 kW (1,250 shp). First flew in October 1962.

CH-46D. USMC version generally similar to CH-46A. Powered by T58-GE-10 engines rated at 1,044 kW (1,400 shp).

CH-46E. Designation for modified USMC CH-46s. Total of 275 completed. Improvements included T58-GE-16 engines, pilot and copilot crash attenuating seats, crash- and combat-resistant fuel systems, and an improved rescue system for older H-46s.

CH-46F. USMC version generally similar to CH-46D but featuring additional avionics.

CH-113 Labrador. Royal Canadian Air Force version. Similar to CH-46A but with increased fuel capacity.

CH-113A Voyageur. Canadian army version. Similar to CH-46A.

HKP-4. Designation for two versions produced for Sweden by Boeing: one for Swedish navy and one for Swedish air force.

UH-46A. US Navy version used for vertical replenishment of ships at sea. Similar to CH-46A.

UH-46D. US Navy variant. Similar to CH-46D.

KV-107II. Variant of Vertol 107-II produced by Kawasaki under license. Several versions have been built, including KV107II A-2, a basic airline helicopter.

Program Review

Background. The original Vertol CH-46 was designed in the late fifties as a turboshaft-powered replacement for obsolescent piston-powered rotorcraft. Vertol flew a prototype in 1958 and tried to develop a civil market. Only seven sales were realized, however, so the company turned its attention to the military. The US Army evaluated the aircraft in 1959, but was much more interested in the CH-47, a larger, related development with more powerful Lycoming T55 engines.

Orders from the US Navy began in 1961, and through 1971, when production ended, Boeing delivered a total of 625 CH/UH-46 helicopters to the USN and USMC. A few export sales were made to Canada, Japan and Sweden, bringing the total Boeing output to 664 aircraft. Kawasaki obtained licensed rights in 1961, flying its first machine in May 1962.

Dynamic Component SLEP. The CH-46 is nearing the end of its originally planned service life. Several dynamic components failed between 1988 and 1990 due to fatigue. This modification incorporates design improvements to the critical safety items which have been identified by in-service failure and flight stain survey. The changes increase thickness of critical sections, and make other specific changes to increase resistance to fatigue damage. The major components include the forward and aft rotor heads, the drive shafts, the forward and aft transmissions, the mixbox, the aft vertical rotor shaft, the swashplates, and the synchronizing shafts.

To date Boeing has been contracted to supply 312 upgrade kits; no more are planned. Final installations are scheduled during FY00.

ARC-210(V). Currently, tactical aircraft and Marine Air/Ground Tactical Force (Special Operational Capable) ground units are being equipped with frequency-hopping anti-jam UHF (HAVE QUICK) and VHF (SINCGARS) communications systems. In order to perform its mission, the CH-46E must be capable of communicating with both aircraft and ground units in situations where hostile radio communication jamming can be expected to occur. The ARC-210(V) radio system has the capability of countering the jamming signals by the addition of electronic counter-countermeasures (ECCM) containing several algorithms for anti-jamming in both UHF and VHF. Additionally, the ARC-210(V) radio system provides capability for use as an automatic direction finding system receiver and is also compatible with the time signal from GPS voice/data from the TSEC/KY-58 COMSEC system. Each aircraft requires two ARC-210(V) radios.

Current plans call for installations in 231 aircraft through FY01.

Funding

Recent and planned CH-46 Modifications funding is as follows:

	US FUNDING							
	FY98		FY99		FY00 (Req)		FY01 (Req)	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
CH-46 Mods		33.4		31.6		17.9		13.6

All \$ are in millions.

Recent Contracts

None noted.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1958	Prototype first flight
	1959	US Army evaluation of CH-46; no orders placed
	1961	USN/USMC initial orders placed; Kawasaki obtains licensed rights
	1971	Boeing Vertol CH-46 line shut down
	1975	Two units converted to CH-46E standard
	1980	Kawasaki announces advanced, re-engined follow-on
	1984	Last of 272 converted CH-46Es redelivered to USN
	1988	Kawasaki production ends
Thru	1990s	Further upgrades/improvements expected

Worldwide Distribution

(As of June 1, 1999)

Military Operators

Country	Qty	Variant
Japan	35	KV-107/IIA/II
Sweden	14	HKP-4
Canada	5	CH-113
	8	CH-113A
US	232	CH-46E
	53	HH/UH-46D
	27	CH-46D

Commercial Operators

Approximately 10 Model 107/107-II helicopters are in commercial use worldwide, some of which were produced by Kawasaki under license.

Forecast Rationale

The US Navy continues to purchase and install dynamic component upgrade kits for its CH-46s and, ultimately, a partial SLEP may be required for a portion of the inventory.

Procurement of Sikorsky's CH-60 Seahawk variant has begun, which will replace the CH-46 in a number of roles. In any event, the Sea Knight line will not be re-started.

Ten-Year Outlook

Not applicable

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