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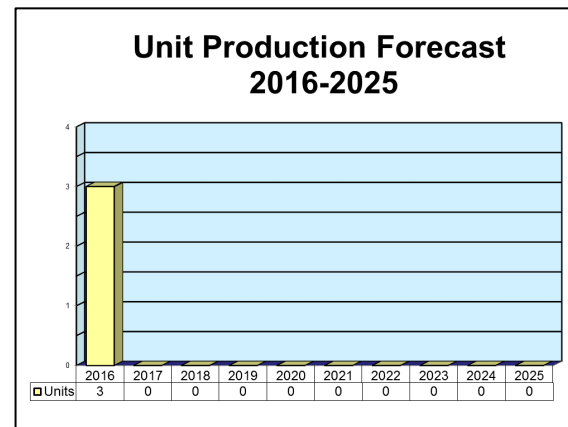
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APQ-174(V)/186(V)

Outlook

- The APQ-187 Silent Knight Radar will enter production in 2017, replacing both the APQ-174 and APQ-186
- Production of the APQ-174 has ended
- The APQ-186 will be produced through 2016 in support of the CV-22 tiltrotor
- This report will be archived in 2017



Orientation

Description. Airborne terrain-following/terrain-avoidance (TF/TA) multimode radars.

Sponsor

United States Air Force
 AF Systems Command
 Aeronautical Systems Center
 Wright-Patterson AFB, OH 45433
 USA
 Tel: + 1 (216) 787-1110
 Website: <http://www.wpafb.af.mil>

Status. In production, ongoing logistics support.

Application. MH-60K, HH-60L/M, MH-47E/G, CV-22.

Price Range. Based on a contract signed in 2004 and a comparison of similar systems in 2012, the price of an APQ-186 ranges between \$950,000 and \$1.1 million.

Contractors

Prime

Raytheon Space and Airborne Systems

<http://www.raytheon.com>, 7408-7412 Brent Way, McKinney, TX 75070 United States, Prime

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

APQ-174(V)/186(V)**Technical Data**

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
Weight	114 kg	250 lb
Radar pod	109 x 33 cm	44 x 13 in
Radar interface unit	76 x 48 x 33 cm	30 x 19 x 13 in
Characteristics		
Frequency	12 to 18 GHz	
TFR minimum	30 m	100 ft
Set clearances	30, 46, 61, 153, 305 m	100, 150, 200, 500, 1,000 ft
Reliability	144 hr MTBF	
Features		
	Extensive built-in test	
	ECM resistance	
	Semi-covert operation	
	Low reflectivity terrain performance	
	MIT-STD-1553 interface	
Performance		
	5.5 deg/sec turn rate	
	Operation in 10 mm/hr rain	
Modes		
	Terrain following/terrain avoidance	
	Power management/low power/low velocity	
	Terrain avoidance 100, 150, 200, 300, 500, 1,000 ft	
	Ground mapping	
	Air-to-ground ranging	
	Beacon detection/interrogation	
	Weather avoidance/detection	
	Cross-scan modes (TF/TA, TF/GM, TF/WX, TF/BCN)	

Design Features. The APQ-174(V) radar was derived from the Low-Altitude Navigation and Targeting Infrared for Night (LANTIRN) system. It is similar to the APQ-170(V) multimode radar carried by C-130 Combat Talon II Special Operations Forces aircraft. It provides terrain-avoidance (TA) and terrain-following (TF) capabilities during low-level, hostile-threat, and adverse weather operations. The design was adapted for special operations and search-and-rescue missions, and features upgraded countermeasures resistance, weather penetration, and extensive built-in test capabilities. The radar was designed to give better guidance information when the aircraft is turning. A power management function provides for semi-covert operation and low-beam reflectivity.

The sensor is installed on the forward fuselage of the V-22, as well as the MH-60K and MH-47B Special Operations helicopters. The hardware is essentially the same as that carried in the LANTIRN pod, except for an

expanded radar interface, which makes added operational modes possible.

The radar pod is mounted on the front of the aircraft, containing a gimbal-mounted antenna, exciter, receiver, and power supply. The radar interface unit is in a separate assembly. The APQ-186(V) features a new processor, low-power/low-velocity mode, and azimuth monopulse processing.

Operational Characteristics. The APQ-174(V) / 186(V) can operate in a TF mode as well as in air-to-air ranging and cross-scan modes. The TF mode uses a data-storage technique that allows the system to "capture" terrain information and operate at a reduced duty cycle. This feature decreases the probability of detection by electronic support measures equipment.

The air-to-air ranging and cross-scan modes combine ground mapping and TA capabilities with TF. They are combined with forward-looking infrared systems to ensure optimal terrain awareness for the pilot.

APQ-174(V)/186(V)APQ-174(V)/186(V)

Source: Raytheon Co

Variants/Upgrades

The **APQ-174(V)** is used for combat search and rescue.

The **APQ-174B** for the U.S. Special Operations Command adds weather-detection and beacon-interrogation modes to help the aircrew conduct navigation and rendezvous missions. Other enhancements include an expanded memory, an electronically erasable memory, and an obstacle warning display. This variant has a set clearance altitude for safer training. It is carried by the MH-60K and MH-47E.

The **APQ-174C** was an upgraded version to support special operations missions. It was suited for aircrew rendezvous and navigation and for covert rescue missions.

The **APQ-186(V)** is designed for the CV-22 Special Operations tiltrotor. It upgrades the basic MMR to a "C" configuration and features a new processor, low-power/low-velocity mode, and azimuth monopulse processing.

Program Review

Development of the original multimode radar began in 1982 under the U.S. Air Force's Combat Helicopter Modernization program. Systems integration and assembly of test hardware began in 1984, with software development, testing, and system checkout completed in 1985. In 1986, weather and beacon modes were added, and the Air Force started preliminary flight-testing on an HH-60 helicopter test platform.

The APQ-174 was chosen in 1990 to equip U.S. Special Forces MH-47E and MH-60K helicopters.

Early V-22 Milestones

With the V-22 program beginning to take shape in 1987, the APQ-174 was offered to equip the new aircraft. Ground-map, air-to-ground-ranging, beacon and weather modes were added to the TF/TA radar. Physical and design changes were made to adapt it to tiltrotor aircraft.

In 1992, Texas Instruments, then the prime contractor for the radar, was awarded a \$13.5 million contract to upgrade the APQ-174. The upgraded version of the

radar was intended to equip the V-22 being developed at that time. By mid-1994, three APQ-174Cs and two sets of spare LRUs had been delivered to the U.S. Special Operations Command (USSOCOM). By August, 54 APQ-174B units had been delivered for flight-qualification testing.

The first low-rate initial production MV-22 aircraft arrived at Patuxent River Naval Air Station, Maryland, in 1999. Operational evaluation (OPEVAL) ran from October 1999 to spring 2000.

In June 1999, an MV-22 Osprey was delivered to Bell Helicopter Textron's Arlington (Texas) facility to be remanufactured into the CV-22. The first two Air Force test aircraft were delivered to Edwards Air Force Base, California, in September 2000 for flight testing.

The FY00 Defense Authorization conferees added \$123 million to the president's budget request, authorizing procurement of 12 aircraft (two more than requested) to accommodate the Marine Corps' unfunded priority for V-22 procurement. An additional \$9 million would accelerate development of the CV-22 variant.

APQ-174(V)/186(V)

Program Delays

In 2000 and 2001, a series of accidents and controversies caused program delays. In April 2001, the Department of Defense recommended a near-term decrease in V-22 production, along with increased design and re-engineering efforts to improve the aircraft's safety and reliability. These actions delayed both the full-rate MV-22 production decision and development of the CV-22 variant.

The FY02 appropriations bill zeroed out the Air Force funding but included approved Navy funding that cut three aircraft from the original request. The FY03 appropriation maintained the program at a minimal production rate.

V-22 Undergoes Testing

The FY04 defense appropriation provided \$1.5 billion for 11 aircraft (nine MV-22s and two CV-22s). The V-22 passed its operational evaluation in mid-2005. In late September, the Pentagon approved the V-22 for full-rate production.

The 412th Test Wing Electronic Warfare Group was tasked with testing the electronics suite on the V-22 in

August 2006. Back-to-back, day-after-day missions were needed in order to hit all required test points. The aircrew used a combination of maneuvers, chaff expendables, radar warning receiver threat cueing, and onboard electronic countermeasures in an attempt to escape a simulated threat engagement. The V-22 Osprey is equipped with the AAQ-27, ALE-47, and APQ-186.

The 58th Special Operations Wing at Kirtland AFB, New Mexico, began CV-22 aircrew training with the first two production aircraft in August 2006. The first operational CV-22 was delivered to USSOCOM's 1st Special Operations Wing at Hurlburt Field, Florida, in January 2007. Initial Operational Capability was achieved in 2009.

APQ-174 Support Contract

In July 2010, Raytheon was awarded a contract with a maximum value of \$17 million for depot-level maintenance of the APQ-174B in support of the USSOCOM Technology Applications Program Office. The performance period ended in June 2014.

Contracts/Orders & Options

(Contracts over \$5 million)

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Raytheon Co	26.7	Apr 2004 – ID/IQ contract for a maximum of 56 APQ-174B multimode radars for U.S. Army Special Operations aircraft. Included a delivery order for 30 systems (\$30.3 million). Completed May 2006. (H92241-04-D-0009)
Raytheon	17.0	Jul 2010 – ID/IQ contract with a maximum value of \$17 million for depot-level maintenance of the APQ-174B multimode radar in support of the USSOCOM Technology Applications Program Office. The minimum order amount of \$8.4 million was obligated with the basic contract. The work was performed in McKinney, TX; the performance period ended Jun 30, 2014. USSOCOM was the contracting activity. (H92241-10-D-0004)

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Oct	1982	MMR development initiated
Jan	1983	Critical Design Review
May	1988	V-22 rollout
	FY89	First V-22 flight tests with APQ-174(V)
Jul	1992	First production delivery
May	1994	First APQ-186(V) delivery
Apr	1995	Start of MH-60K and MH-47E qualification testing
Sep	1995	CV-22 EMD contract
Feb	1996	TF/TA flight-qualification testing
	1999	First production deliveries for V-22
Early	2000	APQ-186(V) EMD flight tests

APQ-174(V)/186(V)

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Sep	2000	First CV-22 arrives at Edwards AFB to begin testing
3Q	FY01	LRIP V award
2Q-3Q	FY02	Program reviews
3Q	FY03	Lot V/VI definitized
3Q	FY04	Block B PDR, MV-22 operational testing
1Q-3Q	FY04-06	CV-22 Block 10 development, Block 0/10 flight test
1Q	FY05	MV-22 Operational Test Readiness Review
2Q-3Q	FY05	MV-22 OPEVAL Phase II
Jan	2007	First operational CV-22 delivered to Hurlburt Field
	2009	CV-22 IOC
	2016/17	Development of APQ-186 replacement; Silent Knight Radar expected to be completed

Worldwide Distribution/Inventories

The APQ-174 and APQ-186 are in sole use by USSOCOM forces on CV-22, MH-47E/G, and MH-60E/L/M aircraft.

Forecast Rationale

The APQ-174 and APQ-186 terrain-following / terrain-avoiding (TF/TA) radars are specialized systems developed for use by the U.S. Special Operations Command. The APQ-174 is used on board USSOCOM's MH-60E/HH-60L/M Black Hawk and MH-47E/G Chinook helicopters. USSOCOM's version of the V-22 Osprey tiltrotor, the CV-22, uses the APQ-186.

While production of the APQ-174 has ended, new-build acquisitions of the CV-22 will ensure production of the APQ-186 through 2016.

An APQ-174 and APQ-186 TF/TA radar replacement known as the APQ-187 Silent Knight Radar will begin full-rate production in FY17, and will eventually displace the older radars. The new radar will eventually

feature across the USSOCOM fleet on CV-22s, H-47s, and H-60s. (Forecast International provides a separate report on the APQ-187 Silent Knight radar in its *Radar Systems Forecast*, *Airborne Electronics Forecast*, and *AN Equipment Forecast*.)

Given the sensitive/classified nature of the technologies used in USSOCOM's equipment, it is unlikely that either the APQ-174 or APQ-186 will be made available for international sale. Should either radar be released in the future for sale to the non-domestic market, it will only be to countries closely aligned, both politically and militarily, with the U.S. At this time, however, Forecast International does not foresee this happening.

This report will be archived in 2017.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	
Raytheon Space and Airborne Systems												
APQ-186 <> United States <> Special Ops <> CV-22												
	46	3	0	0	0	0	0	0	0	0	0	3
Total	46	3	0	0	0	0	0	0	0	0	0	3