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APX-100(V)

Outlook

- FedBizOpps says the U.S. Navy is planning to issue purchase orders to Raytheon Technical Services for APX-100 transponder support services
- Production of the APX-100 is believed to have been completed
- The APX-100 will become less desirable as more advanced systems become commonplace

Orientation

Description. The APX-100 is an airborne-integrated IFF/SIF transponder compatible with Mk XII systems.

Sponsor

U.S. Army
Army Materiel Command (AMC)
5001 Eisenhower Ave
Alexandria, VA 22333
USA
Tel: + 1 (703) 616-9223
Web site: http://www.amc.army.mil

U.S. Navy
Naval Air Systems Command
NAVAIR HQ
47123 Buse Rd Unit IPT
Patuxent River, MD 20670-1547
USA
Tel: + 1 (301) 342-3000
Web site: http://www.nawcad.navy.mil

Status. Ongoing support.

Application. The APX-100 equips a wide variety of aircraft worldwide, including the UH-60, AH-64, CH-47, SH-10, OH-58, F/A-18, P-3, C-9, C-12, C-5B, C-17, C-21A, C-27, C-130, C-141, T-23A, E-2C, KC-135, L-159, AV-8B, RQ-1, Hunter, and Global Hawk. It has even been installed on MiG and Sukhoi aircraft in former Eastern Bloc nations.

Price Range. The price of the APX-100(V) ranges from $19,000 to $27,000 per system, depending on options chosen.

Contractors

Prime

Raytheon Integrated Communications Systems, Advanced Communications and Countermeasures	http://www.raytheon.com/businesses/ncs/ics/, 1300 E Joppa Rd, Baltimore, MD 21286 United States, Tel: + 1 (410) 583-4202, Fax: + 1 (410) 583-4510, Email: elkin_s_rossell@raytheon.com, Prime

Technical Data

	Metric	U.S.
Dimensions		
Weight	4.5 kg	10 lb
Dimensions	13.65 x 21.27 x 54.02 cm	5.375 x 8.375 x 21.27 in
Characteristics		
Frequency	1.030 MHz ± 1.5 MHz (interrogate) 1.090 MHz ± 1.0 MHz (respond)	
Peak power out	500 W ± 3 dB under all conditions	
Transmit duty cycle	1% maximum	
Receiver bandwidth	7 MHz: -6 dB down ± 22 MHz: -90 dB down	
Sensitivity (MTL)	-77 dBm (each channel)	
Dynamic range	55 dB minimum	
Antennas	2	
Input power	+18 to +30 VDC, 30 W nominal	
MTBF	>2,000 hr per MIL-STD-781	
MTTR	<20 min	
Electromagnetic compatibility	Per DoD MIL-STD-461	
Diversity operation	Full diversity capability Stronger channel selected over dynamic range 3 dB gray region Sum rate AOC circuitry cross-coupled between channels	
Built-in test (BIT)	Receiver frequency and sensitivity Transmitter frequency and power Decoding all modes Diversity decision logic Reply pulse spacing – all pulses Antenna VSWR Altitude digitizer	
Mode 4 computer	Integrated KIT-1C COMSEC Mode 4 or National Secure Mode (NSM) via external KIT or integrated crypto module	
Interface	MIL-STD 1553B databus C-( )/APX-100 control	
Mount options	Bay mount, panel mount, databus configuration	
Modes	1,2,3/A, C, S, IV, Test IDENT and EMERGENCY reply codes IAW DoD-AIMS-65-1000 Automatic Code Change (ACC) Mode S, Level 3, TCAS compatible	

Design Specifications. The RT-1716/APX-100(C) is a fully integrated, panel-mounted, Mk XII Identification Friend or Foe (IFF) diversity transponder that uses microminiature technology digital and radio frequency circuitry. The solid-state, modular unit provides complete dual-channel digital encoding and high anti-jamming capability. It combines the functionality of the APX-100(V) with a KIT-1A/C Mode 4 cryptographic capability. The one-box configuration and single-board integrated COMSEC design eliminate the need for KIT-1A or KIT-1C computers.

The APX-100(V) uses two antennas to reduce problems with weak coverage and antenna "shadowing." As the aircraft maneuvers, the output is transmitted to whichever antenna receives the strongest interrogation

signal. Additionally, the use of two receivers removes "null" areas. This diverse system provides improvement in the areas of overloading and jamming, and offers a multipath setting with automatic overload control and built-in anti-jamming.

The RT-1717/APX-100(V) is an integrated Mk XII/Mode S transponder with the ability to interoperate with a Mode S ground interrogator and aircraft Traffic Collision Avoidance System. TCAS uses a subset of Mode S signal formats to provide aircraft with both the ability to determine potential aircraft collision conditions and the means to exchange messages between aircraft when resolving a potential collision situation. This transponder satisfies Mode S stand-alone requirements up to and including Level 3 for aircraft not equipped with TCAS.

Other options include either integrated or separate cryptographic security functions, a MIL-STD-1553B databus, a smart control panel, automatic code change (ACC), and a GPS position-reporting data interface.

The APX-100(V) offers long mean time between failures (MTBF) and lightweight construction. It features a solid-state transmitter and a built-in test (BIT) system. It was designed for quick maintenance, and failed modules can be easily replaced. Enough test points are built into the APX-100(V) to enable depot-level diagnosis and repairs down to the individual part.

Operational Characteristics. The APX-100(V) is a standard military-capable IFF/SIF transponder. It receives coded electronic queries from ground and airborne radar systems, and responds with a set code to identify the aircraft as friendly. Added codes establish the identity of the carrying aircraft. Mode 4 uses encrypted identification waveforms to support combat operations. Mode S operation accommodates the aircraft-ground data transfer requirements of today's air traffic control systems.

With earlier transponders, a separate Mode S unit was required for that mode to work properly and the aircraft to operate effectively with civilian air traffic control systems. Combining older transponders with the add-on Mode S unit and TCAS created interface problems. The integrated Mk XII/Mode S transponder overcame most of these problems.

The APX-100(V) provides IDENT and EMERGENCY reply codes in accordance with U.S. DoD AIMS-65-1000.

APX-100(V)

Source: Raytheon

Variants/Upgrades

RT-1157/APX-100A(V). This improved IFF interrogator went into production in the early 1980s. It was an alternate remote configuration available as a retrofit for aircraft with limited cockpit space, such as the CH-47D and the OH-58D.

APX-100(V)

It has the same electrical performance characteristics as the panel-mount model, but greater environmental tolerance. In addition, this version was designed to operate with either the conventional control boxes or integrated control panels.

RT-1716/APX-100(C). This integrated Mk XII IFF diversity transponder is capable of Mode 4 classified military Selective Identification Facility (SIF) operation.

RT-1717/APX-100(V). This is a fully integrated Mk XII/Mode S transponder and is interoperable with an aircraft's TCAS. It replaces earlier transponders in the C-17 and other select aircraft as part of the Global Air Traffic Management (GATM) Phase II program.

Other versions include platform-specific components:

RT-1284/APX-100(V)
RT-1285/APX-100(V)
RT-1286/APX-100(V)
RT-1296/APX-100(V)
RT-1471A/APX-100(V)

Program Review

The APX-100(V) was developed in the early 1970s for U.S. Army and Navy helicopters. The transponder was designed to replace older multi-box systems, such as the APX-72, APX-64, KY-532, and APX-101, with a lighter weight and more compact unit, while taking advantage of newer technology. Initial production was funded in 1978, and it soon became standard on Army and Navy platforms.

One of the most significant foreign sales of the APX-100(V) of late was to Hungary as part of the Peace Pannon program, instituted to bring Hungary in line with Western European air management systems. Previously, Hungarian military aircraft had used Soviet-manufactured IFF equipment that was not compatible with Western air traffic control systems. The Hungarian aircraft could not interrogate civil traffic with their systems.

Peace Pannon included the procurement of 113 APX-100(V)s and such ground equipment as TPX-54(V) interrogators, workstations, and displays for installation at four Hungarian air surveillance centers. Aircraft included Soviet-built MiG-21s, MiG-23s, and MiG-29s, and Sukhoi Su-22s.

In 1998, the Royal Australian Air Force decided to replace the APX-72(V) in its C-130H aircraft with APX-100(V) Mode S transponders. Additionally, in 2002, the U.S. Army began replacing its APX-100s with the APX-118.

In June 2008, the U.S. Army issued a solicitation notice for depot-level repair services for the APX-100. The notice specifically states that the contract will not provide for upgrades to the systems because the APX-100s are being replaced with newer systems.

Timetable

Month	Year	Major Development
	1973	Development begins
	1976	Service testing completed
	1978	Initial production
	1979	Production for CH-47 authorized
	1983	Initial deliveries to USN/USAF
	1984	OH-58D Army Helicopter Improvement Program begins
	1994	Installation aboard Hungarian MiG-21/23 and Su-22 aircraft completed
Mar	1997	F/A-18 MIDS interference test and evaluation
May	1998	U.S. DoD and Allied Signal improve APX-100 testing process
Nov	2003	Poland receives first two of eight C-295s equipped with APX-100

Worldwide Distribution/Inventories

Argentina. MB.339
Australia. F-18A, C-130

Canada. F-18A
Hungary. MiG-21, MiG-23, MiG-29, Su-22
Jordan. C-101
Poland. C-295
Spain. EAV-8B, EF-18A/B
United States
Army. AH-1S, AH-64A, C-12, CH-47D, OH-58D, UH-60A/L
USAF. C-5B, C-21A, C-130, KC-135, T-23A, UH-60A, MH-60G
USCG. HH-65A, HH-60J
USN/USMC. AV-8B, EC-120Q, F/A-18A/B/C/D, SH-60B/F, HH-60H

Forecast Rationale

Production of the APX-100 is more than likely finished. In 2002, the U.S. Army began replacing its APX-100s with the APX-118. There have been no new orders in some time, and existing contracts were completed in 2009.

There is a possibility of very limited sales. In August 2009, Congress was notified of a possible Foreign Military Sale (FMS) to Thailand for three Black Hawk helicopters and associated equipment, including one APX-100(V) IFF system. However, the Black Hawks could be sold with a different transponder.

Replaced by Newer Models

The APX-100 is a small, lightweight system, making it ideal for unmanned aerial vehicles (UAVs) and helicopters. However, the Department of Defense continues to purchase new systems, such as the APX-118 and APX-123. The BAE Systems APX-118 literature states that it is a direct replacement for the APX-100; the APX-123 is also configured to replace the APX-100. These will eventually replace the APX-100.

Contracts for Maintenance

The U.S. Army continues to seek contractors to maintain systems already in service. In March 2009, it was announced on the Federal Business Opportunities (FedBizOpps) Web site that the Naval Surface Warfare Center (NSWC), Crane Division, was planning to issue purchase orders to Raytheon Technical Services for provision of repairs, spares, modifications, and upgrades in direct support of the C-130J and derivative Type Model Series (T/M/S) aircraft. The notice lists the APX-100 transponder as a sole-source item.

Production Complete

Production of the APX-100 is believed to have been completed in 2009. At most, a limited number will be produced in the near future. Funding should continue for spare parts and repairs.

Barring further information, this report will be archived in April 2012.

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