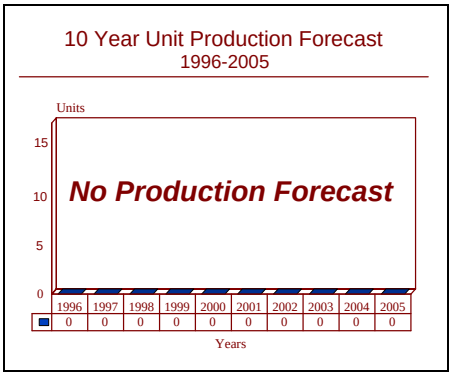
ARC-199 - Archived 9/97

Outlook

- Production complete
- Limited near-term spares support
- No further production expected



Orientation

Description. Airborne high frequency (HF) radio.

Sponsor
US Army
Communications and Electronics Command
Fort Monmouth, New Jersey (NJ)
USA

Contractors
AlliedSignal Aerospace Co
Bendix/King General Aviation Avionics Division
400 N. Rodgers Rd.
Olathe, Kansas (KS) 66062-1212
USA
Tel: +1 913 782-0400

Status. Production completed.

Total Produced. Through 1993, a total of 356 units were produced.

Application. Airborne tactical communications.

Price Range. Unit cost US $25,000.

Technical Data

Dimensions	Metric	US
Size:		
RT-1432/U	13.33 cm x 34.67 cm x 10.56 cm	5.25 in x 13.65 in x 4.16 in
AM-7201/U	18.41 cm x 36.19 cm x 13.33 cm	7.25 in x 14.25 in x 5.25 in
CU-2305	8.45 cm x 9.22 cm x 9.22 cm	3.33 in x 3.63 in x 3.63 in
Weight:		
RT-1432/U	4.54 kg	10 lb
AM-7201/U	6.81 kg	15 lb
CU-2305	0.49 kg	1.1 lb

Frequency Range:	2 MHz - 30 MHz
No. of Channels:	280,000
Preset Channels:	20
Channel Spacing:	100 Hz
Modes:	USB/LSB/AME/CW
Power Requirements:	500 W, 27.5 VDC
Environmental:	Qualified to MIL-E-5400
Data Bus:	MIL-STD-1553B

Design Specifications. Through the use of some of the latest micro-electronics technology, the ARC-199 high-frequency radio is designed to supply reliable communications on any of 280,000 operating frequencies, separated by 10 Hz steps, in the 2 MHz-to-30 MHz frequency band. The system is highly automated (incorporating four microprocessors) and allows preflight or in-flight programming of 20 designated frequency channels. Microprocessor memory stores the operating parameters associated with each channel, which are instantly activated when that channel is chosen. Among these operating parameters are transmit and receive frequencies, mode of operation, Selective Address (SELADR) codes, transmitter power level, scan listing, and the position of antenna tuning elements.

The ARC-199 Control Display Unit (CDU) consists of a three-inch diagonal CRT and a functional keyboard. The CRT supplies data on eight lines of 14 characters each and uses a P-43 green phosphor with the whole panel background lit with green luminescence to improve visibility and provide compatibility with night vision goggles. With 17 multifunction keys, the keyboard provides maximum flexibility. Because Bendix/King engineers were able to put in multi-use keys, they were able to design a CDU whose face measures only 4.5 inches by 5.75 inches, thus using only a small amount of valuable cockpit space. Easy, logically organized operation of the radio is made possible by the system software. Should changes be needed, the operator is able to reprogram the channel number, the modulation mode, transmit and receive frequencies, SELADR code, transmitter power levels, or scan listing. However, most of these parameters are preprogrammable before taking off, thus minimizing changes while in flight. The use of Electronically Alterable Read Only Memory (EAROM) makes possible this data preprogramming and storage feature because it gives the radio the capability to retain all data input to memory even during power shutdowns.

Operational Characteristics. The ARC-199 can be preprogrammed to operate in a semi-duplex mode (transmitting on one frequency and receiving on another) or simplex mode (transmitting and receiving frequency are the same), selecting from the 280,000 possible operating frequencies. The system also can operate in upper sideband (USB), lower sideband (LSB), amplitude equivalent (AME), or continuous wave (CW) modes.

When the operator desires to use the SELADR mode during transmission, the radio broadcasts four simultaneous audio tones which represent its unique address. These tones last long enough to allow other SELADR mode scanning ARC-199s and ground-based counterpart VRC-86 receivers to detect them. Only if the receiving radio has been programmed to identify and respond to the unique address involved will receiver squelch be broken, and a communications link established. Thus, use of SELADR ensures that the operator won't be disturbed by unwanted traffic.

A selection of three different transmitter power settings (4, 40 and 150 watts) is available. This ECCM feature aids in minimizing the risk of interception by tailoring the output power of the radio to local operating conditions. The radio interfaces with standard encrypting gear which allows the securing of both voice and data messages.

Upon the programming of a channel onto the scan list, the receiver will briefly monitor that frequency and scan for activity. During SELADR mode operation the dwell time is decreased since the receiver will only halt at a channel if it comes across a preprogrammed SELADR code. In either case, the operator can continuously monitor as many as 20 active frequencies.

The radio can tune a variety of antennas (long wire, shorted loop, probe, and inverted V) with initial tuning and loading of the antenna requiring only about three seconds. Only 50 milliseconds are required for antenna tuning when selecting a preset channel which has the antenna tuning parameters stored in memory.

The ARC-199 Built-In-Test-Equipment (BITE) will run an internal test sequence on command and then report if system performance is satisfactory or if there exists a major or minor fault in any of the three Line Replaceable Units (LRUs). BITE also monitors the radio during operation. Should any malfunction be encountered, it will supply the operator with fault messages.

Variants/Upgrades

Improved ARC-199. Bendix/King has spent the past several years developing an updated ARC-199 as an answer to the US Army requirement for an Improved Airborne HF Radio program. Enhancements to the ARC-199 include an Automatic Link Establishment (ALE), digital burst modem and frequency-hopping ECCM capabilities. The ALE provides the required processing capacity and software to scan programmed frequencies, signal specific receiver addresses, and execute a Link Quality Analysis (LQA) on the reply.

The highest LQA value indicates the best frequency to use and the radio's control panel informs the pilot when to begin talking once the link has been opened automatically. The improved ARC-199 interfaces with the MIL-STD-1553 aircraft databuses, data modems and encryption devices. A concept evaluation program (CEP) was conducted using the improved ARC-199 onboard a CH-47D and a UH-1H in 1990.

ARC-200. The ARC-200 is essentially a ruggedized version of the ARC-199 HF transceiver. The set consists of the RT-1449 receiver-transmitter, CU-2312 antenna-coupler, and KVC-979 antenna. Specific improvements include increased tolerance of higher temperature environments typical of high-speed fighter operations (see separate report).

ARC-220. As part of its ambitious battlefield digitization plan, the Army has earmarked $233 million for HF communications. The first project to fall under this aegis was the ARC-220. The ARC-220 will replace the ARC-199, perhaps by the end of the year. The new HF radio will be form/fit interchangeable. It will be comprised of three LRUs (a control display, power amplifier/ coupler, and a receiver/transmitter).

It will use embedded automatic link establishment, digital message capability and digital noise reduction, and interface with COMSEC gear. It will also support 1553 bus operation to achieve compatibility with the Army's multifunction display, and will employ a highly classified Army-Enhanced ECCM frequency-hopping capability.

Potential prospects for the ARC-220 are strong. Rockwell-Collins received an $11.7 million contract in August 1994 to have an initial batch completed for delivery in 1996. If all options are exercised on this contract alone, the value could soar to $144.9 million.

Program Review

Background. The ARC-199 high-frequency (HF) radio was designed to satisfy the quick response, fast action demands of an airborne combat crew and operates as conveniently as a telephone with its immediate "push to talk" capability. The ARC-199 is aimed at those aircrews who fly US Army helicopters at tree-top levels in Nap-Of-the-Earth (NOE) profiles. These helicopters typically operate at ranges averaging 35 kilometers to 50 kilometers from their ground-based command posts. Existing VHF communications systems have proved inadequate for this role.

The solution was to use an HF/SSB system. The requirement specified a reliable, lightweight, ECM-resistant HF communications system capable of using encryption devices. Other specifications included compatibility with existing communications networks, performance in a combat environment, and ease of use. Also, the system had to be designed in a way to allow the addition of the results of a preplanned product improvement program.

The US Army required a rigorous HF radio for NOE communication (0 to 15 meters altitude). Standard line-of-sight radios (UHF/VHF) do not provide this capability at these altitudes with ground forces. AlliedSignal General Aviation (formerly King Radio) entered its commercial radio, the KHF-950HF, into competition against Collins and Gould for the US Army helicopter and fixed-wing aircraft in 1981. The radio, a non-prototype, seemed to fit the Army need for a "non-developmental", i.e., off-the-shelf, system for airborne and ground uses. Bendix/King won the Army development contract in 1982.

The ARC-199 is compatible with the MIL-STD 1553 data bus as well as the Parkhill system (secure voice). King's ARC-199 radio sale to the Army is significant in that it is the most advanced commercial HF radio that has been adopted for military use.

VRC-86 Companion**.** The companion radio to the ARC-199 is the VRC-86 (also built by King) ground-based radio. The VRC-86 is functionally identical to the ARC-199 and can be installed in fixed-location command posts or mounted in various vehicles to complete the HF voice and data link net necessary in an operational environment. The ARC-199 and VRC-86 both use the same receiver/transmitter, amplifier/ coupler and control display units, thus ensuring a high degree of commonality.

Funding

	US FUNDING							
	FY95		FY96		FY97		FY98	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (US Army)								
PE#0604201A Aircraft Avionics Project DC97 Aircraft Avionics[a]	-	14.0	-	21.4	-	15.0	-	14.8

FY99		FY00		FY01	
QTY	AMT	QTY	AMT	QTY	AMT
-	1.3	-	0	-	0

(a)Project DC97 - Aircraft Avionics funds the ARC-220 nap-of-earth communications HF radio, the form/fit interchangeable replacement for the ARC-199.

All $ are in millions.

Recent Contracts

Contractor	Award ($ millions)	Date/Description
Bendix/King	1.9	March 1989 - Contract for ARC-199 High Frequency Single Sideband radios (DAAB07-89-C-H009).

Timetable

Feb	1981	Commercial radio variant introduced (KHF-950)
	1982	Bendix/King won ARC-199 competition
	1986	Initial production deliveries began
Sep	1986	In Process Review for ARC-199 took place
Jan	1987	Navy Approved Limited Production
Jul	1987	Navy Approved Full Production of ARC-199 for EA-6B
	1991	Current procurement completed
Sep	1994	Rockwell-Collins became next-phase ARC-220 contractor
	1996	Efforts scheduled to begin for the replacement of ARC-199 with model ARC-220

Worldwide Distribution

No foreign sales have been reported.

Forecast Rationale

The US Army has procured only a limited number (201 units) of the ARC-199 HF radio for evaluation and installation in applications ranging from front-line tactical helicopters and CINC Hawk airborne command centers to air traffic control operations. Among these platforms are the EA-6B and VIP VH-3, as well as the USMC OV-10 and other unidentified special-purpose aircraft. However, the Army is planning to use HF communications for short-

range tactical communications, especially for aircraft flying nap-of-the-Earth (NOE) missions under 100 km (54 miles). Use of this short-range HF solution is seen as less vulnerable than reliance on satellite communications. Selected for this role has been the ARC-220.

The Army has moved ahead with plans to procure NDI, HF-SSB ARC-220 radios for its helicopter fleet; specifically, they are likely being installed in the AH-64 Apache, CH-47 Chinook, UH-60 Black Hawk and OH-58 Kiowa. The new radios are said to provide Automatic Link Establishment (ALE) to MIL-STD-188-141A for simplified crew member operation, data operation to MIL-STD-188-110A and NATO interoperability standards, and Advanced Narrowband Digital Voice Terminal (ANDVT) compatibility. The ARC-220 will also provide anti-jam backward compatibility with the ARC-199 so that it can be used in existing aircraft installations.

The award was made in August 1994 - a $2.8 million increment as part of an $11.7 firm fixed price (potentially $144.9 million if all options are exercised) with time and materials-options contract - to Rockwell-Collins. It calls for production of 28 NDI NOE aircraft radios. with four one-year option periods beyond the base year for components, technical data and technical support services (estimated at approximately 3,000 radios).

For all applications, the ARC-220 upgrade has bounded past the ARC-199 and is poised to soon replace that device entirely. Therefore, this report may be replaced next year with one on the ARC-220.

Ten-Year Outlook

We are not forecasting additional procurement of the ARC-199. There will, however, be some spares support over the near term.

* * *