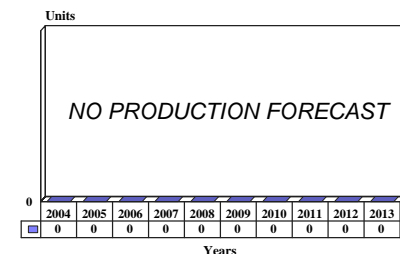


# AYK-14 - Archived 3/2005

## Outlook

- No new contracts for AYK-14 have been detected
- The AYK-14's replacement, the Advanced Mission Computer is now dominating the market production
- Barring any new information, this report will be archived in the near future

10 Year Unit Production Forecast  
2004 - 2013



## Orientation

**Description.** The AYK-14 mission computer is employed by a number of U.S. forces and its allies – primarily on tactical aircraft as a standard airborne data computer.

### Sponsor

United States Navy  
Naval Air Systems Command (NAVAIR)  
Washington, DC  
USA

**Status.** In service.

**Total Produced.** Approximately 9,314 AYK-14 had been produced through 2003.

### Application

AYK-14: General-purpose digital computer primarily used for aircraft applications, but also used in land- and sea-based systems.

### Price Range

AYK-14: Approximately US\$75,000 per unit based on contract averaging (1998 dollars).

## Contractors

General Dynamics Advanced Information Systems, <http://www.generaldynamics.com>, 8800 Queen Ave South, Bloomington, MN 55431 United States, Tel: 1 (612) 921-6771, Fax: 1 (612) 921-6869, Prime

## Technical Data

### Design Specifications

**AYK-14.** The AYK-14 is a variable-configuration, general-purpose 16-bit computer featuring a performance range of up to 2.3 million instructions per second (MIPS). The computer has a high degree of functional and mechanical modularity, and is designed for flexible growth and extensive hardware commonality. The AYK-14 architecture is not altered by modular hardware configuration changes, permitting the use of machine transferable support software (MTASS) systems. This software is compatible with the UYK-20 and UYK-44, permitting the adaptation and use of

existing UYK-20 and UYK-44 support software as a development and maintenance tool.

The AYK-14 computer system consists of a series of plugged modules, enclosures, support equipment, and software. The system is composed of functional modules that form the processing, memory, input/output, and power subsystems, as well as interconnecting data transfer and control buses.

System configurations can range from a 16-bit single card IOP to a 32-bit high-speed processor with extensive input/output abilities. The input-output (I/O) is expandable to 16 channels total and is compatible

with MIL-STD-1553A/B, PROTEUS, and RE 232. Memory capacity is up to four million words. The 16K or 32K option applies to a number of different areas including memory and instruction.

Advanced Mission Computer (AMC). The AMC will be able to integrate many of the AYK-14's functions, as well as expand the overall capability of the platform. While based on commercial off-the-shelf (COTS) technology, the system was designed and tested according to the MIL-STD-5400 environment. The system retains an open systems architecture (OSA) to increase the flexibility and upgrade capabilities of the computer.

The AMC can be procured in two chassis sizes, a one-half or full ATR, depending on customer requirements. A conditional, convectional, or forced-air-cooled chassis can be procured, depending on mission requirements.

The modules are built to the avionics standard of 6 x 9 inches. The modules are also available in a variety of backplane buses including VME64, PCI, and Futurebus+. It should be noted that the PCI bus includes a standard intra-module bus, thereby making it available as a front-plane bus for increased bandwidth communications between modules. The AMC has also

been designed to minimize power dissipation while maximizing reliability of the system.

Currently available functions that can be added include graphics processing, video processing, and GPS/DPS integration. Additionally, the I/O capabilities include 28± VDC discrete, fiber channel buses, scaleable coherent interface (SCI), SCSI, and the current standard MIL-STD-1553A/B in RT, BC, and MON modes.

### **Operational Characteristics**

AYK-14. The AYK-14 computer consists of a series of standard computing elements that provide an extremely wide range of applications. A general complement of standard computer module building blocks configurable to specific user needs is made possible by the use of basic shop-replaceable assembly units.

Representative applications include airborne, shipboard, and land-based uses as a general-purpose processor, emulator, controller, dedicated processor, or algorithm unit. In that respect, the AYK-14 can perform the following tasks: weapons delivery, fire control, guidance, communications, navigation, display subsystem control, radar or sonar processing system control, electronic countermeasures, electronic surveillance management, and digital flight control.

## **Variants/Upgrades**

AYK-14 P<sup>3</sup>I. The AYK-14 Pre-Planned Product Improvement program (P<sup>3</sup>I) was initiated to enhance the capabilities of existing weapons systems in U.S. Navy inventory. The existing AYK-14 was found unable to meet the majority of identified TACAIR requirements beyond the year 1985. The P<sup>3</sup>I was initiated as a response to new and urgent user operational requirements for the AV-8B, F/A-18, F-14D, and V-22 aircraft and for the Mk 50 torpedo.

In mid-1986, the P<sup>3</sup>I update was running into some fairly serious problems resulting in large-scale cost overruns. These problems centered on the computer's data processing speed. These problems have since been corrected, and performance testing was completed in February 1987, after achieving an unprecedented 1.67 MIPS. The P<sup>3</sup>I AYK-14 replaces three of the AYK-14's processor module cards with a single module that is four times faster than current models (with eight times the memory and two times the input capacity).

VPM. In 1986, Control Data Corp was awarded a developmental contract for the VHSIC (very high-speed integrated circuit) processor module (VPM) as a means of increasing processor performance and capacity. While it performs all the functions of the AYK-14

single-card processor (SCP), the VPM has additional capabilities, including 32K words of cache memory (expandable to 128K words), up to 1024K (1M) words of onboard memory, and a reconfigurable I/O bus adapter.

The VPM is packaged on a standard 6x9 ATR module for compatibility with current AYK-14 systems, or on an optional SEM-E module for use in new advanced avionics applications. The VPM is said to provide eight times the processing performance of the basic AYK-14 and four times the performance of the P<sup>3</sup>I variant. The system was designed to equip the F/A-18 and F-14D, as these two programs expanded their requirements throughout the mid-1990s. Aside from the above-mentioned aircraft, this program has the potential of equipping the entire inventory of existing systems. Initial production began in FY91.

Advanced AYK-14. This is was to be a fourth-generation advanced airborne processor version of the AYK-14, initially designated the Integrated Mission Computer (IMP). Control Data Corp initiated development work for the Advanced AYK-14 in FY91. Development had focused on providing the bridge needed to evolve new and existing platforms to an open

system architecture. Initial design features included the following:

- A 50 MHz serial high-speed data bus module to alleviate F/A-18 input/output deficiencies and serve as the high-throughput bus for future generation airborne computer standards
- A reduced instruction set card to enable communications between existing AYK-14 16-bit Compiler Monitor System (CMS-2) modules and AYK-14 32-bit Ada modules for advanced applications; a MIPS 4400 microprocessor is utilized
- An interactive voice I/O module for the AV-8B to enable voice control of the mission computer, radios, and weapon system

- An embedded Intel i860 video processor module set to reduce aircraft weight by 43 pounds and reduce video latency (up to 10 seconds) when switching between display formats
- A 32-bit AYK-14 configuration for the E-2C and other current-generation aircraft (embedded coprocessor)
- An embedded GPS module set

The Advanced AYK-14 has since been re-designated the Advanced Mission Computer (AMC) program. (For more information please see the *Advanced Mission Computer (GD3000)* report in our Airborne Electronics binder.)

## Program Review

**Background.** The AYK-14 airborne data computer is derived from Control Data Corporation's CDC 480 microcomputer family. Hardware and software are integrated, resulting in standard government-furnished equipment that provides a standard airborne computer capable of satisfying the U.S. Armed Forces' airborne digital requirements.

The AYK-14 program was spurred when the U.S. Navy signed a Joint Memorandum of Agreement with the U.S. Army and the U.S. Air Force in 1981 to promote inter-service avionics components and subsystem development. In August 1987, Control Data Corp won a competition to supply an updated AYK-14 to the U.S. Marines and U.S. Air Force. The Marines began receiving their updated AYK-14 variants in 1989.

Control Data Corp completed VHSIC development during FY90, with deliveries of the first VHSIC preproduction units made that year. The company continued follow-on development of technology improvements for the AYK-14, which were applied to the Advanced AYK-14 design. This included a 50 MHz linear high-speed databus, a video display module set, a voice interaction module, and 32-bit processor modules.

Control Data Corp had long been the prime contractor for the AYK-14, but the company had to make room for competitors and/or partners. In the spring of 1993, IBM Federal Systems (since purchased by Loral) won the prime contractor position for the RISC version AYK-14, with Control Data Corp named as the second source. Control Data Corp had previously accounted for 80 percent of the AYK-14 production work, with Unisys second-sourcing the rest.

In mid-1992, Control Data Corp was reorganized, with its defense unit, Government Systems Group, spun off as a new subsidiary called Computing Devices International. That year the Navy selected the AYK-14 core processor set (CPS), including the RISC processor module and Futurebus+ backplane/chassis and associated configuration items, as the primary processing subsection for the LAMPS Mk III Block 2 integrated mission processor (IMP) on the SH-60B anti-submarine warfare helicopter. Preliminary specifications were completed for the future development of AYK-14 modules, including the high-speed data bus module, GPS module, and display processor modules. The Navy continued development of the CPS in FY93, and also evaluated design, test, and qualification requirements to bring other Futurebus+ open system architecture (OSA) module developments into the AYK-14 family.

In FY94, a full-up SH-60 IMP was designed and produced. Testing of the IMP began, including interoperability testing between existing AYK-14 16-bit CMS-2 modules and new-design 32-bit Ada modules. This effort tested the ability of the RISC card to be integrated with its MIPS 4400 microprocessor on the AYK-14 to handle the Pentagon's Ada language, with the older CMS-2 Navy software running through the AYK-14 portion itself. The program also included work to coordinate the integration of AYK-14 technology into the V-22's Advanced Mission Computer (AMC); both preliminary design and critical design reviews were performed.

Through FY95, the project focused on creating compatibility and adaptability via OSA. Efforts included developing a backplane based on the Institute of Electrical and Electronic Engineers/Next Generation

Computer Resources OSA standard Futurebus+ interface, as well as other means of enabling the AYK-14 to communicate with other modules for multi-user requirements. Also, commercial OSA products were militarized to fit the AYK-14 family. Specific program activities centered on AYK-14 development for three aircraft: the SH-60, the V-22 Osprey, and the EA-6B Prowler. Qualification testing was conducted and reliability development testing was begun for the SH-60B IMP/AYK-14. Engineering and manufacturing development for the V-22 AMC/AYK-14 was completed. Finally, efforts were made to transfer the technology of the AYK-14 to the EA-6B mission processing upgrade; this transfer was completed in FY96. Also completed in FY96 were engineering and manufacturing development and integration of the SH-60 IMP/AYK-14 with the aircraft.

General Dynamics Information Systems has completed the qualifications for a new hybrid chassis, including

legacy and VME backplanes in a single chassis. A Hub module, a VME bridge module, and a 32-bit VME processor were lab tested in 2000 and 2001. Initial flight testing of VME module in the AYK-14 dual backplane chassis was planned for 2002 and 2003. No further information on the flight test is available.

Advanced Mission Computer. In the FY97/FY98 budget description, the AYK-14 program had been redefined and re-designated the Advanced Mission Computer (AMC) program. The AYK-14 is used as the basis for the AMC. The AMC project is geared to provide an airborne digital computer using a standard commercial open architecture that will allow for the rapid deployment of new technologies via preplanned product improvements. The primary purpose of the open system is to allow for the integration to existing platforms of a Higher Order Language (HOL) and high-speed bus architecture.

## Funding

In FY00, PE#0604574N Project W0845, which originally funded AYK-14, was absorbed into PE#0604215N Project W0572, Joint Services/Navy Standard Avionics Components Subsystems. In the current U.S. Navy budget (FY 2004/2005) only a minimum amount of funds are being allotted to support and/or upgrade the AYK-14.

## Recent Contracts

<u>Contractor</u>	<u>Award (US\$ millions)</u>	<u>Date/Description</u>
General Dynamics Advanced Information Systems Inc.	10.0	Mar 2000 – Fixed-price delivery order against a previously awarded requirements contract for 66 AYK-14 standard airborne computers for the F/A-18E/F program. Completion date is February 2002 and the contracting authority is the Naval Air Systems Command, Patuxent River, MD. (N00163-96-D-0014)
General Dynamics Advanced Information Systems Inc.	24.6	Jun 2003 – An estimated value US\$24,606,753 firm-fixed-price, indefinite-delivery/indefinite-quantity contract for the procurement of AYK-14(V) Navy standard airborne computer weapons replaceable assemblies, shop replaceable assemblies and associated equipment and services for installation in scheduled aircraft production deliveries, aircraft upgrades and associated Naval inventory control point fleet spares. Platforms utilizing the AN/AYK-14(V) include domestic and foreign military sales F/A-18, AV-8B, F-14, EA-6B, E-2C, SH-60B and EP-3E. Work is expected to be completed in November 2004. The Naval Air Systems Command Aircraft Division, Patuxent River, MD, is the contracting agency. (N00421-03-D-0039)

## Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
	1976	Competitive source selection

March 2004

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Sep	1976	Control Data Corp awarded contract for design, development, test, and delivery
Oct	1977	Preproduction units delivered
	1996	Advanced AYK-14 becomes available
	1997	Begin technology shrink of existing Advanced AYK-14 units to fit F/A-18 E/F
	1997	AYK-14 re-designated the Advanced Mission Computer (AMC)
	1998	First AMCs delivered for testing in V-22 and F/A-18 E/F fighters
	2000	AYK-14 funding shifted to AMC program
	2001	General Dynamics Information Systems began lab and flight test of modified AYK-14
	2008	Production of the AYK-14 scheduled to end

## Worldwide Distribution

The AYK-14 is employed by the following nations (in varying degrees) on the indicated platforms:

<b>Australia</b>	F/A-18, P-3C	<b>Norway</b>	P-3C
<b>Canada</b>	F/A-18, CP-140	<b>Singapore</b>	E-2C
<b>Egypt</b>	E-2C	<b>Spain</b>	F/A-18, EAV-8B, SH-60B
<b>Japan</b>	E-2C	<b>United States</b>	US Navy/USMC: E-2C, EA-6B,
<b>Kuwait</b>	F/A-18s		P-3C, F-14A/A+, F-14D, F/A-18,
<b>Netherlands</b>	P-3C		SH-60B/F, V-22

## Forecast Rationale

It appears that major production of the AYK-14 has come to an end. Practically all of the contracts for new mission computers have been for the AYK-14's replacement, the Advanced Mission Computer (AMC). The last known AYK-14 contract, issued in June of 2033, was for AYK-14 weapons replaceable assemblies, shop replaceable assemblies and associated equipment and services for installation.

Current U.S. Navy budget documents indicate that a COTS PowerPC processor is being added to the

AYK-14 of the EA-6B. The AYK-14 computer will be upgraded with Very High Speed Integrated Circuit Technology (VHSIC) improving processing, memory, and throughput. The last funds for this program were allocated in the fiscal year 2002 budget.

General Dynamics states that AYK-14 production planned to continue through 2008 and supported until 2018. Most of this production will likely be for replaceable assemblies and spares. No new large orders are expected.

## Ten-Year Outlook

### ESTIMATED CALENDAR YEAR PRODUCTION

		High Confidence Level					Good Confidence Level			Speculative			Total 04-13
Designation	Application	Thru 03	04	05	06	07	08	09	10	11	12	13	
AYK-14	Prior Prod'n:	9200	0	0	0	0	0	0	0	0	0	0	0
AYK-14(V)	Prior Prod'n:	114	0	0	0	0	0	0	0	0	0	0	0
Total Production		9314	0	0	0	0	0	0	0	0	0	0	0