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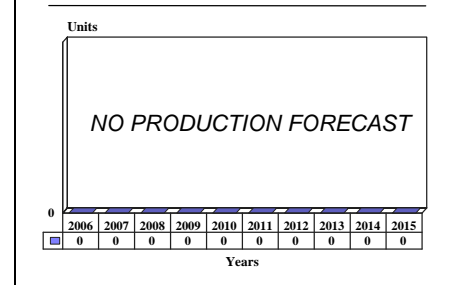
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UYK-43(V) - Archived 6/2007

Outlook

- Budget documents indicate 650 UYK-43 cards are to be delivered between 2006 and 2008
- NGC2P, Next Generation Command and Control Processor designed to replace the UYK-43, contract awarded May 2005
- German Navy replaces UYK-43 computers with new Thales product
- Barring further activity, this report will be archived in 2007

10 Year Unit Production Forecast
2006 - 2015



Orientation

Description. U.S. Navy's standard 32-bit computer

Sponsor

U.S. Navy
 Naval Undersea Warfare Center
 Newport, Rhode Island (RI)
 USA

Status. In production and service.

Total Produced. As of January 2006, an estimated 1300 units were produced.

Application. The UYK-43(V) is utilized for fire control, command and control, sonar, and process navigation aboard AEGIS cruisers, Trident submarines, carriers, and destroyers. For the U.S. Navy, applications have included the BSY-1 Submarine Combat System, the SPY-1D AEGIS for the DDG-51s, and the larger AEGIS SPY-1A/Bs on new-construction CG-47 Ticonderoga class cruisers.

Price Range. Approximately \$160,000 each, in 1996 dollars, based on contract cost averaging.

Contractors

Prime

Lockheed Martin Maritime Systems and Sensors

<http://www.lockheedmartin.com/ms2/>, 199 Borton Landing Rd, Moorestown, NJ 08057-0927 United States, Tel: + 1 (856) 722-4100, Email: kenneth.r.rossi@lmco.com, Prime

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UYK-43(V)

Technical Data

	<u>Metric</u>	<u>U.S.</u>
Dimensions		
A Enclosure (water-cooled)	50.29 cm x 56.69 cm x 175.26 cm 571.13 kg	19.80 in x 22.32 in x 69 in 1,258 lb
Dimensions (continued)		
A Enclosure (air-cooled)	50.29 cm x 56.69 cm x 175.26 cm 555.24 kg	19.80 in x 22.32 in x 69 in 1,223 lb
B Enclosure (water-cooled)	50.29 cm x 56.69 cm x 175.26 cm 953.40 kg	19.80 in x 22.32 in x 69 in 2,100 lb
B Enclosure (air-cooled)	74.42 cm x 56.69 cm x 182.88 cm 985.18 kg	29.30 in x 22.32 in x 72 in 2,170 lb



The UYK-43(V)

Source: U.S. Navy

Design Specifications. The architecture of the base UYK-43(V) includes a central processor unit (CPU) with a four-billion 32-bit word addressing capability, and an input/output controller (IOC) with one to 64 full duplex input/output channels, throughput of three million words per second, and embedded diagnostics. Also included is a computer interconnection system (CIS) for up to 16 enclosed internal buses; a memory with a 32K 32-bit word and byte parity; semiconductor modules of 64K, 128K, 256K, and 512K capacities; system addressing to four billion words and enclosure addressing to 268 million words; and a seven-port bus interface. The CPU offers a performance of 150-

nanosecond microcycle and 2.25 million instructions per second (MIPS).

Two different enclosures are available, the A and the B. Both are configurable using the above-mentioned CPU, IOC, and CIS, plus the input/output adapter, memory module unit, display control unit, and power supply. The B enclosure can contain two CPUs, two IOCs, and twice the memory of the A. The A enclosure's mean time between failures (MTBF) is 8,000 hours, and the B enclosure's MTBF is 56,000 hours (or six years). The mean time to repair (MTTR) is 15 minutes.

When it was introduced, this computer took advantage of the latest technology in microelectronics, computer

architecture, and software engineering. The use of Very Large Scale Integrated Circuits (VLSIC), high-density chips that have more than 1,000 gates each, resulted in an overall system configuration that was smaller, faster,

and more reliable. An optional fiber-optic input/output channel eliminated the typical massive, heavy array of cabling needed to channel data in and out.

Variants/Upgrades

UYK-43(V) Product Improvements. In 1988, the Navy received the go-ahead for a UYK-43/44 family upgrade. The value of the Product Improvement Program (PIP) was estimated at \$40 million. The PIP was quite controversial: its upgrades threatened to render the Next-Generation Computer Resource (NGCR) program superfluous. The NGCR had been intended as the follow-on to the UYK-43/44 computer family, but proponents of the UYK-43/44 claimed that upgrades of these computers could handle the job requirements of the Navy. Congressional approval of the UYK-43/44 upgrade was finally granted after two years of funding bans – largely because of delays in the NGCR program, which saw its first standards implemented in 1996 with the development of the Advanced AYK-14 (AAYK-14). PIP work centered on the addition of a series of state-of-the-art microprocessor coprocessors.

In 1990, Unisys announced the introduction of a series of modular, embedded product enhancements for the UYK-43(V) family that would increase processing speed and available memory. They would also provide a non-developmental database and backpanel for open-architecture flexibility, and would accommodate the Ada programming language. Processing enhancements included the high-performance processor (HPP) and

time-critical subfunction (TCS) coprocessor. Memory improvements included time-volatile memory (TVM), an embedded memory subsystem (EMS), and high-bandwidth memory (HBM).

The time-volatile memory module provided a fourfold increase in resident memory capacity, as well as a 30-minute data retention capability in the event of power interruption. These improvements increased speed by up to 80 million instructions per second and enlarged addressable memory to four billion words. The EMS provided increased data storage capacity of up to 1.2 gigabits with no additional requirements of space, power, or cooling. The EMS can be embedded within a UYK-43(V) enclosure either as a new feature or as an upgrade.

Since 1991, all new-production UYK-43A computers have included the open-architecture backpanel (OAB). UYK-43C models have included the OAB from the start. Customers with older UYK-43A computers have the option of replacing the standard backpanel (which uses seven main data transfer paths) with the OAB (which uses eight). The OAB was designed to support radiation circumvention and recovery using a nuclear event detector, located on the power/temperature control card. These changes formed the basis for a radiation-hardened UYK-43 computer system.

Program Review

Background. The UYK-43(V) was developed by the former Sperry Computer Systems and the U.S. Navy. The system was developed to replace the Navy's former shipboard tactical UYK-7/20 computers because their old hardware technology had become virtually obsolete. The UYK-43(V) has been procured for new systems with high- and medium-performance requirements.

Note: *Producers of the UYK-43 have been involved in the following mergers and acquisitions: Sperry became Unisys, then Paramax, then Unisys again. Loral acquired Unisys in 1995, and Lockheed Martin acquired Loral in early 1996.*

The initial development contract was issued to Sperry and IBM Federal Systems in 1980; however, the U.S. Navy selected Sperry over IBM to build the UYK-43(V) in May 1983. Sperry's initial award was valued at \$433.2 million and included procurement of a reported

733 systems. Including options, the contract had a potential value of more than \$1.5 billion.

GAO Critical Due to Computer Language Incompatibility

In 1988, the project was criticized in a General Accounting Office (GAO) report because the UYK-43/44's hardware architectures were not suited to the Pentagon's Ada computer language. Because of these differences, the 43/44 systems would be unable to fully capitalize on the cost savings of Ada's software – thus preserving large amounts of CMS-2 (former standard computer language) applications. The CMS-2 language would need to be converted to Ada gradually to ensure that bugs in the language could be thoroughly worked out.

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Short-lived Second Source

Also in 1988, the U.S. Navy chose a second source for the UYK-43, the Aerospace Division of Control Data Corp (Control Data Corp later became Computing Devices International). The Navy then awarded prime contractor Unisys (formerly Sperry) \$11 million to test and validate two UYK-43(V)s. The contract also included options for initial preproduction quantities of UYK-43(V)s from Control Data Corp, with a potential total subcontract value of \$40 million. Control Data Corp was to be fully qualified to compete for production contracts, but following the loss of a January 1991 contract award to Unisys worth \$156 million, the company terminated its involvement as a second source.

International Orders and Controversy

Following Unisys' receipt of the \$156 million contract, covering the years 1991-1994, the company received another award (as Paramax) unchallenged in July 1993. The 1993 contract, valued at \$56.8 million, called for the delivery of all computers, accessories, spares, upgrade kits, software, and related services by September 1996. The contract combined orders for the U.S. Navy (90 percent), Australia, Japan, Germany, and Taiwan.

In FY95, initial open-systems products were certified following major RDT&E. The RDT&E was conducted under PE#0604574N, Navy Tactical Computer Resources, Project S1353, Standard Hardware.

Transitional improvements were added to the UYK-43 computer under a Computer Open Systems Implementation Program (COSIP), established under Project S1353. Under the COSIP, a production model of the Computer Resources Information Base (CRIB) was completed in FY95 and populated with non-developmental item components. Also, candidate technologies, including optical medium flat-panel displays and local area network technology, were examined for application to AEGIS, Ship Defense, and Navy Tactical Data System (NTDS) software improvement programs. COSIP efforts were monitored in FY96 to ensure their readiness for final assessment and certification as scheduled for FY97.

UYK-43(V) activity was also part of the BSY-1 portion of the restructured SUBACS program. Controversy had ensued over Japanese acquisition of the system, as it was part of a plan to license-produce the AEGIS system (using the UYK-43(V)). The DoD turned them down on the grounds that the system was not releasable – not even to allies. Congress eventually relented, agreeing to the deal under the condition that the AEGIS systems be built in the U.S.

Along with Japan, the UYK-43 has been sold to other international customers such as Australia, Taiwan, and Germany. In March 2001, the Royal Norwegian Navy placed an order with Lockheed Martin for UYQ-70 and UYK-43 computers for Integrated Weapon Systems to be installed on five new frigates. The Integrated Weapon System, which will be supplied by Lockheed Martin, is a derivative of the U.S. Navy's AEGIS combat system. Deliveries of these systems began in 2001.

COTS: Faster, Smaller and More Capacity

Recently, new warfighting requirements, exceeding the current computing capacity of the UYK-43, have been placed on the AEGIS system by the Surface Warfare division of the Office of Naval Operations (OPNAV). In an effort to consolidate the baselines of the AEGIS combat system deployed on various vessels and to meet the new OPNAV requirements, the U.S. Navy plans to upgrade the AEGIS by shifting away from Navy proprietary computer hardware, like the UYK-43, to a fully open computing architecture that will incorporate new commercial off-the-shelf (COTS) computer hardware.

Navy Budget Activities 2, 3, and 5 Support Replacement of UYK-43

According to U.S. Navy documentation, the shift away from the UYK-43 starts with baseline 6.3, which introduces adjunct processors to support the UYK-43, and ends with baseline 7.1, which replaces the UYK-43 with COTS computing architecture based on the use of symmetric multipurpose processors. The first baseline 6.3 capabilities were introduced in new-construction AEGIS destroyers in 2003 and in AEGIS cruisers developed under the Cruiser Conversion program, which started in 2004. Legacy AEGIS destroyers will begin to be retrofitted with the baseline 6.3 modification in 2005.

Baseline 7.1 is still in development, but U.S. Navy FY2007 Budget Activity 4 documentation reports Full COTS Advanced Computing for use on the Arleigh Burke class guided-missile destroyers DDG-91 through DDG-102. Additionally, U.S. Navy FY2007 Budget Activity 2, Non-Shipalt, SSN Acoustics, Legacy Replacements, funding is requested to support the replacement of obsolete UYK-43 computers on SSN688I submarines. Finally, U.S. Navy FY2007 Budget Activity 5, RDT&E documents show PE#0604307N supporting all UYK-43 and adjunct computers being replaced with COTS-based advanced computer processing.

Significant News

Thales Wins Upgrade Contract for German Navy – The German Navy and Thales Deutschland and Thales Nederland have signed a contract for the full modernization and overhaul of the firepower and command and control systems of the Navy's F122 and F123 frigates and the associated naval command ground stations. Eight F122s and four F123s will be retrofitted in a contract worth EUR70 million. Under this modernization program, all the outdated firepower command and control systems will be replaced by high-performance IT equipment and modern display consoles. The contract includes command software and the integration of all sensors, weapons, and communications systems. (Thales, 9/05)

Note: Reports indicate that this overhaul means the removal of UYK-43 computers from the German F122 and F123 frigates.

U.S. Navy to Replace UYK-43 Computers – According to U.S. Navy FY2007 Budget Estimates Submission, RDT&E, Budget Activity 5, PE#0604307N, Major Baseline 7 upgrades will include all UYK-43 and adjunct computers to be replaced with COTS-based advanced computer processing. Also, U.S. Navy FY2007 Budget Estimates Submission, Other Procurement, Budget Activity 2, Non-Shipalt, SSN Acoustics, Legacy Replacements, funding is requested to support the replacement of obsolete UYK-43 computers on SSN688I submarines. (U.S. Navy, 2/06)

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Funding

	U.S. FUNDING					
	<u>FY05</u> <u>QTY</u>	<u>FY05</u> <u>AMT</u>	<u>FY06</u> <u>QTY</u>	<u>FY06</u> <u>AMT</u>	<u>FY07</u> <u>QTY</u>	<u>FY07</u> <u>AMT</u>
Other Procurement (U.S. Navy) PE#0604307N AEGIS Support Equipment BA-4 Ordnance Support Equipment L7011 AWS Shipalts UYK-43 Cards	200	2.0	200	2.0	250	2.5

All \$ are in millions.

Source: U.S. Navy FY2007 Budget Estimates Submission, February 2006, Other Procurement, Navy, Budget Activity 4

UYK-43(V)

Contracts / Orders & Options

<u>Contractors</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Lockheed Martin Canada	4.5	Oct 2001 – Award for the development and delivery of PC-based trainers for systems used in U.S. Navy AEGIS class warships. These trainers are expected to include the UYK-43 along with the UYK-7, UYH-16, and UYH-3.
Lockheed Martin	N/A	Mar 2001 – The Royal Norwegian Navy has ordered weapon-system computer suites for five new frigates. The contract calls for UYQ-70 and UYK-43 computers for the new frigates' Integrated Weapon Systems. Deliveries began in 2001.

Timetable

<u>Month</u>	<u>Year</u>	<u>Major Development</u>
Jul	1993	FMS contract includes production for Australia, Germany, Japan, and Taiwan
May	1996	FMS contract for Australia, Germany, Japan, and Spain
Aug	2001	Deliveries of Norwegian UYK-43s begin
	2002	Norwegian order scheduled to be completed
	2003	Baseline 6.3 capability introduced on new-build AEGIS destroyers
	2005	Beginning of UYK-43 card deliveries
	2008	End of UYK-43 card deliveries

Worldwide Distribution / Inventories

Recipients of the UYK-43(V) have included the navies of **Australia, Germany, Japan, Norway, Spain, Taiwan,** and the **U.S.**

Forecast Rationale

UYK-43 Technology is Outdated

In U.S. Navy procurement documents, the only line item concerning the purchase of UYK-43s are the UYK-43 cards being acquired, cited under the AEGIS Support Equipment (PE#0604307N) budget line item. According to the documents, 950 UYK-43 cards are to be delivered between 2005 and 2008.

Several budget lines are devoted to the replacement of UYK-43 computers with COTS computers. In addition, the first delivery for a Next Generation Command and Control Processor (NGC2P) Field Change Kit Ship was scheduled for February 2006. The NGC2P is designed to replace the outdated UYK-43 with next-generation open system hardware and software.

The procurement of the NGC2P is the start of the U.S. Navy's effort to move away from its proprietary hardware, like the UYK-43, to incorporate more open-architecture, commercial off-the-shelf (COTS) equipment. Production of the UYK-43 is expected to stop in the very near future. Also, it is only a matter of time before the UYK-43s on older vessels are replaced. In the near term, manufacture of the UYK-43 cards mentioned earlier will be the only work on the production line.

International Developments

The German Navy has awarded a contract to Thales Deutschland and Thales Nederland to upgrade its F122 and F123 frigates. Reports suggest that Thales will

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replace UYK-43 computers with new CMS (combat management system) computers that are partly COTS and partly Thales-built boards. Thales will be updating eight F122 Bremen-class frigates and four F123

Breanden class frigates. The same technology is used on Germany's new F-124 Sachsen class frigates and its K130 Braunschweig class corvettes. Lockheed Martin was one of the losing contenders for this contract.

Ten-Year Outlook

No production is forecasted.

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