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AN/SQQ-89 ASW Combat System [ASWCS]

The AN/SQQ-89 is the ASW Combat System for all surface combatants and will be the technological foundation for the ASW combat system of the DD-21. The ANISQQ-89 combat system suite provides Oliver Hazard Perry (FFG-7), Spruance (DD-963), Ticonderoga (CG-47), and Arleigb Burke (DDG-51) warships with an integrated undersea warfare detection, classification, display, and targeting capability. The system combines and processes all active sonar information, and processes and displays all SH-60B Light Airborne Multi-Purpose System (LAMPS) Mk III sensor data.

The AN/SQQ-89 USW Combat System is a fully integrated, real-time, distributed system that contains acoustic and environmental sensors, mission control, contact management, and weapon fire control subsystems. Legacy AN/SQQ-89 Combat System suites consist of the AN/SQS-53 hull sonar, AN/SQR-19 Towed-Array Sonar, AN/SQQ-28 LAMPS, AN/SQS-25 SIMAS, and ASW Control System (ASWCS) MK 116 systems. These legacy systems are linked via NTDS interfaces to form an integrated combat system. In order to engage and launch weapons against a subsurface threat, the AN/SQQ-89 has external interfaces to the MK 331 Torpedo Setting Panel (TSP), MK 41 Vertical Launch System (VLS), and the AEGIS Weapon System (AWS).

The SQQ-89 tactical sonar suite is composed of a hull-mounted sonar (SQS-53B) and Tactical Towed Array Sonar (TACTAS), and is fully integrated with the ship's Light Airborne Multi-Purpose Systems (LAMPS MK 111) helicopter. The AN/SQQ-89 Integrated ASW Combat System suite is the most advanced ASW system in the world today, and makes the AEGIS cruiser the best equipped anti- submarine warfare platform in the world today. In light of various deficiencies identified in 1998, the Navy is reviewing and revising its AN/SQQ 89 upgrade program to develop and procure a fully integrated system in FY 03.

- AN/SQQ-89(V)1/2 Configurations (CG-47/DD-993/DD-963 and FFG-7 Class Ships).
  - AN/SQS-53B Hull Mounted Sonar
  - AN/SQR-19 Towed Array Sonar
  - AN/SQQ-28 LAMPS MK III Sonobuoy Processing System
- AN/SQQ-89(V)2/4 Configurations (FFG-7/36 and DDG-51/DDG-993/DD-963 Class Ships).

Further Reading

- SQS-53C bow-mounted sonar
- SQR-19 towed passive sonar array
- SQQ-28 helicopter datalink
- AN/UYQ-25 SIMAS
- Mk 116 Mod. 7 weapon-control system

References

- Engineering Support Center OLDR
- Beware of Geeks Bearing Gifts By Lieutenant Commander Eric Johns, U.S. Navy (Retired) NAVAL INSTITUTE PROCEEDINGS

- AN/SQS-53C Hull Mounted Sonar
- AN/SQR-19 Towed Array Sonar
- AN/SQQ-28 LAMPS MK III Sonobuoy Processing System
- ASWCS MK116 MOD 7 Anti-Submarine Warfare Control System

- AN/SQQ-89(V)6/9 Configurations (DDG-51/DDG-993/DD-963 and FFG-7/36 Class Ships).
  - AN/SQS-53C Hull Mounted Sonar
  - AN/SQR-19 Towed Array Sonar
  - AN/SQQ-28 LAMPS MK III Sonobuoy Processing System
  - ASWCS MK116 MOD 7 Anti-Submarine Warfare Control System.

The AN/SQQ-89(V)14 Surface Ship ASW Combat System integrates COTS into surface ASW combat systems and is intended to generate significant cost savings over previous Military Standard Systems. However, the SQQ-89 project built a system entirely of COTS and TAC-3 components. A third of the way through the production run, before the units were installed, the computer and monitors were taken off the market and replaced by systems that used a different set of "commercially standard" connectors. The wiring harnesses had to be redesigned, and to maintain configuration management, the program office removed the old computers and backfitted the new ones at a cost of half a million dollars, excluding the expense of performing the modification. This entire cycle occurred in less than four years.

The objective of the Surface ASW Combat Systems Integration Program is to incrementally modernize the existing AN/SQQ-89(V) system by providing contact fusion capabilities, improved data processing and classification performance, and develop an open system architecture. The open system architecture developed into the AN/SQQ-89 (V) will enable further affordable performance growth to meet fleet requirements. Additionally, this program supports the efforts to develop adjunct processing capability to process transmissions bistatically using the AN/SQS-53C or Towed Active Receiver Subsystem (TARS) as the receiver. Adjunct processing capability will be further enhanced by the development of the Multi-Function Towed Array (MFTA). The MFTA system will be engineered to perform as the receive array for the mid-frequency active sonar, torpedo defense, and BroadBand Variable Depth Sonar (developed by PE 0603553N) which will increase bandwidth over existing AN/SQQ-89(V) sensors and improve Measures Of Performance (MOP) in detection, tracking and classification. These efforts will provide a fully integrated AN/SQQ-89(V) ASW Combat System, with improved performance in the shallow, littoral environment.

Surface ASW Combat Systems Integration will fully support the integration of follow-on adjunct processing capabilities into the AN/SQQ-89(V) in these areas: 1) development of the MFTA to perform as the receive array for the mid-frequency active sonar, torpedo defense, and BroadBand Variable Depth Sonar, 2) implementation of the next incremental active classification improvement that will incorporate environmentally adaptive processing, and, 3) implementation of a follow-on mid-frequency bistatics capability to further improve detection, tracking, and classification of shallow water USW targets.

The Towed Active Receive System (TARS) Program is appying COTS technology to provide the U.S. Surface Navy's AN/SQQ-89(V) Combat System with a new fiber optic Towed Array, a Mid-Frequency bistatic Processor and the SPS developed wideband Beamformer. The COTS Asynchronous Transfer Mode (ATM) optical interface from Array to Beamformer to Processor is a commercial standard that easily achieves 19.2 Megabytes/second sustained input and output data rates. The Beamformer features Texas Instruments TMS320C40 DSP, PowerPC, and SPARCStation hardware and SPOX, VxWorks, and Solaris operating systems. The use of Internet Protocol (IP) between processor types provides a reliable heterogeneous processor and operating system environment. The multichannel parallel

processing DSP nodes provide 300 Beam channels from 200 Elements. A highly structured portable application layer allows for rapid different development and new technology migration.

The latest variant of the USW Combat System is the AN/SQQ-89(V)15. It is intended for forward-fit installation onboard DDG-51 (Flight IIA) Class Guided Missile Destroyers. The AN/SQQ-89(V)15 system is a significant step on the evolutionary path to a fully open, Commercial-Off-The-Shelf (COTS) system incorporating performance enhancements to meet the changing Undersea Warfare (USW) threats. The AN/SQQ-89(V)15 architecture builds upon previous AN/SQQ-89 architectures. However, for the AN/SQQ-89(V)15 system, architecture changes include the elimination of the majority of the MIL-SPEC equipment and the NTDS point-to-point interfaces. The AN/SQQ-89(V)15 architecture utilizes an Asynchronous Transfer Mode (ATM) network. The AN/SQQ-89(V)15 is comprised of the following eight functional segments, grouped into three system tasks:

1. USW Sensor and Processing Segments
    1. Acoustic Sensor Functional Segment (ASFS)
    2. LAMPS Sonobuoy Functional Segment (LSFS)
    3. Torpedo Recognition and Alertment Functional Segment (TRAFS)
2. Contact Management and Fire Control Segment
    1. Undersea Warfare Control Functional Segment (UCFS)
3. Support Segments
    1. On-Board Trainer Functional Segment (OBTFS)
    2. Sensor Performance Prediction Functional Segment (SPPFS)
    3. Workstation Functional Segment (WSFS)
    4. Common System Services Functional Segment (CSSFS).

The AN/SQQ-89(V)15 system is designed to reduce system production costs versus legacy AN/SQQ-89 systems, while at the same time increasing system warfighting capability. The design goals of the AN/SQQ-89(V)15 system are as follows:

1. Increase COTS Content The AN/SQQ-89(V)15 system replaces the majority of the remaining AN/SQQ-89 standard militarized legacy components with COTS hardware. Specifically the Enhanced Modular Signal Processors (EMSPs), AN/UYK-43B and associated peripherals, Active Receiver Beamformer (ARBF), Waveform Generator and Transmit Beamformer (WGTB), Interface Signal Switch Unit (ISSU), and On-Board Trainer (OBT) units are replaced with COTS equivalents.
2. Enhanced Warfighting Capability The AN/SQQ-89(V)15 system provides selected enhanced warfighting capability particularly in a littoral environment. Echo Track/Classification (ETC) is provided for hull array processing, and AEGIS/USW display integration efforts are supported.
3. Backfit Synergy The AN/SQQ-89(V)15 system takes advantage of technologies which have been or are being developed for the AN/SQQ-89(V)14 system and the block upgrade programs.

The AN/SQQ-89(V)15 open system architecture allows for easy incorporation of enhancements and new capabilities either by accessing the data available on the ATM LAN for use by new functions within the COTS equipment, or by adding new processors. Other features of the AN/SQQ-89(V)15 architecture include:

1. Data Processing - A common set of data processing resources have been selected to support a minimal ILS supply line. These are consistent with the processors selected for the AN/UYQ-70 display systems. The HP744 provides high performance, a VME form factor, and supports multiple options for incorporating interfaces to the ATM LAN.
2. Signal Processing - A common signal processing architecture is utilized for all new signal processing development activities such as OBT target generation, ETC signal processing, Hull Array receiver/beamformer, and sonobuoy signal processing. The signal processing architecture is a standard based cross bar switched design utilizing COTS solutions.
3. Communications Middleware - The architecture uses a collection of middleware products to isolate the applications from the computer platform, ATM LAN, and operating system. The middleware allows the system to be partitioned along functional boundaries, and mapped to a hardware implementation based on resource availability and loading. The architecture utilizes CORBA as the foundation for the communications middleware. Enhancements are made to support new functions, and inclusion of new features, such as database managers and the ATM LAN.

4. Resource Management - The resource management approach utilizes SNMP standards to implement system initialization, reconfiguration, and to control system PM/FL tests.

The use of COTS equipment reduces the total cost to the program through reduction of the combined Government Furnished Equipment (GFE) and Contractor Furnished Equipment (CFE) costs. In addition, the open architecture allows easy incorporation of enhancements and new capabilities either by accessing the data available on the Local Area Network (LAN) for use by new functions within the COTS equipment, or by adding new processors.

COTS insertion brings with it the advantage of easier technology refreshment to keep up with the rapidly changing world of commercial processing capability.

The life cycle cost is reduced due to the reduction in the number of units, the number of unique assemblies within the units, the overall number of assemblies, and the cost per assembly.