

## ADVANCED COMBAT DIRECTION SYSTEM (ACDS) BLOCK I



### Navy ACAT II Program\*

Total Number of Systems:	40
Total Program Cost (TY\$):	\$296.8M
Average Unit Cost (TY\$):	\$1.8M back fit \$13.9M forward fit
Full-rate production:	TBD

### Prime Contractor

Raytheon Naval and Maritime Systems  
San Diego, CA

\* Original plan. See program status under Background Information.

### SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The AN/SYQ-20 Advanced Combat Direction System (ACDS) Block 1 consists of computer program software and associated hardware for non-Aegis combatant ships (aircraft carriers and selected amphibious warfare ships). ACDS Block 1 provides extended range display, expanded track capacity, Joint Tactical Information Distribution System interoperability, modifiable doctrine, display of mapping information, automatic gridlock, and doctrine-controlled multi-source identification. AN/SYQ-20 hardware includes computers, a display system with consoles, data terminal sets, automatic data processor, and automated status boards.

ACDS Block 1 is a combat direction system for aircraft carriers and amphibious warfare ships that supports the *Joint Vision 2010* concept of *full-dimensional protection*, by providing control for a final layer of self-protection against threat “leakers” (air, surface, subsurface) for individual ships. By ensuring such protection, ACDS Block 1 contributes indirectly to the concept of *precision engagement*, enabling strike operations against targets to be executed from these platforms.

## **BACKGROUND INFORMATION**

ACDS Block 1 represents the second phase of implementation of the Combat Direction System improvement plan of 1981, with ACDS Block 0 representing the initial phase. The Block 1 program was restructured in April 1991. Further adjustment occurred in FY93, targeting FY97 for fleet delivery of the software. Work to address deficiencies observed during 1997 testing delayed the OPEVAL and the full production decision. OPEVAL was conducted in February 1998 in the Atlantic Fleet and Puerto Rican operating areas. As required by DOT&E, OPEVAL included operations in a battle group environment. Based on OPEVAL results, ACDS Block 1 was assessed as neither operationally effective nor operationally suitable. Subsequently and contrary to original plans, it was determined that ACDS Block 1 will be installed in no more than five ships (USS JOHN F. KENNEDY, USS DWIGHT D. EISENHOWER, USS WASP, USS NIMITZ, and USS IWO JIMA). ACDS functionality will be included in the Ship Self Defense System Mark 2, using some ACDS algorithms but implemented with new code.

## **TEST & EVALUATION ACTIVITY**

As the future of ACDS Block 1 was being determined, it was being installed on USS JOHN F. KENNEDY (CV 67). The Commander of the Second Fleet requested that OT be conducted on the system to determine the capability and limitations prior to deployment by JOHN F. KENNEDY. Accordingly, two phases of OT were conducted in a battle group environment in the Puerto Rican operating area. The first was conducted in April 1999 during fleet exercise *El Morro Castle* and the second in July 1999 during a fleet composite training unit exercise. Operations included NATO Sea Sparrow missile firings against an attack by subsonic anti-ship cruise missiles, simulated by target drones. Also included were multiple warfare area exercises, tactical data link (Link-11 and Link-16) surveillance operations with E-2C aircraft and NATO airborne warning and control system aircraft, air control exercises with F-18 aircraft, and an antisubmarine warfare exercise. ACDS Block 1 was operated with the Cooperative Engagement Capability (CEC) providing radar inputs. Testing was conducted in accordance with a DOT&E approved TEMP and test plan. A DOT&E representative observed testing.

## **TEST & EVALUATION ASSESSMENT**

The FY99 OT was conducted to examine software improvements since OPEVAL and provide analysis of capabilities and limitations provided by ACDS Block 1 for JOHN F. KENNEDY and the KENNEDY battle group. Combined test time for the April and July 1999 underway periods was 307 hours, with test operations exercising ACDS Block 1 functions associated with detection, identification, tracking and engagement of air, surface, and underwater targets in an operationally realistic environment.

Based on results of the OT in the realistic battle group environment, some COIs were resolved as satisfactory. These were reliability, availability, compatibility, training, safety, and security. Improvement was observed in the software reliability measure, mean time between operational mission faults, which increased from 11 hours during the OPEVAL to 32.8 hours during this OT (threshold is no less than 25 hours). Operational availability increased from 0.91 during the OPEVAL to 0.96 during this OT (threshold of no less than 0.90). The COI of doctrine management was partially resolved. However, other COIs were found to be unsatisfactory. Own-ship management, composite warfare command management, performance monitoring and casualty modes, survivability, maintainability, logistic supportability, interoperability, human factors, and documentation were resolved as unsatisfactory. With

the exception of logistic supportability, these COIs were also unsatisfactory during OPEVAL. The software maintainability measure and mean corrective maintenance time for operational mission faults, remained well in excess of the threshold.

Although 8 of 38 major deficiencies from the OPEVAL have been corrected, five additional ones were identified in the FY99 OT. Major performance deficiencies included the following:

- Poor human-machine interface design, compounded by use of first generation AN/UYQ-70 consoles.
- Computer program maintainability is unsatisfactory in a realistic operational environment.
- Tracks from own ship radar data are frequently not correlated properly with tactical data link tracks. In general, aggressive action and extraordinary alertness by operators is required to maintain a tactically useful surveillance display.
- Although the overall system software reliability performance met the threshold requirement, operator console (AN/UYQ-70) performance was inadequate, as evidenced by lockups, reboots, console readout failures, and other problems (averaging 7 failures per day). The failures are extremely disruptive, although they fall short of being operational mission failures.
- Console and information display design makes some operator actions tedious and requires so much attention in some areas (keyboard data entry, for example) that it detracts from operator performance. Other human-machine interaction deficiencies included failure to provide adequate alert of the loss of interface to CEC (resulting in loss of own-ship sensor input), poor management of operator alerts, and confusing management of tactical display doctrine.
- Track number management is deficient. Single tracks sometimes display toggling track numbers, and multiple tracks sometimes show the same number.
- Functionality of the interface with the electronic warfare system remains inadequate.
- The display in the tactical flag command center was without an ACDS tactical picture for extended periods.

As a result of the observed deficiencies that led to assessment of several COIs as being unsatisfactory, the Operational Test Agency, COMOPTEVFOR, recommended that ACDS Block 1 not be installed in USS NIMITZ and USS IWO JIMA until correction of deficiencies.

## **LESSONS LEARNED**

Both the FY98 OPEVAL and the FY99 OT provided reaffirmation of a lesson learned from earlier testing with other systems: software-intensive systems intended to support control of defense against threat “leakers” (especially fast-moving air threats) must be immersed in a realistic operational test environment. In the case of ACDS Block 1, this equated to at-sea operations by the aircraft carrier

with accompanying ships, along with a realistic number of air targets for radar tracking, identification, and threat prioritization by fleet operators.