DEFENSE STANDARDIZATION PROGRAM

CASE STUDY

Common Air Defense Interrogator

This case study describes the Army's development of the Common Air Defense Interrogator (ADI). The new ADI is interoperable with systems used by allied forces and is safer and more reliable, reducing the chance of friendly fire. Also, by implementing the new ADI, the Army will avoid an estimated $31 million in costs.

Defense Standardization Program Case Study

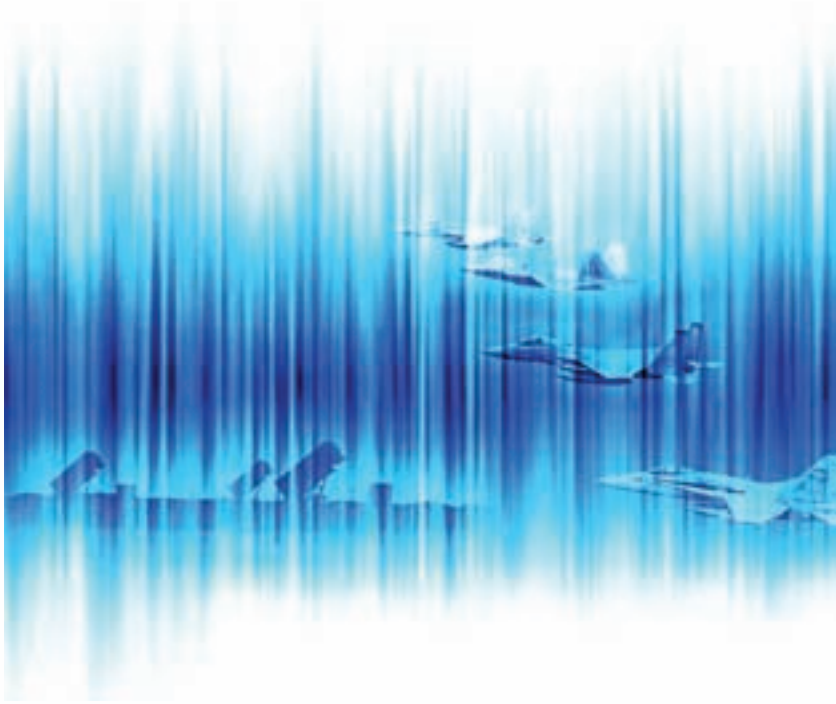
Common Air Defense Interrogator

Background and Problem

The Mode 4 Mark XII Identification Friend or Foe (IFF) has been operational since the 1960s and was used by all three military services. A cooperative question-and-answer friend identification system, the Mode 4 IFF has four main components: an interrogator subsystem, a transponder subsystem, decoders, and antennas. The system has steadily become obsolete due to old technology and the unavailability of components. Moreover, the Mode 4 was not sufficiently effective, nor was it interoperable with the systems used by our allies. The lack of effective, compatible, and interoperable combat identification systems contributed significantly to fatalities due to friendly fire, or "fratricide."

Recognizing the Mode 4's obsolescence and resulting problems, the National Security Agency directed that the Mode 4 equipment be phased out and replaced with a new Mode 5 waveform system that could provide high-confidence, secure identification. The new system would need to be fully capable of operation in all the existing selective identification feature modes as well as Mode 4 for legacy platform support. Each mode has different characteristics, but all decode an identification-of-position reply from a transponder, and all mark on the radar indicator a particular aircraft with which the system's operator has voice communications.

The Air Force and Navy established formal program offices to acquire and field Mode 5 equipment. In contrast, because the Office of the Secretary of Defense did not direct replacement of Mode 4 equipment, the Army did not establish a dedicated program office. Instead, the Army decided to develop a cohesive Mode 5 program with available, minimal resources. The Army's aim was to pro-



vide a new state-of-the-art Mode 5 air defense system that satisfies commonality requirements and remains backward compatible with existing Mark XII IFF systems.

Approach

To develop an ADI having a common standard, lower-cost logistics, and superior capabilities, the Army—specifically, the U.S. Army Communications-Electronics Research, Development and Engineering Center (CERDEC) Intelligence and Information Warfare Directorate (I2WD)—built on the DoD-developed enterprise architecture. The term "enterprise architecture" describes the practice of documenting and analyzing the elements of business strategy, policies, and processes and the supporting technologies and infrastructures that enable an enterprise to fulfill its mission. A clearly defined enterprise architecture provides a framework for identifying, optimizing, and validating interdependencies and interrelationships.

DoD has long recognized the necessity of an enterprise architecture. In February 1998, DoD directed its components and activities to use the Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) Architecture Framework 2.0. The framework has three components:

- Operational architecture—the operational elements, activities, tasks, and information flows required
- Systems architecture—the systems and interconnections supporting the mission
- Technical architecture—the minimum set of standards and rules governing the arrangement, interaction, and interdependence of system applications and infrastructure.

It was within the C4ISR framework that CERDEC I2WD began addressing the challenge of finding new ways to avoid friendly fire in joint and coalition operations.

Assembling the Team

The first challenge for the CERDEC I2WD was to assemble an ADI team with the necessary knowledge, technical expertise, and management skills. It was critical that the team be fully informed of ongoing efforts to improve existing systems. The Army, lacking a dedicated program office, chose to pursue its IFF transformation by linking the upgrade to the Patriot Missile Systems Recapitalization initiative. CERDEC addressed the Mode 5 IFF upgrade by making it a Technical Insertion Program for the Patriot Missile system. To ensure joint compatibility and interoperability, the ADI team engaged with the Air Force and the Navy Mode 5 IFF programs. It was essential for the team to understand, leverage, and coordinate with the Air Force and Navy efforts. The team also recognized the need to engage other Army programs, both aviation and ground, to develop solutions Army-wide and not just for the Patriot.

The team also included acquisition professionals.

These individuals provided valuable input, ensuring that the acquisition was conducted in compliance with the *Federal Acquisition Regulation*.

Describing the Requirement

The ADI team worked closely with the various air defense program managers to understand their unique needs and to ensure that all requirements were satisfied for each Army defense mission area. Ensuring satisfaction of all requirements involved reviewing all equipment specifications, as well as integrated logistics support and maintenance strategies, and then preparing the Mode 5 ADI equipment specification. Team members participated in the development of a NATO standardization agreement to ensure that equipment designed by NATO and coalition partners would be interoperable. The team participated actively in the tri-service effort to develop a specification to ensure interoperability among U.S.-manufactured Mode 5 equipment. The basic design was to be adaptable to allow integration onto multiple air defense platforms, including the Patriot Missile System; Air Traffic Navigation, Integration and Coordination System; and Medium Extended Air Defense System. After gaining an understanding of the overarching concerns and the logistical and technical issues, the team developed an architectural "blueprint" of the envisioned ADI system.

Developing the Request for Proposals

The team, in conjunction with contract personnel, emphasized several critical elements in the request for proposals. For example, it required that the cryptographic computer be an appliqué as opposed to a standalone or embedded module. The team also attempted to leverage the basic design for high commonality with variants of four platforms: Joint Land Attack Cruise Missile Defense Elevated Netted Sensor, Man Portable Air Defense Systems, Avenger, and Linebacker. Although these platforms were ultimately not included, the team focused on maximizing standardization to the greatest extent possible.

Working with Contractors

The team was active in implementing updates to the interoperability standards on the contract to ensure that interoperability was maintained at the international level and nationally at the tri-service level. Team members were instrumental in working with the contractor to contain costs while maintaining the schedule.

Working with Partners

The ADI team was successful in securing funding for research, development, test, and evaluation (RDT&E) and for follow-on production. The team worked with both the Air Force and the Navy to ensure synchronization of the three services' Mode 5 programs. The team also added the Air Force to the contract, thereby allowing the sharing of costs for mutual product changes. The insistence that the cryptographic computer be an appliqué resulted in a cooperative agreement with the Air Force to utilize the KIV-77 crypto appliqué module for several Air Force platforms.

Being Proactive and Dedicated to Accomplishing the Task

Perhaps most critical was the team's commitment to the task in spite of the fact that no Army program of record was ever established. Lack of a dedicated program office was a serious obstacle for the team, because it was difficult to have an equal voice at critical interservice meetings. The team took it upon itself to act on behalf of the Army without the specific funding and staffing that being designated a program of record would provide. The team recognized the need and proceeded because it was important and it was the right thing to do.

Benefits

The Common Air Defense Interrogator provides enhanced performance and capabilities to meet current and future challenges in its primary role: identify friendly aerial platforms. The new ADI IFF

- standardizes applications and interoperability with joint U.S., NATO, and other allied forces;
- reduces the chance of fratricide;
- substantially improves safety and reliability;
- improves sustainability during its life cycle; and
- improves program efficiencies as reflected in achieved cost avoidance.

Implementing the ADI will result in cost avoidance of an estimated $31 million. Of that amount, $21 million are attributable to the combined production programs, and $10 million are attributable to logistics cost avoidance resulting from use of a common application.

The common form, fit, and function interchangeability of the crypto appliqué assembly will significantly reduce costs associated with spares and with maintenance and repair requirements. It is anticipated that the ADI will be used by the majority of U.S. Army air defenders and, because a comparable interrogator is not available elsewhere, will be installed on many foreign military sales applications as well. A significant number of Army air defense platforms and tri-service DoD Mode 5 transponders and interrogators, as well as foreign military sale applications, will utilize the KIV-77 crypto appliqué.

The Mode 5 design is compact and offers substantial weight reduction and power consumption

savings when compared to other designs. The incorporation of high-confidence built-in-test (BIT) reporting and the provision of a simplified plain-text fault display that eliminates the need for special test equipment promise substantial logistics savings. Cost savings will result from reduced logistics requirements inherent with the common hardware implementations and from the elimination of field test equipment due to the improved BIT capability. Participation on the NATO standardization agreement committee and the DoD IFF standards committee ensured interoperability between the ADI and the NATO and DoD Mode 5 IFF transponder equipment.

Training requirements will be decreased due to a simplified maintenance concept, one that eliminates the need for unique test measurement and diagnostic equipment and for reliance on manual troubleshooting, alignment, and adjustment procedures. Technical manual development cost was markedly decreased with a common IFF solution that resulted in a single manual that can be tailored for specific applications rather than multiple manuals—one for each platform. Life-cycle cost modeling and related decision processes decreased overall support costs by determining the least-cost maintenance alternative while still meeting all platform requirements.

Future Efforts

The Common Air Defense Interrogator program is in the final year of RDT&E. It was tested at White Sands Missile Range, NM, in June 2008 as part of the final developmental/operational testing on the Patriot radar. A production decision will follow, with an initial operating capability anticipated by 2014.

Lessons Learned

The ADI team learned several lessons that other projects should consider:

- Establish a dedicated program office (program of record)
- Focus on describing the requirement using the common denominators
- Focus on interoperability
- Focus on compatibility
- Focus on maintenance, testing, life-cycle modeling, and training costs
- Involve all concerned parties as early in the process as practical
- Ensure that the project team has the necessary technical expertise
- Ensure that the project team has the necessary acquisition expertise
- Focus on teamwork
- Recognize a need and take action.

Each of these is discussed below.

Establish a Dedicated Program Office (Program of Record)

Although the ADI team was successful, the project faced obstacles because it was not an established Army program of record. No other single factor

could have had a more profound impact. Through hard work and dedication to the task, the project team persevered. But having a dedicated Army program office would have greatly reduced obstacles and placed the Army on an equal footing with the other services.

Focus on Describing the Requirement using the Common Denominators

Thorough consideration of all the various potential users, domestic and foreign, was critical. To effectively identify the critical common denominators, the team had to understand all users' requirements in order to define the requirements in the most universal terms.

Focus on Interoperability

The performance standards put in place will ensure interoperability between U.S. military and NATO platforms. The team was actively involved with the Army aviation community to ensure that interoperability would be maintained between Army air defense and Army aviation platforms.

Focus on Compatibility

The new Mode 5 performance standards will be used to certify military transponders installed on aviation, unmanned aerial vehicle, and watercraft platforms, as well as interrogators installed on air defense systems and air traffic control platforms, common test equipment, and over-the-air operational testing of IFF-equipped platforms. A common crypto appliqué, developed to the new Mark XIIA performance standards, is being installed on more than 3,000 Army, Navy, and Air Force platforms, and it will be used on more than 2,000 IFF test sets used throughout the military to accomplish bench and over-the-air testing of Mode 5-equipped platforms.

Focus on Maintenance, Testing, Life-Cycle Modeling, and Training Costs

Standardization makes interoperability and compatibility across platforms an achievable goal. Standardization also simplifies maintenance and reduces the number of manuals for required training and operation. The incorporation of BIT with a simplified plain-text fault display eliminated the need for special test equipment and reduced logistical costs. Standardization helps life-cycle modeling and the decision process find the least-cost maintenance alternative.

Involve All Concerned Parties as Early in the Process as Practical

The Air Force and Navy established programs of record for fielding Mode 5 equipment, but the Army did not. The Army's involvement through the ADI team was critical in the development of a state-of-the-art air defense system that was interoperable and compatible—a true tri-service system. However, earlier cooperation and interaction among the three services may have resulted in greater savings and expedited the deployment of the Mode 5 system.

Ensure That the Project Team Has the Necessary Technical Expertise

The team's knowledge of the mission requirements and the equipment being utilized proved invaluable in developing the architectural blueprint and resulting procurement documentation. The team's expertise in technical, maintenance engineering, and integrated logistics support, along with hands-on IFF experience, was instrumental in successfully implementing a two-level maintenance concept that increased system operational availability. By stressing the utilization of common modules, thus reducing overall spares to support a common interrogator, maintenance downtime and overall spare part and documentation requirements were decreased. A robust system BIT capability provided the maintainer a high confidence level to fault isolate to a field replaceable module with minimal manual intervention. In addition, the team provided direction in the areas of warranty implementation and management that provided quicker repair turnaround times and near-real-time access to inventory and system status.

Ensure That the Project Team has the Necessary Acquisition Expertise

The statement of work, the proposed contract terms, and the evaluation criteria allowed the Army to select the contractor offering the best value. The criteria were structured to reward basic design approaches with a high commonality that would factor in the width and breadth of the user community. By working closely with acquisition professionals, a carefully structured and well-thought-out solicitation resulted in a contract that effectively met the requirements of the mission. The ADI team believes now that the use of a cost-plus-award-fee contract might have been superior to the cost-plus-fixed-fee contract that was awarded. Although it is generally recognized that an award-fee contract is more difficult to administer, it provides incentives for the contractor and can be a helpful tool in directing and monitoring a contract.

Focus on Teamwork

The project team recognized that it needed to enlist partners in the overall effort to minimize costs and maintain the schedule. The team proved particularly effective in working with the contractor as well as with the Air Force and the Navy to synchronize the Mark XIIA programs. The team solicited and

obtained Army RDT&E funding as well as support from the other services to allow for the sharing of costs.

Recognize a Need and Take Action

It is unfortunate that it took dozens of friendly fire fatalities in Iraq for DoD to begin to focus on the obsolescence of rapidly aging technology. Mode 4 had been operational since the 1960s. Maintaining the equipment was becoming more and more problematic because component parts could no longer be procured. But it was the National Security Agency that ultimately directed that the Mode 4 equipment be phased out.

The team, recognizing the need for a common ADI, took steps to realize it. Some substantial obstacles could have been eliminated if the effort had been designated a joint program and if the Army's effort had been designed as a program of record.

DEFENSE STANDARDIZATION PROGRAM OFFICE
8725 John J. Kingman Road
Fort Belvoir, VA 22060-6221
(703) 767-6888
dsp.dla.mil