DEFENSE STANDARDIZATION PROGRAM

CASE STUDY

AN/PRC-112 Survival Radio

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This case study describes how the U.S. Army Communications-Electronics Command (CECOM) is using standardization and other innovative acquisition methods to extend the life and improve the performance of the AN/PRC-112 survival radio.

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Defense Standardization Program Case Study

AN/PRC-112 Survival Radio

Standardization Extends and Improves Performance

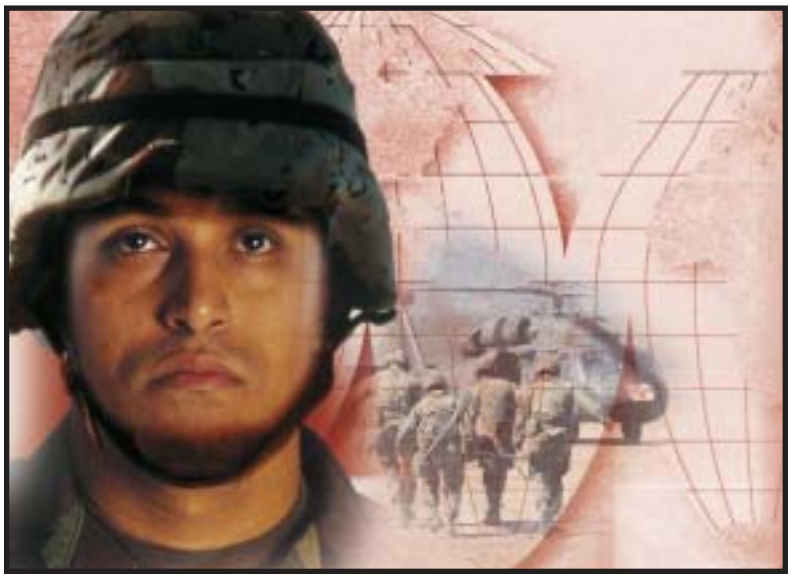
Background and Problem

Downed military pilots use a survival radio to signal their location to rescuers. The AN/PRC-112C—the radio in use by American military pilots and several allies—was designed in the mid-1980s and first fielded in Desert Storm in 1990. The AN/PRC-112 is the only radio in the DoD inventory with adequate protection to avoid enemy intercept.

The AN/PRC-112 operates only in line-of-sight conditions and lacks geopositioning information; this makes planning missions to recover downed pilots very difficult. The ability of enemy forces to detect the homing beacon and voice transmissions has caused some recovery missions to fail: the enemy captured evaders before recovery forces arrived in the area.

Not only does the AN/PRC-112C have limited capability and moderate reliability, but many of its parts are obsolete. Motorola, the original equipment manufacturer for the radio, notified CECOM in 1998 that certain components and parts were no longer available. Advancements in electronics technology, driven by industry standards, were making it impossible to sustain the radio's hardware-driven design; any change in design requires a change in hardware.

To further complicate the situation, the industrial base has been deteriorating, which has driven operation and support costs exponentially higher. For those and other reasons—including the lack of sufficient acquisition funds—the Army is finding it increasingly difficult to sustain the legacy system and field enough radios. The Army fielded only one-half of the approved acquisition objective, resulting in a severe shortage of survival radios for peacekeeping operations in Eastern Europe.



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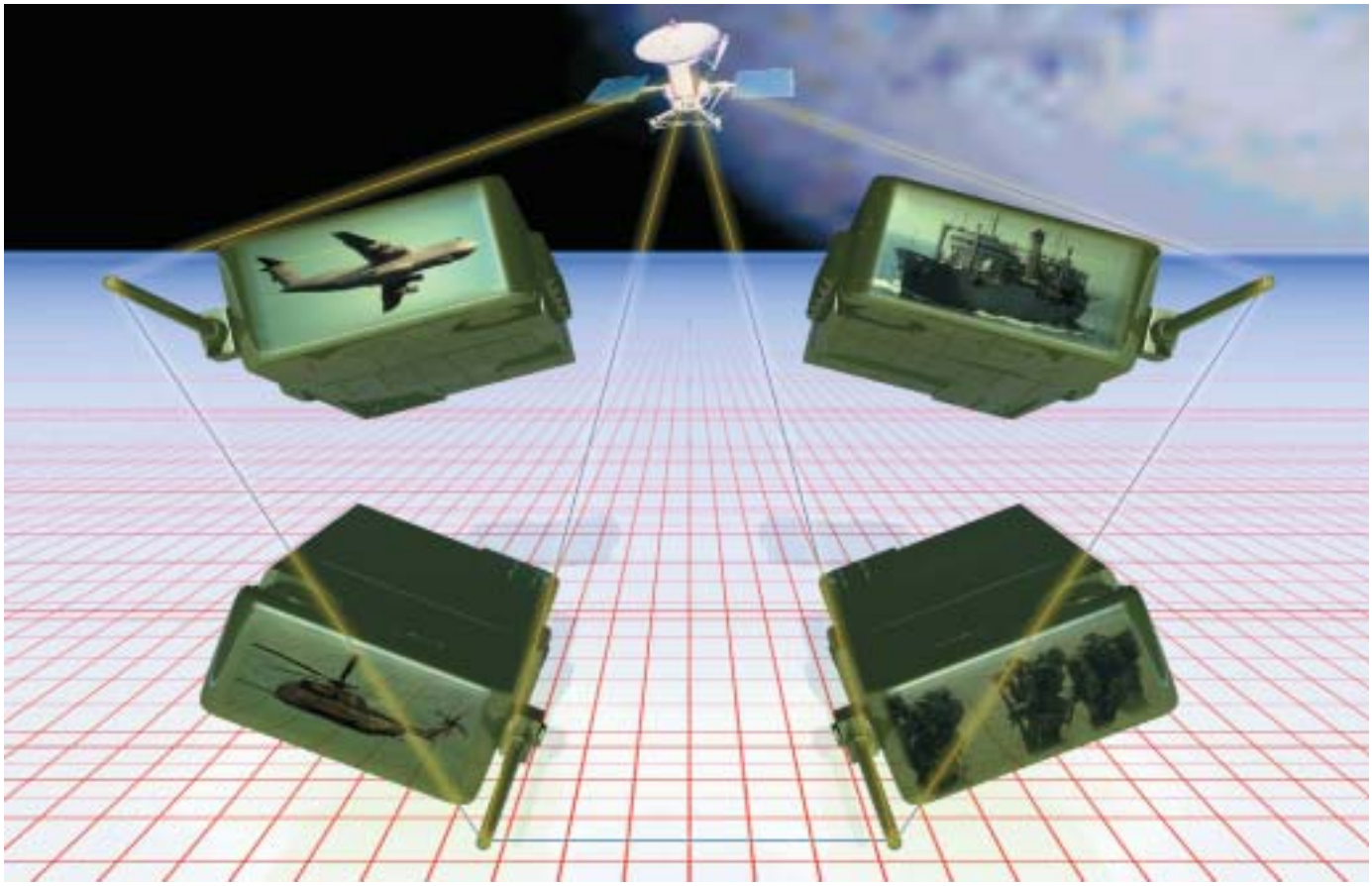
DoD has planned the next-generation combat search-and-rescue communication system—the tri-service Combat Survivor Evader Locator—as the successor to the AN/PRC-112C.[1] However, development of the next-generation survivor system has been delayed.[2] Nevertheless, an effective and sustainable survival radio continues to be needed for military operations. Therefore, in 1998, CECOM's Logistics and Readiness Center began an initiative to extend the life and improve the performance of the AN/PRC-112.

Approach

To ensure that the Army could adequately sustain and support the AN/PRC-112 as long as required—until about 2010—CECOM took three key steps:

- Analyzed user requirements and commercially available technology
- Obtained funds from standardization initiatives

Survival in the field depends on an efficient radio. Once a satellite receives the information, coordination is crucial between disparate elements from air command to near ground rescue.



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- Developed and initiated competitive contracting procedures using performance specifications that emphasized improving the radio's cost, performance, and availability.

Requirements Analysis and Market Survey

CECOM's first step was to meet with users in the field to determine their needs. User requirements reflected capabilities available to pilots through commercial consumer products such as cell phones. CECOM then surveyed industry to identify what is commercially available and to assess what is technically possible. Several vendors responded—including the original equipment manufacturer—and demonstrated that software-programmable radio technology is readily available and in commercial use.

Standardization Initiative Funding

Next, CECOM did an economic analysis of the depot rework program at Tobyhanna Army Depot in Pennsylvania. Tobyhanna—DoD's largest full-service maintenance and logistics support communications-electronics facility—is the primary repair depot for the AN/PRC-112. When a radio fails in the field, the user returns it to Tobyhanna for repair or retrofit. CECOM found that the field returned 400 to 500 radios—5 percent of the population—over the past 10 years.

CECOM submitted a proposal to two Army standardization initiatives—Reliability, Maintainability, Supportability initiative and Operations Support Cost Reduction initiative—and received $2.5 million to improve the radio's performance, reliability, and price.

Competitive Contracting Procedures

With a view toward awarding a performance-based contract for improving the AN/PRC-112C, CECOM developed a set of key performance specifications. The specifications, based on user requirements and industry knowledge, included the following:

- Reduction in energy consumption of 40 percent
- System mission operational life of at least 20 hours
- Sleep mode
- "Go/no go" built-in test capability
- Ability to accommodate a secured global positioning system transponder, search-and-rescue satellite-aided tracking, and over-the-horizon capabilities
- Availability of 99.99 percent for a mission duration of 24 hours
- Warranty concept
- Commercial quality standards.

CECOM also included a cost estimate for the radio and spares retrofit kits with the performance specifications.

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On December 23, 2000, CECOM awarded a $2.5 million performance-based, incentivized contract to Engineering and Professional Services, Inc. (EPS), to upgrade the radio to an AN/PRC-112D model. EPS formed a consortium with Tadiran Spectralink, Kaiser Electronics, and Tobyhanna Army Depot:

- EPS serves as the prime contractor, responsible for program management and integrated logistics support.
- Tadiran Spectralink provides technical oversight and repackages the circuitry of their commercially available PRC-434 survival radio into the "look and feel" of the AN/PRC-112 radio.[3]
- Kaiser Electronics produces the new circuit card upgrade kits and any future end-item radio production.
- Tobyhanna incorporates the kits into existing inventory radios by removing the old electronics from the radio and incorporating the new circuit cards. Through Tobyhanna's partnership with industry, the Army retains its core maintenance capability. Moreover, capital investments in new production equipment can benefit other Army programs.

CECOM also awarded an option on the EPS contract for commercial rechargeable and nonrechargeable radio batteries. EPS, together with the American Competitiveness Institute and the University of Pennsylvania, are the developers of the battery products.

Outcome

As a result of CECOM's work, the Army can now retrofit existing AN/PRC-112Cs with commercial circuitry and batteries. CECOM's AN/PRC-112 initiative has paid off in several ways:

- Designed-out obsolescence
- Decreased power consumption and designed-in commercial batteries
- Compressed development cycle time
- Improved reliability
- Reduced acquisition cost.

Designed-Out Obsolescence

The AN/PRC-112D is a software-centered design that uses programmable waveforms; no hardware changes are necessary to add functionality. The radio contains two circuit cards—down from the 11 original circuit cards—creating sufficient space for

- a secure global positioning system transponder,
- search-and-rescue satellite-aided tracking, and
- over-the-horizon capabilities.[4]

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Decreased Power Consumption and Designed-In Commercial Batteries[5]

The performance specification requires a 40 percent reduction in current energy consumption. The new radio achieves this in part by "going to sleep" when not being interrogated. The radio remains "on" but consumes less energy in the sleep mode.

Under the legacy requirement, the radio operated for 12 mission hours on a $40 military-unique battery, which was increasingly difficult to procure: there is a 3-year backorder on the BA5112 military battery. The performance specification requires the upgraded radio to operate for 20 mission hours using commercial, nonrechargeable batteries. In testing, the radio operates for an average of 40 hours, while using four AA lithium Energizer batteries—a consumer battery costing about $2 each.[6] The batteries fit into a $75 case resembling the military battery, which operates for 500 battery replacement cycles. Another advantage offered by AA lithium batteries is the reduction in hazardous waste and disposal costs. AA lithium batteries are not classified as hazardous material and, therefore, are transportable on commercial aircraft.

The performance specification also calls for an unlimited power source. The upgraded radio will use a rechargeable nickel-metal hydride Energizer battery that lasts 20 hours without a recharge, is rechargeable for 500 cycles, and costs the same as the nonrechargeable lithium battery. An adapter facilitates charging or powering the radio during tactical missions through external power sources such as solar panels and zinc air power packs.

Solar Panels

When it needed an unlimited power source for the upgraded radio, the AN/PRC-112 team turned to CECOM's Power Sources Center of Excellence (PSCOE) for help. PSCOE is working with two industrial partners—at no cost to the government—to develop a remote, tactical, photovoltaic solar panel that warfighters can carry folded in their pocket. Starting with a commercial solar panel available on the General Services Administration schedule, CECOM and industry are making improvements to

- increase ruggedness,
- reduce glare, and
- build in current flow indicators.

The panel can recharge the AN/PRC-112D in less than 4 hours; nickel-metal hydride batteries can operate without full recharge.

Compressed Development Cycle Time

CECOM received the first retrofitted radio 18 months after awarding the upgrade con-

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tract. CECOM shipped the first 280 AN/PRC-112Ds to the field in April 2003 and an additional 200 radios in May 2003. CECOM credits the research and analysis of requirements and capabilities conducted before formal solicitation as key to the compressed development cycle time. Also critical to its success was CECOM's assembly, early in the process, of an integrated weapon systems team: managers, engineers, logisticians, contract specialists, and legal experts.

Improved Reliability

Although it is too early in the program to measure reliability, CECOM expects the "no-fault, reduced-demand, incentivized" warranty for the new circuit cards and other component parts to yield significant reliability improvements. The warranty covers all failures—including items with defects beyond contractor control—such as willful misconduct; accident; misuse; abuse; improper maintenance; negligence in transportation, packaging, handling, or storage; catastrophic damage such as fire, flood, explosion, or combat damage; or an act of God. The duration of the warranty is 10 years—the contract execution period.

The economic analysis conducted before solicitation revealed a radio return rate of 5 percent over the past 10 years. For the new radio, CECOM set a return rate target of 1 percent of all modified or new end-items within a 1-year period. At its own expense, the contractor supplies spares in excess of 1 percent of the annual quantity. The contractor is paid up-front each production year at the 1 percent rate. If the returns to the depot are less than that rate, the contractor keeps the fee as incentive for saving operation and support costs for the warfighter.

To further maximize benefit and control of this process, CECOM tasked the contractor to include an effective internal fault detection process in the radio to reduce soldier time in assessing mission readiness, as well as to simplify the return decision made at the unit level. The built-in test feature, for both radio and battery, precludes the need to field separate test equipment.

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Reduced Acquisition Cost

The solicitation contained a price schedule with a $4,000 cap for the radio and a $2,500 cap for the spares kit. EPS proposed a $3,000 radio and a $2,000 spares kit, with additional price breaks based on quantity. The initial government buy is based on a lot quantity of 1,000. Larger buy quantities could further drive down the price to $2,000 per radio.[7] CECOM expects approximately $8 million in battery savings and $20 million in radio savings over the next 10 years. Table 1 compares the cost and battery life of the AN/PRC-112C with the new retrofitted D model.

Table 1. Comparison of Model Costs and Battery Life

Item	AN/PRC-112C	AN/PRC-112D
Cost per radio	$6,000	$3,000
Cost per spares kit	$4,000–$5,000	$2,000
Battery Life	8–10 hours	20 hours[a]

[a]Contract performance specification. In tests, the AN/PRC-112D battery life averaged 40 hours.

Status

Even when all existing AN/PRC-112C radios are retrofitted, the Army will still not have enough survival radios. Therefore, CECOM is requesting funding to purchase new AN/PRC-112D radios. In the future, the AN/PRC-112D's capabilities likely will roll into the Defense Department's Joint Tactical Radio System—an effort to meet diverse warfighter needs through software-programmable radio technology. In the meantime, CECOM continues to work with industry to develop alternative power sources for rechargeable batteries.

Lessons Learned

Several lessons learned by CECOM may apply to other areas:

- *Know what's possible.* Through its survey of industry, CECOM learned what was technically possible and commercially available. This knowledge enabled CECOM to issue, with confidence, the performance specifications, including the cost estimate and warranty requirements, which were nonnegotiable.
- *Leverage commercial products.* The AN/PRC-112D uses commercially available software-programmable radio technology, consumer batteries, and advances in civilian solar panel technology.
- *Never take "no" for an answer.* Knowledge of industry capability and commercial technology allowed CECOM to stand firm on its performance specifications.
- *Communicate.* By assembling an integrat-

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ed team early in the process, CECOM established clear lines of communication that headed off potential problems and significantly reduced the development cycle time.

- *Know your customer.* Although initially wary, users now welcome CECOM's efforts. CECOM listened to the user and delivered what the warfighter requested.

Notes

[1]The next-generation system will enable line-of-sight voice communication, user identification, military-precision global positioning satellite data, and worldwide, continuously available, two-way secure data communications over multiple satellite systems.

[2]Several factors are contributing to delays in the Combat Survivor Evader Locator program, including technical and financial hurdles.

[3]The PRC-434 is used by Israeli military forces and sold commercially by Tadiran to other countries. Tadiran repackaged the circuitry of the PRC-434 to avoid impact to the older AN/PRC-112s and the interrogator systems.

[4]Current funding does not support these additional capabilities.

[5]For a detailed review of Army efforts to reduce battery-related operational support costs, see *Defense Standardization Program Case Study 2002, Army Battery Standardization: Rechargeable Batteries Power the Future Force*.

[6]Lithium batteries have three to four times the energy capacity of alkaline batteries and operate within greater temperature ranges. CECOM is working with Energizer—which holds a patent on the lithium cell—to increase production of the battery that Energizer produces primarily for digital cameras. Other military applications of AA lithium batteries include chemical agent detectors, mine detectors, night vision goggles, and global positioning system transponders.

[7]During wartime, it is difficult to recall a high volume of radios to the depot for retrofit.

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

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