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Report to the Secretary of Defense

April 1998

ELECTRONIC WARFARE

DOD Should Select Most Cost-Effective Infrared Countermeasure System

GAO/NSIAD-98-2

GAO

United States
General Accounting Office
Washington, D.C. 20548

National Security and
International Affairs Division

B-276171

April 28, 1998

The Honorable William S. Cohen
The Secretary of Defense

Dear Mr. Secretary:

The Army is developing the Advanced Threat Infrared Countermeasure (ATIRCM) System to protect U.S. aircraft from infrared guided missiles, while the U.S. Special Operations Command (SOCOM) intends to procure the Directional Infrared Countermeasure (DIRCM) System, which it is jointly developing with the United Kingdom, to satisfy the same requirement. We reviewed these programs to determine whether the Department of Defense (DOD) is justified in acquiring both systems. We are issuing this report to bring to your attention our finding that the acquisition of both systems simultaneously may not be cost-effective and that substantial savings may be realized by procuring and having to support and maintain only one system.

Background

SOCOM and the Army are purchasing two separate active infrared countermeasure systems to protect U.S. aircraft. They plan to spend a total of approximately $2.74 billion, including about $2.475 billion for 815 ATIRCM systems and associated common missile warning systems and about $261 million for 60 DIRCM systems and its own unique missile warning system. In addition, there are many other potential customers for an active infrared countermeasure system, such as Air Force, Navy, and Marine Corps aircraft that have not yet been committed to either ATIRCM or DIRCM.

SOCOM and the Army both have a need for an effective integrated infrared countermeasure system capable of defeating infrared guided weapon systems. The Army considers this capability especially critical to counter newer, more sophisticated, infrared guided missiles. Likewise, SOCOM has established an urgent need for a near-term directional infrared countermeasure system capable of countering currently deployed infrared guided missiles. To meet its urgent need, SOCOM plans to exercise its first production option for 15 DIRCM systems in July 1998 and procure 45 additional systems during fiscal years 1998 and 1999. The Army expects to begin ATIRCM production in April 2001.

Two generations of infrared missiles are currently deployed. First generation missiles can be defeated by current countermeasures, such as

flares. Second generation infrared guided missiles are more difficult to defeat. More advanced infrared guided missiles are being developed that will have even greater capabilities against current countermeasures.

To defeat infrared guided missiles, the ATIRCM and DIRCM systems will emit directed energy to decoy or jam the missile's seeker. Both systems are composed of a missile approach warning system, a computer processor, a power supply, and energy transmitters housed in a pointing turret. After a missile is detected, the computer is to rotate the turret and point the transmitters at the missile. The transmitters are to then emit the directed energy.

Results in Brief

DOD may be able to achieve sizable savings by procuring, supporting, and maintaining only one active infrared countermeasure system to protect its aircraft from infrared guided missiles. Despite congressional emphasis on, and DOD's stated commitment to, commonality, SOCOM and the Army are acquiring two separate countermeasure systems that eventually will have the same laser technology. DOD should determine which system is more cost-effective and procure that one to protect its aircraft. If DIRCM is determined to be more cost-effective, the ATIRCM program should be terminated. If ATIRCM is determined to be more cost-effective, no additional DIRCM systems should be procured beyond those planned to be procured in July 1998 to meet SOCOM's urgent need.

Congress and DOD Recognize the Benefit of Common Systems

Congress and DOD have a long-standing interest in reducing proliferation of electronic warfare systems. By urging development of common systems, Congress expected to reduce the costly proliferation of duplicative systems and achieve cost savings in program development, production, and logistics. DOD agrees on the need for commonality, and its policy statements reflect congressional concerns about electronic warfare system proliferation. DOD policy states that prior to initiating a new acquisition program, the services must consider using or modifying an existing system or initiate a new joint-service development program. DOD policy also requires the services to consider commonality alternatives at various points in the acquisition process.

Joint electronic warfare programs and increased commonality among the services' systems results in economy of scale savings. Buying larger quantities for common use among the services usually results in lower procurement costs. Similarly, lower support costs result from a more

simplified logistics system providing common repair parts, maintenance, test equipment, and training. For example, under Army leadership, a common radar warning receiver was acquired for helicopters and other special purpose aircraft of the Army, Marine Corps, and Air Force. In addition, a follow-on radar warning system for certain Army and Marine Corps special purpose aircraft and helicopters was jointly acquired with savings estimated by Army officials of $187.7 million attributable to commonality benefits.[1]

DIRCM and ATIRCM Will Eventually Have the Same Technology

The ATIRCM and DIRCM systems will initially have one key difference in technological capability. The DIRCM system will rely on existing flash lamp technology to defeat all currently deployed first and second generation threat missiles. (A flash lamp emits a beam of light energy to confuse the missile's seeker.) The Army's ATIRCM system will also be fielded with a flash lamp but it will also have a laser. According to SOCOM officials, after the flash lamp-equipped DIRCM is fielded, they plan to upgrade the DIRCM system with a laser that has completed development and is already in production. As described later in this report, the upgraded DIRCM system could be available around the same time as the ATIRCM system. Furthermore, the DIRCM laser could be the same as the one used in ATIRCM, according to DOD officials. The Army's cost and effectiveness analysis used to justify the ATIRCM system indicates that with a laser upgrade, DIRCM could provide capability equal to the ATIRCM.

The two systems will have a total of three different size turrets. According to DOD and contractor officials, the size of the turret matters because larger aircraft present larger targets and must apply more energy to decoy an incoming missile's seeker. A larger turret can direct more of the flash lamp's energy. The larger the amount of directed energy, the greater the likelihood the missile will become confused as to the actual location of the target aircraft. The DIRCM turret, to be used on SOCOM C-130s, is the largest of the three. The United Kingdom intends to use the larger DIRCM turret on its larger aircraft and a smaller turret for its helicopters and smaller aircraft. The ATIRCM turret is between the two DIRCM turrets in size. Since the ATIRCM turret will also have a laser, however, DOD acquisition officials believe it will ultimately be more effective than any system equipped only with a flash lamp.

[1]Electronic Warfare: Costly Radar Warning Receiver Duplication Continues (GAO/NSIAD-94-4, Nov. 29, 1993).

Laser-Equipped DIRCM and ATIRCM Are Expected to Be Available at About the Same Time

Both the DIRCM and ATIRCM programs are experiencing delays that have moved their projected availability dates significantly closer together. However, DOD has not yet taken advantage of the schedule changes to determine if one system will be more cost-effective than the other and if it can achieve significant savings by procuring only one system to protect all its aircraft.

SOCOM plans to exercise the first of three production options and buy 15 DIRCM systems in July 1998. These systems will not be equipped with lasers. Production funds are projected to be included in the fiscal year 2001 budget for the DIRCM laser upgrade. Production of ATIRCM is to begin in April 2001. SOCOM officials maintain that because of their urgent need they cannot wait for the laser-equipped ATIRCM. However, the difference in the time frames for beginning production can be misleading. DIRCM is scheduled to go into production before operational testing begins, while the ATIRCM is not scheduled to begin production until operational testing is completed. If both DIRCM and ATIRCM production begin immediately after their respective operational tests, DIRCM's production is delayed until April 2000 and ATIRCM is moved up to January 2001. As a result, the systems will start production within 9 months of each other. Additionally, DIRCM, with a laser upgrade, is projected to be available in 2001, about the same time as ATIRCM with a laser.

ATIRCM and DIRCM Are Being Developed for the Same or Similar Aircraft

The Army is developing ATIRCM and the United Kingdom with SOCOM is developing DIRCM to work on a variety of aircraft, including some that are the same or similar. (See table 1.) For example, the United Kingdom plans to use the DIRCM system on the CH-47 Chinook helicopter while the Army plans to use ATIRCM on the Chinook. By varying the size of the turret, the United Kingdom intends to use DIRCM on aircraft of a wide range of sizes, from its very large, fixed-wing C-130s to small rotary wing aircraft such as the Lynx. Although the Army currently has no plans to install ATIRCM on fixed-wing aircraft the size of C-130s, it too will be placing its system on a wide range of aircraft from the very large CH-47 heavy lift helicopter, to the small OH-58D helicopter. If development of both systems is successful, therefore, the Army and the United Kingdom will prove that ATIRCM and DIRCM provide redundant capability for many aircraft.

In addition to those SOCOM and Army aircraft identified as platforms for DIRCM or ATIRCM, there are many potential Air Force, Navy, and Marine Corps aircraft that are not yet committed to either system. These include

large fixed-wing aircraft of the Air Force, as well as 425 future Marine Corps V-22 aircraft and the Navy's SH-60 helicopters.

Table 1: Planned Aircraft for DIRCM and ATIRCM

	DIRCM	ATIRCM
United States	Fixed Wing C-130	Rotary Wing AH-64 CH-47 OH-58D UH/EH-60 Fixed Wing CV-22
United Kingdom	Fixed Wing HS-125 BAe-146 C-130 VC-10 ISLANDER Rotary Wing EH-101 CH-47 PUMA A-109 LYNX H-3	Fixed Wing None Rotary Wing WAH-64

Conclusions and Recommendations

DOD's plans to acquire infrared countermeasure capability may not represent the most cost-effective approach. While we recognize SOCOM's urgent need for a countermeasure capability in the near term, we believe that DOD can satisfy this need and meet the Army's needs without procuring two separate systems. Specifically, proceeding with procurement of the first 15 DIRCM systems beginning in July 1998 appears warranted. However, continued production of DIRCM may not be the most cost-effective option for DOD since the Army is developing the ATIRCM system, which will have the same technology, be available at about the same time, and is being developed for the same or similar aircraft.

We, therefore, recommend that the Secretary of Defense (1) direct that the appropriate tests and analyses be conducted to determine whether DIRCM or ATIRCM will provide the most cost-effective means to protect U.S. aircraft and (2) procure that system for U.S. aircraft that have a requirement for similar Infrared Countermeasure capabilities. Until that decision can be made, we further recommend that the Secretary of Defense limit DIRCM system procurement to the first production option of

15 systems to allow a limited number for SOCOM's urgent deployment needs.

Agency Comments and Our Evaluation

In written comments on a draft of this report, DOD concurred with our recommendation that the appropriate tests and analyses be conducted to determine whether ATIRCM or DIRCM will provide the most cost-effective protection for U.S. aircraft. According to DOD, the results of such analyses were completed in 1994 and 1995 and showed that both systems were the most cost-effective: DIRCM for large, fixed-wing C-130 aircraft and ATIRCM for smaller, rotary wing aircraft.

However, as a result of events that have occurred in both programs since the analyses were conducted in 1994 and 1995, DOD's earlier conclusions as to cost-effectiveness are no longer necessarily valid and a new analysis needs to be conducted as we recommended. For example, the 1994 cost- and operational effectiveness analysis conducted for SOCOM's C-130s concluded that DIRCM should be selected because it was to be available significantly sooner than ATIRCM. As our report states, the DIRCM schedule has slipped significantly, and by the time the planned laser upgrade for DIRCM is available, ATIRCM is also scheduled to be available. Furthermore, the 1994 analysis justifying DIRCM concluded that ATIRCM would be a less expensive option and did not conclude that DIRCM would be more effective than ATIRCM. Thus, the question of which system would be most cost-effective for SOCOM's C-130s is a legitimate issue that should be addressed by DOD in a new cost-effectiveness analysis before SOCOM commits fully to DIRCM.

In addition, the Army's 1995 cost- and operational effectiveness analysis justifying ATIRCM also concluded DIRCM could meet the Army's rotary wing requirement if DIRCM's effectiveness were to be improved by adding a laser. As our report notes, DOD now plans to acquire a laser as an upgrade for DIRCM. Thus, whether DIRCM or ATIRCM would be most cost-effective for the Army's rotary wing aircraft remains a legitimate and viable question that DOD should reconsider.

Further, in 1994 and 1995, when DOD conducted the prior cost-effectiveness analyses, effectiveness levels for DIRCM and ATIRCM had to be assumed from simulations because no operational test results were available at that time. Operational testing, including live missile shots against the DIRCM system, is scheduled to begin in the summer of 1998 and ATIRCM testing is scheduled for 1999. In the near future, then, DOD may be in

a better position to know conclusively how effective DIRCM or ATIRCM will be and this should be taken into consideration in a new cost-effectiveness analysis.

DOD did not concur with a recommendation in a draft of this report that one system be procured for all U.S. aircraft, arguing that one system cannot meet all aircraft requirements. We have clarified our recommendation by eliminating the word "all". Our intent was to focus this recommendation on U.S. aircraft having a requirement for advanced infrared countermeasure protection, such as that to be provided by DIRCM or ATIRCM. For those aircraft that have an advanced infrared countermeasure requirement, we reiterate that the United Kingdom plans to use the DIRCM system on a wide variety of fixed- and rotary wing aircraft of many shapes and sizes, and the Army plans to use ATIRCM on a wide variety of rotary wing aircraft, as well as the fixed-wing CV-22. Thus, DOD should reconsider whether DIRCM or ATIRCM could provide the advanced infrared countermeasure protection necessary to meet the multiple U.S. aircraft requirements.

In commenting further on its belief that one system cannot meet all U.S. aircraft requirements, DOD also stated that (1) the SOCOM DIRCM is too heavy for Army helicopters, (2) ATIRCM's smaller turret drive motors are not designed for the increased wind in SOCOM C-130 applications, and (3) ATIRCM will not emit enough Band I and II jamming energy to protect SOCOM's C-130s.[2] We agree that the SOCOM DIRCM is too heavy for Army helicopters, but point out that the DIRCM contractor is designing a smaller DIRCM turret for the United Kingdom's helicopters that would not be too heavy for the Army's helicopters. DOD has never planned for DIRCM or ATIRCM to be the only means of protection for its aircraft from infrared guided missiles. Other systems are available to DOD to help protect against threat missiles, including those in Bands I and II, and these alternatives should be considered for use in conjunction with DIRCM or ATIRCM as DOD tries to determine how to protect its aircraft in the most cost-effective manner.

DOD also did not concur with our recommendation that it limit initial DIRCM production to the first 15 units to begin filling its urgent need and to provide units to be used for testing and analysis before committing SOCOM's entire fleet of 59 C-130s to the DIRCM program. DOD maintained that SOCOM's remaining C-130s would remain vulnerable to missile threats such as the

[2]The seekers on infrared guided missiles are designed to seek out and home in on particular groups of wavelengths, or "bands," of heat energy given off by targets. DOD considers the specifics of which bands are associated with which seekers to be classified.

one that shot down a SOCOM AC-130 during Operation Desert Storm if any production decisions were delayed.

We continue to believe that the additional analysis needs to be conducted before any DIRCM production decisions beyond the first one are made. More than 7 years have passed since the unfortunate loss of the SOCOM AC-130 and its crew in 1991. During that time, DOD delayed the first DIRCM production decision several times. The resolution of the technical problems causing these schedule slips can only be known through successful testing and implementation of our recommendation would allow units to be produced for testing. Finally, we agree with DOD that SOCOM's need is urgent and believe that the best way to begin fulfilling the urgent need while determining whether DIRCM or ATIRCM is the more cost-effective system for C-130s is to limit DIRCM production to only the first 15 systems.

Scope and Methodology

To develop information for this report, we compared and examined the Army's and the SOCOM's respective plans and proposed schedules for acquiring the ATIRCM and DIRCM systems. We obtained acquisition and testing plans and the proposed schedule for acquiring and fielding the systems. We compared these plans to legislative and DOD acquisition guidance and to the results of past DOD procurements. We discussed the programs with officials of the ATIRCM Project Office, St. Louis, Missouri, and the DIRCM Project Office, Tampa, Florida. Also, we visited with Lockheed-Sanders, the ATIRCM contractor, and Northrop-Grumman, the DIRCM contractor, and discussed their respective programs.

We conducted our review from August 1996 to December 1997 in accordance with generally accepted government auditing standards.

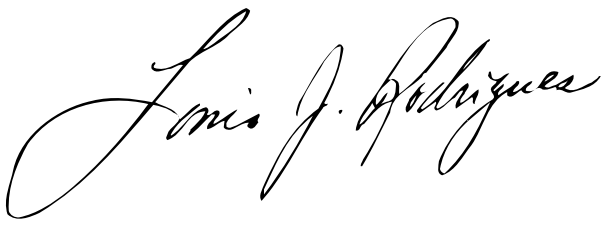
As you know, 31 U.S.C. 720 requires the head of a federal agency to submit a written statement on actions taken on our recommendations to the Senate Committee on Governmental Affairs and the House Committee on Government Reform and Oversight not later than 60 days after the date of the report. A written statement must also be submitted to the Senate and House Committees on Appropriations with an agency's first request for appropriations made more than 60 days after the date of the report.

We are sending copies of this report to appropriate congressional committees, the Under Secretary of Defense for Acquisition and

Technology, the Secretary of the Army, the Director of the Office of Management and Budget, and the Commander of the U.S. Special Operations Command. We will also make copies available to others on request.

Please contact me at (202) 512-4841 if you or your staff have any questions concerning this report. Major contributors to this report were Danny Owens, Wendy Smythe, Charles Ward, and Mark Lambert.

Sincerely yours,



Louis J. Rodrigues
Director, Defense Acquisitions Issues

Comments From the Office of the Under Secretary of Defense

OFFICE OF THE UNDER SECRETARY OF DEFENSE

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ACQUISITION AND TECHNOLOGY

09 FEB 1998

Mr. Louis J. Rodrigues
Director, Defense Acquisition Issues
National Security and International
Affairs Division
United States General Accounting Office
Washington, D. C. 20548

Dear Mr. Rodrigues:

This is the Department of Defense (DOD) response to the General Accounting Office (GAO) Draft Report, "ELECTRONIC WARFARE: DOD Should Select Most Cost-Effective Infrared Countermeasure System," Dated December 12, 1997 (GAO Code 707216), OSD Case 1505. The DOD concurs with the draft report's first recommendation and nonconcurs with the last two recommendations.

The attachment provides specifics regarding the analyses and tests conducted by both the USCINCSOC and the Army in preparation for a competitive source selection and contract award for different requirements. The results of these activities led to USCINCSOC AC/MC-130 "fixed wing" requirements that are met by the Directional Infrared Countermeasures (DIRCM) System. The Army results led to Army MH-47/MH-60/AH-64 "helicopter rotary wing" requirements that are met by the Advanced Threat Infrared Countermeasures (ATIRCM) System. Neither system meets a universal aircraft requirement and cannot be fit to "all" U. S. aircraft. Furthermore, a decision to limit USCINSOC's ability to fit 15 of his 59 AC/MC-130s with DIRCM would make the remaining aircraft vulnerable to the same threats that resulted in the catastrophic loss of AC-130 "SPIRIT 03" in Operation Desert Storm and would not allow the CINC an alternative system to protect these high-operational-tempo aircraft.

The DOD appreciates the opportunity to comment on the draft report. We have provided some factual and technical corrections separately.

Sincerely,

George R. Schneiter
Director
Strategic and Tactical Systems

Enclosure

GAO DRAFT REPORT - DATED DECEMBER 12, 1997
(GAO CODE 707216) OSD CASE 1505

"ELECTRONIC WARFARE: DOD SHOULD SELECT MOST COST-EFFECTIVE INFRARED COUNTERMEASURE SYSTEM"

DOD COMMENTS ON THE GAO RECOMMENDATIONS

Now on p. 5.

RECOMMENDATION 1: The GAO recommended that the Secretary of Defense direct that the appropriate tests and analyses be conducted to determine whether the Directional Infrared Countermeasure (DIRCM) system or the Advanced Threat Infrared Countermeasure (ATIRCM) system will provide the most cost-effective means to protect U. S. aircraft. (p. 12/GAO Draft Report)

DOD RESPONSE: Concur. Detailed government analyses and tests were conducted for the AC/MC-130 fixed wing DIRCM system in 1994 and the MH-47/MH-60/AH-64 rotary wing ATIRCM system in 1995.

The USSOCOM AC/MC-130 IRCM process started with an urgent requirement after the combat loss of an AC-130 to an IR surface-to-air missile in Operation Desert Storm. Actions included requirements definition, specification generation, contractor demonstration of technology and its application to infrared countermeasures, risk evaluation, a cost and operational effectiveness analysis, an evaluation of potential technical solutions, and preliminary development contracts with three competing contractors. The results were a competitive source selection and Full Development/Production contract award for the DIRCM system.

The Army's ATIRCM process was similar to the above; however, its requirement is for small rotary wing helicopters, not fixed wing AC/MC-130's. In addition, the Services merged tactical fighter common missile warning system (CMWS) requirements into the Army's ATIRCM system. The result was a competitively awarded tri-Service missile warning system program and an Army rotary wing IRCM program for the ATIRCM/CMWS system.

The major points of difference between DIRCM and ATIRCM are that the USSOCOM DIRCM system is too heavy for the Army helicopter requirement and it uses lamp technology for its jamming power source. In addition, its missile warning function does not have the severe environment requirement faced by the tri-Service CMWS requirement. As for ATIRCM/CMWS, it does not emit the minimum jamming energy in infrared bands 1 and 2 required to protect the USSOCOM AC/MC-130s. In addition, the ATIRCM design, geared to helicopters, has smaller subsystem drive motors. These drive motors are not designed for the increased wind in AC/MC-130 applications and cannot slew to the missile threat azimuth and elevation fast enough over the possible engagement timelines.

Now on p. 5.

RECOMMENDATION 2: The GAO also recommended that the Secretary of Defense procure that system for all U.S. aircraft. (p. 12/GAO Draft Report)

DOD RESPONSE: Nonconcur. Each of these systems is built to different requirements. Neither system can meet "all" U.S. aircraft requirements.

Now on p. 5.

RECOMMENDATION 3: The GAO further recommended that the Secretary of Defense limit DIRCM system procurement to the first production option of 15 systems to allow a limited number for the Special Operations Command's urgent deployment needs. (p. 12/GAO Draft Report)

DOD RESPONSE: Nonconcur. The small AC/MC-130 fleet size of 59 aircraft and their high operational tempo makes this recommendation inappropriate. This recommendation would still require the Group A (aircraft hardware installation wiring kits) modifications necessary to support world-wide special operations commitments of 59 aircraft. Buying just 15 systems would leave the majority of AC/MC-130s vulnerable to the same catastrophic results of AC-130 "SPIRIT 03' in Operation Desert Storm.

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