Audit Report

OFFICE OF THE INSPECTOR GENERAL

SUPPRESSION SYSTEMS FOR THE AH-1 HELICOPTER AND OV-1 AIRCRAFT, AND THE AN/ALQ-144 JAMMER FOR HELICOPTERS

Report Number 91-099

June 18, 1991

Department of Defense

The following acronyms are used in this report.

NAVAIR.....Naval Air Systems Command
TM.....Technical Manual

INSPECTOR GENERAL
DEPARTMENT OF DEFENSE
400 ARMY NAVY DRIVE
ARLINGTON, VIRGINIA 22202-2884

June 18, 1991

MEMORANDUM FOR ASSISTANT SECRETARY OF DEFENSE (PROGRAM ANALYSIS AND EVALUATION)
ASSISTANT SECRETARY OF THE ARMY (FINANCIAL MANAGEMENT)
ASSISTANT SECRETARY OF THE NAVY (FINANCIAL MANAGEMENT)
ASSISTANT SECRETARY OF THE AIR FORCE (FINANCIAL MANAGEMENT AND COMPTROLLER)
DIRECTOR, DEFENSE LOGISTICS AGENCY

SUBJECT: Report on the Audit of Suppression Systems for the AH-1 Helicopter and OV-1 Aircraft, and the AN/ALQ-144 Jammer for Helicopters (Report No. 91-099)

We are providing this final report for your information and use. Comments on a draft of this report were considered in preparing the final report. We performed the audit from January through August 1990 in response to a DoD Hotline complaint.

Defensive infrared countermeasures systems were not always effectively employed to protect combat and combat support helicopters. The Army did not always install missile detection systems, and the Navy and Marine Corps did not install infrared suppression systems or upgrade existing infrared jammers. The AN/ALQ-144 Infrared Jammer experienced premature bearing failures because of protracted periods of jammer disuse and the failure of unit personnel to adhere to recommended operation and maintenance procedures. Army military intelligence unit commanders did not install the Louvered Scarfed Shroud Suppression system on the OV-1 Mohawk aircraft because of concerns stemming from suppression system induced buffeting, or aircraft vibration. On November 2, 1990, we issued Quick-Reaction Report No. 91-008, which focused on a pending improper payment to a contractor for a $5 million share in savings stemming from a value engineering change proposal.

DoD Directive 7650.3 requires that all audit recommendations be resolved promptly. Therefore, the Assistant Secretary of the Army (Financial Management), the Assistant Secretary of the Navy (Financial Management), and the Assistant Secretary of the Air Force (Financial Management and Comptroller) must provide final

comments on the unresolved recommendations by August 14, 1991. See the "Status of Recommendations" section at the end of each finding for the unresolved recommendations and specific requirements for your comments.

The courtesies extended to the audit staff are appreciated. If you have any questions on this audit, please contact Mr. Thomas Corkhill at (703) 614-1416 (DSN 224-1416). Copies of this report are being provided to the activities listed in Appendix E.

Robert J. Lieberman
Assistant Inspector General
for Auditing

Enclosure

cc:
Secretary of the Army
Secretary of the Navy
Secretary of the Air Force

Office of the Inspector General

AUDIT REPORT NO. 91-099 **JUNE** 18, 1991
(Project No. 0AL-8004)

ACQUISITION OF SUPPRESSION SYSTEMS FOR THE AH-1 HELICOPTER AND OV-1 AIRCRAFT, AND THE AN/ALQ-144 INFRARED JAMMER FOR HELICOPTERS

EXECUTIVE SUMMARY

Introduction. Defensive infrared countermeasures systems are integral to the survival of combat and combat support aircraft in the modern battlefield environment. DoD studies have concluded that 90 percent of the aircraft losses resulting from hostile fire from 1975 through 1985 were attributable to infrared seeking missiles. A number of countermeasures systems exist that combine to reduce the vulnerability of aircraft to threats stemming from weapon systems that use infrared guidance technology. Suppression systems, jammers, and missile detection systems are complementary countermeasures systems and are important to ensure optimal protection of aircraft from the infrared seeking threat.

Objectives. The overall audit objective was to evaluate the design adequacy of the Hot Metal Plus Plume Suppression system for the AH-1 Cobra helicopter, the Louvered Scarfed Shroud Suppression system for the OV-1 Mohawk aircraft, and the AN/ALQ-144 Infrared Jammer for a variety of lift helicopters. Also, we evaluated the adequacy and sufficiency of internal controls related to the three systems.

Audit Results. Our audit disclosed four reportable conditions.

- Defensive countermeasures systems were not always effectively employed to protect combat and combat support helicopters. As a result, the helicopters were vulnerable to the infrared seeking threat (Finding A).

- The AN/ALQ-144 Infrared Jammer experienced premature bearing failures. As a result, the Jammer's reliability was severely degraded, which increased aircraft vulnerability to infrared seeking threats and reduced the probability of mission success (Finding B).

- Army military intelligence unit commanders did not install the Louvered Scarfed Shroud Suppression system on the OV-1 Mohawk aircraft. As a result, the aircraft were vulnerable to infrared seeking threats (Finding C).

o On November 2, 1990, we issued Quick-Reaction Report No. 91-008, "Contracting Procedures for the Hot Metal Plus Plume Suppression System Used on the AH-1 Helicopter." That report is discussed in the "Other Matters of Interest" section of Part I.

Internal Controls. We identified an internal control weakness regarding the failure of unit personnel to adhere to established operation and maintenance procedures. This weakness is discussed in Finding B. Our review of the internal controls is discussed in Part I.

Potential Benefits of Audit. The principal benefits that will be realized from the audit are improvements in the protection of aircraft from the current infrared seeking threat. Also, undeterminable monetary benefits will be realized from improved operation and maintenance procedures of the AN/ALQ-144 Infrared Jammer. These monetary benefits are discussed in Appendix C.

Summary of Recommendations. We recommended enhancement of the defensive countermeasures capability, institution of procedural controls, and revision of the training program.

Management Comments. The Army and Navy were generally responsive to the recommendations, but additional data were required. The Air Force did not reply to the draft report. The Army concurred with two recommendations and nonconcurred with two other recommendations. We requested additional comments from the Army on recommendations in Findings A and C. The Navy concurred with two recommendations and nonconcurred with two other recommendations. We have requested additional comments from the Navy on the recommendations in Findings A and B. We requested that the Air Force provide comments on recommendations in Finding B. The complete texts of Army and Navy comments are in Part IV of the report.

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This report was prepared by the Acquisition Management Directorate, Office of the Assistant Inspector General for Auditing, DoD. Copies of the report can be obtained from the information officer, Audit Planning and Technical Support Directorate, (703) 614-6302.

PART I - INTRODUCTION

Background

Defensive infrared countermeasures systems are integral to the survival of combat and combat support aircraft in the modern battlefield environment. These countermeasures systems protect aircraft from weapon systems that use infrared technology. These systems are collectively referred to as the infrared countermeasures suite. Two of the infrared countermeasures systems used on Army aircraft are the Hot Metal Plus Plume Suppression system, which is installed on the AH-1 Cobra helicopter, and the Louvered Scarfed Shroud Suppression system, which is installed on the twin engine OV-1 Mohawk fixed wing aircraft. These systems increase aircraft survivability by reducing the opportunity for an infrared seeking threat system to acquire, lock onto, track, and destroy the aircraft.

The suppression systems reduce the aircraft's heat signature by recirculating hot engine exhaust gases within the suppressor core and mixing the heated gases with ambient air before discharging the exhaust into the atmosphere. The suppression systems are similar to a muffler in an automobile's exhaust system. The suppressed exhaust reduces the aircraft's heat signature, which in turn reduces the target acquisition range and angle of heat sensitive infrared sensors used to guide the missile to the aircraft's heat source. Although other countermeasures systems exist, the suppression systems on many aircraft are the backbone of the countermeasures systems because they make it possible for the other active infrared countermeasures systems to function more effectively.

The AN/ALQ-144 Infrared Jammer is an active, electromechanical, infrared countermeasures system that is used on a variety of Service helicopters. The Infrared Jammer is an omnidirectional, continuously operating, signal generating transmitter that mounts on the helicopter airframe. The Infrared Jammer emits spurious and erroneous signals to confuse the infrared seeking threat systems. The effectiveness of the Infrared Jammer depends on its ability to overload the threat system's infrared sensors or generate conflicting signals of sufficient frequency and magnitude to inject erroneous guidance commands into the threat's guidance system.

Missile detection is another important countermeasures system that activates decoys, such as chaff or flares, and alerts pilots of an approaching missile. The warning may also give the pilot the opportunity to initiate evasive action.

Objectives

The overall audit objective was to evaluate the design adequacy of the Hot Metal Plus Plume Suppression system for the AH-1 Cobra helicopter, the Louvered Scarfed Shroud Suppression system for the OV-1 Mohawk aircraft, and the AN/ALQ-144 Infrared Jammer for various Service helicopters. Also, our objective included determining the validity of statements contained in four Hotline complaints and whether any of the allegations warranted further management attention. On November 16, 1990, we issued a Hotline completion report that focused on the 21 allegations identified in the 4 complaints. Our Hotline completion report is summarized in Appendix A.

Specifically, we evaluated various aspects of the Suppression systems and the Infrared Jammer including:

- o system design (all three systems);
- o threat compared to system requirements (AN/ALQ-144 Infrared Jammer);
- o reliability, availability, and maintainability (all three systems);
- o contract procedures (Hot Metal Plus Plume Suppression system and AN/ALQ-144 Infrared Jammer); and
- o stock management (Hot Metal Plus Plume Suppression system).

Our audit disclosed four reportable conditions. Three of these are described in Part II of this report. The fourth condition was reported in Quick-Reaction Report No. 91-008, "Contracting Procedures for the Hot Metal Plus Plume Suppression System Used on the AH-1 Helicopter." Other observations and conclusions are summarized in Appendix B.

Scope

This program audit was conducted from January through August 1990 and included a review of records and supporting information dating primarily from 1982 through 1990. We interviewed cognizant Government and contractor personnel and personnel involved in the management, maintenance, acquisition, operation, testing, and support of the Hot Metal Plus Plume Suppression system, the Louvered Scarfed Shroud Suppression system, and the AN/ALQ-144 Infrared Jammer. The audit was made in accordance with auditing standards issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD, and accordingly included such tests of internal controls as were deemed necessary. A list of the activities visited or contacted is in Appendix D.

Internal Controls

We evaluated internal control procedures related to the management of the Hot Metal Plus Plume Suppression system, the Louvered Scarfed Shroud Suppression system, and the AN/ALQ-144 Infrared Jammer. In assessing the internal controls, we evaluated internal control techniques, such as management plans, written policies and procedures, and management initiated reviews. The audit identified material internal control weaknesses as defined by Public Law 97-255, Office of Management and Budget Circular A-123, and DoD Directive 5010.38. Controls were not effective to ensure that the operation and maintenance procedures for the AN/ALQ-144 Infrared Jammer were being followed. Recommendations B.1. and B.2. in this report, if implemented, will correct the weaknesses. We could not determine the monetary benefits to be realized by implementing Recommendations B.1. and B.2. The monetary benefits were not readily identifiable because the Infrared Jammer had not been sufficiently used to establish an accurate reliability baseline. A copy of this report will be provided to the senior officials responsible for internal controls within each of the Military Departments.

Prior Audit Coverage

There have not been any prior audits of the Hot Metal Plus Plume Suppression system, the Louvered Scarfed Shroud Suppression system, or the AN/ALQ-144 Infrared Jammer in the last 5 years. However, there were inquiries and reviews conducted that pertained to specific aspects of the three systems.

Army Inspector General inquiries. There have been four Hotline complaints concerning the Hot Metal Plus Plume Suppression system and AN/ALQ-144 Infrared Jammer. The DoD Hotline referred these complaints to the Army Inspector General for inquiry. The complaints were received between December 1988 and December 1989, and the Army examining officials found that all the allegations were unsubstantiated. The same allegations were reviewed again in conjunction with this audit and found to be unsubstantiated. The results of our review are contained in Appendix A.

Army Materiel Command review. In April 1989, an Army Materiel Command review team conducted an independent review of the sole source acquisition of the AN/ALQ-144A Infrared Jammer. The results of the review reaffirmed the Communications-Electronics Command's acquisition strategy. In April 1989, the Army Materiel Command issued a memorandum to the Under Secretary of the Army, which concluded that the planned sole source acquisition of the AN/ALQ-144A Infrared Jammer was proper and in the Army's best interest.

General Accounting Office protest. On June 16, 1989, the General Accounting Office issued a decision denying a protest of the proposed award of the sole source AN/ALQ-144A Infrared Jammer contract. The General Accounting Office held that the award was valid and appropriate because only a prototype of the AN/ALQ-144A had been developed and delivered, development was not complete, drawings suitable for manufacture were not available, and the protesting contractor was not a viable additional contractor.

Other Matters of Interest

On November 2, 1990, we issued Quick-Reaction Report No. 91-008, which focused on a pending improper payment to a contractor for a $5 million share in savings stemming from a value engineering change proposal. We concluded that the payment would have been improper because the Army had already paid for the development of the changes. The Army agreed with our recommendation and implemented the appropriate corrective action.

PART II - FINDINGS AND RECOMMENDATIONS

FINDING A. THREAT COMPARED TO SYSTEM REQUIREMENTS

Defensive infrared countermeasures systems were not always effectively employed to protect combat and combat support helicopters. This occurred because the Army did not always install missile detection systems, and the Navy and Marine Corps did not install suppression systems or upgrade existing Infrared Jammers. As a result, some combat and combat support helicopters could be exposed to infrared directed threat systems against which they have only limited effectiveness.

DISCUSSION OF DETAILS

Background

Evolving technology in weapons development has necessitated the continual upgrade of aircraft survivability systems to counteract the emerging sophistication of infrared seeking weapon systems. The principal infrared threat to helicopters and other slow moving combat and combat support aircraft is ground based infrared seeking surface-to-air missiles. Portable, shoulder fired infrared seeking missiles proliferate the global ground forces' structure and represent a formidable threat to close air support aircraft. Aircraft survivability depends upon a variety of countermeasures systems to protect the aircraft from the infrared seeking threat. Typical infrared countermeasures systems include infrared suppression systems to reduce the aircraft's heat signature, infrared jammers to confuse the threat, and missile detection systems to decoy the threat away from the target aircraft and to warn the pilot of approaching missiles.

Infrared Suppression Systems

Most infrared seeking threat systems must acquire, or lock onto, the target before they can be launched. Infrared suppression systems reduce the aircraft's infrared heat signature and present a smaller, less distinctive infrared target to the threat system's heat seeking infrared sensors. The suppression system reduces the effective range of infrared seeking threat systems by reducing the distance and angle that the infrared sensors are able to detect the aircraft. Suppression systems provide continuous protection, and because they are passive (nonsignal emitting) and made up of nonmoving parts, they are not prone to mechanical failures. Although suppression systems alone are not sufficient to defeat the infrared seeking threat, extensive operational tests have demonstrated that suppression systems are required for other defensive countermeasures systems to function

more effectively. The Army used suppression systems on its combat and combat support helicopters, but the Navy and Marine Corps did not use them. The Navy and Marine Corps relied on alternative countermeasures systems to protect their helicopters, but the level of protection offered by the other systems was inadequate.

Army implementation. The Army installed infrared suppression systems on combat and combat support helicopters. The Army Project Manager for Aircraft Survivability Equipment stated that suppression systems are critical to the survival of helicopters in the modern battlefield environment. Army tests conducted with helicopters using various combinations of countermeasures systems demonstrated consistent success only when a suppression system accompanied the use of other countermeasures systems. Conversely, some tests demonstrated that the other countermeasures systems were ineffective without the suppression system. We agreed with the Army assessment that suppression systems were essential to the survivability of helicopters exposed to infrared seeking threat systems.

Navy and Marine Corps implementation. The Navy and Marine Corps did not use infrared suppression systems on combat and combat support helicopters. This policy was based on the perceived ability to adequately protect the helicopters by employing other countermeasures systems, the mission of Navy and Marine Corps helicopters, and the additional weight and power loss imposed when the suppression systems were installed.

The Navy and Marine Corps relied on the AN/ALQ-144 Infrared Jammer and decoy devices to protect combat and combat support helicopters. Historically, those countermeasures systems have been adequate. However, the threat assessment promulgated in 1988 addressed a new generation of more sophisticated infrared seeking threat technology that was less susceptible to existing countermeasures systems. The current infrared seeking threat significantly reduced the effectiveness of the existing Navy and Marine Corps countermeasures systems. Operational tests using the 1988 threat technology demonstrated that suppression systems were essential and must be augmented by other countermeasures systems to effectively protect the helicopters from the infrared seeking threat.

Navy and Marine Corps officials indicated that the additional weight of the suppression system, coupled with the power loss accompanied by installation of a suppression system, was a factor in deciding not to install infrared suppression systems on the combat and combat support helicopter fleet. The estimated additional gross weight of the suppression systems is about 110 pounds, while the power loss resulting from installation of suppression systems is about 1.5 percent of the total available power. Further, the officials stated that Navy and Marine Corps helicopters were principally operated over water and were not vulnerable to the same ground based threat as the Army

helicopters. The officials stated that the Marine Corps did attempt to install suppression systems on certain combat helicopters, but the project was curtailed because of insufficient funding. The Navy and Marine Corps mission may have reduced the helicopter's exposure to the threat, but the mission did not reduce the helicopter's vulnerability to the threat.

Infrared Jammer

The AN/ALQ-144 Infrared Jammer emits spurious and erroneous signals to confuse the infrared seeking threat's guidance system. The Infrared Jammer was effective against the early generation of infrared seeking threat systems, but advancements in the threat systems' technology reduced the effectiveness of the Infrared Jammer and degraded its ability to protect helicopters. Army operational tests concluded that the AN/ALQ-144 Infrared Jammer was not effective in counteracting certain aspects of the infrared seeking threat technology that existed at the time of our review. The same operational tests demonstrated that the newly developed Infrared Jammer, the AN/ALQ-144A Infrared Countermeasures Set, was effective against all known threat systems when it was used in conjunction with an infrared suppression system. The Army adequately upgraded its helicopters with the AN/ALQ-144A Infrared Jammer, but the Navy and Marine Corps rejected the upgrade. As a result, their helicopters were not adequately protected from the infrared seeking threat.

Army implementation. The Army was the lead Service in the development of the AN/ALQ-144 Infrared Jammer and its AN/ALQ-144A replacement. The Army has upgraded Army combat and combat support helicopters with the AN/ALQ-144A Infrared Jammer. The Army's implementation was timely and responsive to the change in the infrared seeking threat.

Navy and Marine Corps implementation. The Navy and Marine Corps officials did not upgrade existing AN/ALQ-144 Infrared Jammers with the AN/ALQ-144A model. A scientist at the Naval Research Laboratory stated that any decision to upgrade with the AN/ALQ-144A without installing suppression systems as well would be based on political or economic considerations because the AN/ALQ-144A Infrared Jammer without a suppression system could not adequately protect the helicopters from the current infrared seeking threat. At the time of our audit, the Naval Research Laboratory was conducting tests that may result in a revised Navy and Marine Corps position. Until the Navy and Marine Corps upgrade the AN/ALQ-144 Infrared Jammer with the AN/ALQ-144A model and accompany the upgrade with the installation of infrared suppression systems, Navy and Marine Corps helicopters will be vulnerable to the current infrared seeking threat.

Missile Detection Systems

Missile detection systems, when used in conjunction with chaff and flare dispensers, enhance the survivability of helicopters by ejecting decoys that mimic the aircraft's infrared signature. When an approaching missile is detected, the dispenser ejects either flares or chaff to lure the missile away from the aircraft. Although suppression systems and Infrared Jammers are able to adequately protect most helicopters, such protection is not absolute. Additionally, missile detection systems alert the pilot to the imminent threat and enable the pilot to initiate evasive action. The Army did not use missile detection systems to enhance the protection afforded by other countermeasures systems. The Navy and Marine Corps relied on missile detection systems as the principal countermeasures systems.

Army implementation. The Army did not install missile detection systems on most combat and combat support helicopters. Army officials indicated that missile detection systems are included in future plans, but funding does not exist to install missile detection systems. The project manager for aircraft survivability equipment stated that adequate protection exists, there is no requirement for missile detection systems, and missile detection systems are not essential to the survivability of Army helicopters. While the missile detection systems may only marginally increase the level of protection on some helicopters, they do afford additional protection in the form of chaff and flare decoys, and they alert the pilot to the presence of an imminent threat.

Navy and Marine Corps implementation. The Navy and Marine Corps did use missile detection systems that were augmented with flare and chaff dispensers. They relied on the missile detection system and the AN/ALQ-144 Infrared Jammer as the primary protection from the threat. The missile detection systems were not an adequate substitute for the use of other available countermeasures systems. For missile detection systems to be effective, the infrared signature of the helicopter should be reduced by a suppression system, and the tracking capability of the infrared seeking threat system should be impaired by an Infrared Jammer.

Summary

The intelligence community validated the current infrared seeking threat in 1988. The threat was common to all Services. However, differing philosophies existed among the Services concerning the importance of employing the full complement of available countermeasures systems to counteract the threat. The Army did use countermeasures systems that provided an adequate level of protection, but it did not install missile detection systems. The Navy and Marine Corps did not use suppression systems and

did not upgrade the AN/ALQ-144 Infrared Jammers with the AN/ALQ-144A, which did not adequately protect its helicopters from the current infrared seeking threat. The Air Force did employ the full complement of available countermeasures systems. The use of the full complement of defensive countermeasures systems, including infrared suppression systems, AN/ALQ-144A Infrared Jammers, and missile detection systems with a chaff and flare dispenser are necessary to provide optimum protection and to increase aircraft survivability. None of the countermeasures systems can individually protect Service helicopters from the infrared seeking threat. The use of the full complement of countermeasures systems lessens the opportunity for an infrared seeking threat system to exploit the vulnerabilities of any of the component countermeasures systems.

RECOMMENDATIONS, MANAGEMENT COMMENTS, AND AUDIT RESPONSE

1. We recommend that the Assistant Chief of Naval Operations (Air Warfare):

a. Install infrared suppression systems on combat and combat support helicopters to reduce the infrared signature and to increase the effectiveness of other infrared countermeasures systems.

Navy comments. The Assistant Secretary of the Navy (Research, Development and Acquisition) concurred with exception. His comments stated that, "Within real world budgetary constraints, the recommendation to install infrared suppressors on USMC/USN combat helicopters is valid and will be pursued. However, the requirement for suppressors (increased weight and reduced engine power) on USN combat support aircraft who face a greatly reduced threat is not justifiable. In this case, the defensive electronic countermeasure equipment already employed is adequate." The full text of the Navy's comments is in Part IV of the report.

Audit response. We believe that our recommendation is valid. In subsequent discussions, Navy officials stated that they considered training squadrons and intership vertical replenishment aircraft as combat support aircraft, and the remainder were combat aircraft. Based on the Navy's definition, aircraft we considered as combat support would in most instances be classified as combat aircraft. Based on the Navy's definition of combat support aircraft, the Navy's comments to our recommendation were responsive. However, the comments did not include an estimated date for completion of the corrective action. Therefore, we request that the Navy provide completion dates.

b. Upgrade the AN/ALQ-144 Infrared Jammers with the AN/ALQ-144A Infrared Countermeasures Set to provide adequate protection from the current infrared seeking threat.

Navy comments. The Assistant Secretary of the Navy (Research, Development and Acquisition) concurred with the recommendation stating the Navy is presently reviewing all programs in the area of applicability on Navy and Marine aircraft.

Audit response. The Navy concurred with our recommendation, but its response did not satisfy the requirements of DoD Directive 7650.3. The Navy response did not identify the planned corrective actions and estimated dates for completion of the actions. We request that the Navy provide these data in response to the final report.

2. We recommend that the Commander, U.S. Army Training and Doctrine Command, reevaluate the need for missile detection systems with automatic chaff and flare dispensers to release decoy devices and alert pilots to the presence of an imminent threat.

Army comments. The Assistant Secretary of the Army (Research, Development and Acquisition) nonconcurred with the recommendation. The Army stated that analysis of the requirement has been completed, and the Army will install the missile detector only on the EH-60, CH-47D, MH-60L, HM-47E, and RC-12K aircraft. The complete text of the Army's comments is in Part IV of the report.

Audit response. The Army's position to selectively employ the full complement of available defensive infrared countermeasures systems to protect some special mission aircraft, while employing less than the full suite of available defensive countermeasures systems to protect most of the combat and combat support helicopters is inconsistent. All Army helicopters are susceptible to the same infrared seeking threat. For example, the AN/AAR-47 Missile Warning System has demonstrated that it can increase the survivability of Army helicopters under a variety of threat conditions. Our conclusion that an infrared suppressor and an AN/ALQ-144A were adequate to protect aircraft from the infrared seeking threat is not vacated by our further recommendation that the missile detection system be incorporated into the defensive countermeasures suite. The intent of our recommendation was to increase the margin of safety and introduce redundant protection in the event of a Jammer

failure. The current Army philosophy does not consider the serious degradation of protection that will accompany the operational loss of the AN/ALQ-144A Infrared Jammer. We still believe that our recommendation is valid and request that the Army reconsider its position in its response to the final report.

STATUS OF RECOMMENDATIONS

		Response should cover:		
Number	Addressee	Concur Nonconcur	Proposed Action	Completion Date
A.1.a.	Navy			X
A.1.b.	Navy		X	X
A.2.	Army	X	X	X

FINDING B. RELIABILITY OF THE AN/ALQ-144 INFRARED JAMMER

The AN/ALQ-144 Infrared Jammer experienced premature bearing failures. The bearing failures were caused by extended periods of disuse and the unit personnel's failure to adhere to recommended operation and maintenance procedures. As a result, the AN/ALQ-144 Infrared Jammer's reliability was severely degraded, which reduced the probability of mission success and increased aircraft vulnerability to infrared seeking threats.

DISCUSSION OF DETAILS

Bearing failure analysis. In 1988, the Army initiated a failure analysis in response to premature AN/ALQ-144 bearing failures experienced during the Lead-the-Fleet Test Program at Fort Rucker, Alabama, and bearing corrosion on systems deployed to Army units in Germany. On December 12, 1988, the resulting report disclosed that the failed systems were produced during the initial production contract in 1979 and had been in the Army's inventory since 1980, but each of the failed systems had been operated less than 90 hours in 8 years. The low operating hours indicated the systems were not being operated during aircraft missions, as required by the operation manual. The analysis concluded that any systems retained in storage or not operated for extended periods of time were susceptible to premature bearing failure. The systems were susceptible to failure because the grease used in the bearings had a shelf life of approximately 2 years, after which it lost its lubricating properties through oil migration. The extended period of nonoperation caused the premature failures. Additionally, the report concluded that when the AN/ALQ-144 was exposed to prolonged adverse weather conditions, such as wind driven rain, or washed with cleaning liquid, water seeped into the bearings and caused corrosion. The report recommended that the Jammers be operated and maintained according to the prescribed procedures and that the Infrared Jammer be kept covered when not in use.

Operation and maintenance procedures. Operation and maintenance procedures to preclude early bearing failure and corrosion are explicitly detailed in the maintenance and operation manuals for the AN/ALQ-144 Infrared Jammer. The Army and Navy Operators and Aviation Unit Maintenance Manuals, TM11-5865-200-12 and NAVAIR16-35ALQ144-1, respectively, require that the Infrared Jammer be operated during aircraft missions. Further, the Manuals specify that a minimum weekly preventative maintenance check be completed by operating the Infrared Jammer and that protective covers be placed on Infrared Jammers that were mounted on aircraft.

Compliance with maintenance procedures. We visited three locations and obtained usage information from another three locations with assigned aircraft having AN/ALQ-144 Infrared Jammers. We reviewed the operational hours accumulated on the elapsed time indicators for 179 AN/ALQ-144 Infrared Jammers at the 6 locations. The average accumulated operational usage time for the 179 Infrared Jammers was 61 hours per Jammer. If the Jammers had been operated as required during aircraft missions, the Jammers should have accumulated significantly greater usage. We did not attempt to determine the dates the 179 Infrared Jammers were manufactured or the expected usage if the Infrared Jammers had been operated as required, but the AN/ALQ-144 Infrared Jammers have been fielded since 1980. The unusually low operating time indicated that the AN/ALQ-144 Infrared Jammers were not being operated as prescribed in the Manuals. Further, interviews with activity personnel confirmed that the Infrared Jammers were not being operated during flight or maintained at weekly intervals, and that the protective covers were not always installed, as required. At one activity, we noted the protective covers were installed on the Infrared Jammers. We were informed that the AN/ALQ-144 Infrared Jammers were covered in anticipation of the auditors' visit. The operation and maintenance procedures are important and must be followed to ensure that the Infrared Jammer's reliability is not reduced.

Summary. The AN/ALQ-144 Infrared Jammer requires frequent operation to retain the integrity of the bearings. In two instances, irregular and infrequent usage coupled with a failure to adhere to prescribed weekly maintenance procedures contributed to bearing failures that rendered the Infrared Jammer inoperative. The Infrared Jammers were reliable when the procedures were followed. Premature failure of the Infrared Jammer in a threat environment will result in an immediate vulnerability and could cause a catastrophic mission failure and loss of the aircraft.

RECOMMENDATIONS, MANAGEMENT COMMENTS, AND AUDIT RESPONSE

We recommend that the Army Deputy Chief of Staff for Operations and Plans; the Assistant Chief of Naval Operations (Air Warfare); and the Commander, Air Force Logistics Command, issue supplemental guidance to ensure:

1. Operation and maintenance of AN/ALQ-144 Infrared Jammers according to the operation and maintenance procedures specified in TM11-5865-200-12 or NAVAIR16-35ALQ144-1.

Army comments. The Army concurred with the recommendation and completed the corrective action on September 30, 1990. A complete text of the Army's comments is in Part IV of the report.

Navy comments. The Navy nonconcurred stating that current directives adequately cover proper operation and maintenance of equipment. Fleet users utilize proper procedures to the greatest extent practicable and in accordance with published directives. Bearings on this system are historically replaced at 200 hours. Excessive running of the system further accelerates replacement. A complete text of the Navy's comments is in Part IV of the report.

Audit response to Navy comments. Our recommendation focused on whether the proper operational procedures, as specified in NAVAIR16-35ALQ144-1, were being followed. Our review disclosed that the Jammers had low usage. We found only 1 Jammer from a total of 179 reviewed that had more than 200 hours. The AN/ALQ 144 Jammer has been fielded since 1980. These facts do not support the Navy's contention that Jammers are being operated as prescribed by the Navy Directive. We recognize that bearing replacement is a routine maintenance action that occurs at 200 operational hour intervals. Our concern is that irregular and infrequent usage will result in catastrophic damage to the Jammer, as evidenced by the documented premature failure. We believe that our recommendation is still valid and accordingly request that the Navy reconsider its position in its response to the final report.

Air Force comments. The Air Force did not provide comments.

Audit response to Air Force comments. We request that the Air Force provide comments to the final report identifying the planned or corrective actions and the estimated date for completion of the actions.

2. Proper installation of the protective covers on the Infrared Jammers that are mounted on aircraft when the aircraft are not being operated.

Army comments. The Army concurred with the recommendation and completed the corrective action on September 30, 1990. A complete text of the comments is contained in Part IV of the report.

Navy comments. The Navy nonconcurred with the recommendation stating that the current directives adequately cover the proper installation of protective covers on the AN/ALQ-144. A complete text of the comments is in Part IV of the report.

Audit response to Navy comments. We agree that existing directives address the proper installation of the Jammer covers, but our analysis disclosed that the existing directives were not followed. The Jammers

were not being covered at the activities we visited, which included Navy and Marine Corps locations. We believe that supplementary guidance is required to ensure that existing directives are adhered to. We request that the Navy reassess its position in response to our final report.

Air Force comments. The Air Force did not respond to the draft report.

Audit response to Air Force comments. We request that the Air Force provide comments to the final report identifying the planned or corrective actions and the estimated date for completion of the actions.

STATUS OF RECOMMENDATIONS

		Response Should Cover:		
Number	Addressee	Concur/ Nonconcur	Proposed Action	Completion Date
1.	Navy	X	X	X
	Air Force	X	X	X
2.	Navy	X	X	X
	Air Force	X	X	X

FINDING C. OPERATIONAL EFFECTIVENESS

Army military intelligence unit commanders did not install the Louvered Scarfed Shroud Suppression system on OV-1 Mohawk aircraft. Concerns stemming from suppression system induced buffeting, or aircraft vibration, at or near stall speeds coupled with the lack of stall warning instrumentation and incomplete flight manual documentation caused unit commanders to refrain from installing the suppression system. Further, pilots were not trained in flying the OV-1 configured with the Louvered Scarfed Shroud Suppression system. As a result, the aircraft were vulnerable to infrared seeking threats.

DISCUSSION OF DETAILS

Background. The OV-1 Mohawk is an Army fixed wing, twin engine aircraft used to gather intelligence for Army forward combat elements. The OV-1 relies on the AN/ALQ-147 Infrared Jammer and the Louvered Scarfed Shroud Suppression system to protect it from infrared seeking threats. The Louvered Scarfed Shroud Suppression system is an optional defensive countermeasures system that can be installed when the OV-1 is operated in an infrared threat environment. Tests have demonstrated that the suppression system is operationally suitable and effective, but the addition of the suppression system ram air scoops increases drag and perturbs the airflow over the wing surfaces. The airflow disturbance becomes more pronounced and causes buffeting as the actual airspeed of the OV-1 approaches to within 5 to 30 knots above the stall airspeed.

OV-1 flight characteristics. The basic design characteristics of the OV-1 without the Louvered Scarfed Shroud Suppression system cause the aircraft to begin buffeting at the threshold of the stall airspeed. OV-1 pilots are trained to react to the prestall buffeting as the principal symptom that the aircraft is about to enter a stall, because the aircraft is not equipped with a stall warning system. The buffeting caused by the suppression system is not distinguishable from the prestall buffeting. The suppression system induced buffeting effectively masks, or covers up, the only indicator available to the pilot that the aircraft is about to stall.

Suppression system problem. The abnormal flight handling characteristics associated with the Louvered Scarfed Shroud Suppression system have been known since 1984, but the Army has taken no action to reduce or eliminate the buffeting problem. On September 21, 1989, the Aircraft Survivability Equipment Project Management Office and the Aviation Systems Command Safety Officer reviewed the buffeting problems and concluded that the buffeting did not pose a flight safety concern. However, Army military intelligence unit commanders did not agree with the conclusions

reached by the Aviation Systems Command officials and continued to resist installing the suppression system on operational aircraft. A product improvement program to include stall warning instrumentation that would have compensated for the suppression system adversities was eliminated when the Army canceled the OV-1 upgrade program in 1990. The upgrade program was canceled because of budget constraints, and the OV-1 is scheduled for retirement by 1997.

Stall warning and training required. Field units had not used the Louvered Scarfed Shroud Suppression system since the system became operational in 1984. The accumulated flight hours of suppressor equipped OV-1's were attributable to flight testing and evaluation. Pilots encountered buffeting and adverse flight handling characteristics caused by the Louvered Scarfed Shroud Suppression system, and they perceived that the buffeting was an "anomaly" that was inherently dangerous. However, the Army Aviation Command Safety Office and the Aircraft Survivability Project Manager concluded that the buffeting did not represent a flight safety concern because the suppression system induced buffeting occurred at airspeeds above the stall airspeed. We interviewed several OV-1 senior instructor pilots and two Grumman OV-1D test pilots, and they asserted that the Louvered Scarfed Shroud Suppression system did cause buffeting, but the buffeting was discomforting rather than inherently unsafe. The pilots also stated that the modified OV-1 flight characteristics stemming from the suppression system could be significant. They recommended that training be established for operation of the OV-1 configured with the Louvered Scarfed Shroud Suppression system. One Grumman test pilot stated that if buffeting could not be relied on as a warning of impending stall, some other warning mechanism, such as a stall warning system, should be made available. The Grumman pilot also stated that the real risk is that most pilots do not have the training or experience to anticipate the changed aerodynamic characteristics of the OV-1 with the suppressor system installed. No aircraft accidents have been caused by the suppression system, but unit commanders have not installed the system on the aircraft.

Operators manual needs revision. We observed that the flight operators manual that describes the operation and performance characteristics of the OV-1 equipped with the Louvered Scarfed Shroud Suppression system was not accurate and complete. U.S. Army Aviation Systems Command engineers had approved 24 changes to the flight operators manual during testing of the OV-1 with the Louvered Scarfed Shroud Suppression system installed. Of the 24 changes, 7 (29 percent) were not made to the operators manual. Officials at the Army Aviation School at Fort Rucker, Alabama, indicated that funding had been removed from the OV-1 program, and no further changes to the flight manual were anticipated.

Summary. The Army has recognized the vulnerability of the OV-1 without the Louvered Scarfed Shroud Suppression system. The Army has also approved the suppression system and has asserted that the suppression system is safe. However, it has not established a training program or published accurate and complete flight documentation to ensure safe operation of the OV-1 with the suppression system. In view of the impending retirement of the OV-1 fleet in 1997 and the absence of further program funding, we concluded that redesigning the suppression system may not be practical. We believe alternative solutions, including installing a stall warning system, updating manuals, and training would be more cost-effective and would compensate for the adversities introduced by the Louvered Scarfed Shroud Suppression system.

RECOMMENDATIONS, MANAGEMENT COMMENTS, AND AUDIT RESPONSE

1. We recommend that the Assistant Secretary of the Army (Research, Development and Acquisition) restore funding to the OV-1 Mohawk program to reinstate the acquisition of a stall warning system.

Army comments. The Assistant Secretary of the Army (Research, Development and Acquisition) nonconcurred with the recommendation based on the time required to obtain funding and the planned retirement of the OV-1 fleet in 1997.

Audit response. The OV-1 is a combat aircraft whose mission requires that it be protected from the infrared seeking threat. In our opinion, the stall warning system is integral to the safe operation of the OV-1 aircraft configured with the Louvered Scarfed Shroud Suppression system. We request that the Army reconsider its position in response to the final report.

2. We recommend that the Commander, U.S. Army Training and Doctrine Command:

a. Update OV-1 flight manuals to reflect operational differences covered by the Louvered Scarfed Shroud Suppression system.

b. Revise the OV-1 flight training program to include use of the Louvered Scarfed Shroud Suppression system on school aircraft.

Army comments. The Assistant Secretary of the Army (Research, Development and Acquisition) concurred with the recommendations concerning the flight manuals and pilot training. The OV-1 flight manual TM55-1510-213-10 was updated to reflect the operational differences of the Louvered Scarfed Shroud Suppression system. The Flight training program will be revised to train OV-1 aviators on Louvered Scarfed Shroud Suppression system-equipped aircraft beginning in FY 1992.

STATUS OF RECOMMENDATIONS

		Response should cover:		
Number	Addressee	Concur Nonconcur	Proposed Action	Completion Date
1.	Army	X	X	X

PART III - ADDITIONAL INFORMATION

APPENDIX A: DEFENSE HOTLINE COMPLETION REPORT

As of November 16, 1990

Hot Metal Plus Plume Suppression System

Louvered Scarfed Shroud Suppression System

AN/ALQ-144 Jammer

Summary of Allegation and Results of Review

The allegations contained in the four complaints received through the DoD Hotline were utilized to draft the following formal allegations. The allegations and the results of our review were:

Hot Metal Plus Plume Suppression (HMPPS) System

Allegation 1

There is no ongoing activity at AVSCOM to develop procedures to extend the service life of the AH-1 Hot Metal Plus Plume Suppression (HMPPS) system beyond the current 300 hours.

Results of Review by DoDIG

The Army initiated efforts to improve the reliability of the HMPPS since the reliability problems were first discovered in 1979. Our review disclosed the Army awarded a contract in December 1981 to improve the suppressor reliability. In 1982, the contractor delivered technical drawings to the Army that detailed design improvements intended to increase reliability. As a result of the 1982 improvement recommendations, in 1985 the Corpus Christi Army Depot began reinforcing the suppressor struts. Also, in 1985 the Army fabricated a prototype suppressor unit that included a replaceable nosecone assembly and reinforced struts. In August 1990, the Army initiated a contract modification to incorporate the prototype suppressor design improvements into the production contract.

Allegation 2

AVSCOM Material Management Directorate is forecasting a huge replacement program without any thought being given to a refurbishment program.

Results of Review by DoDIG

A refurbishment program did exist and the repaired suppressor units were being factored into the supply availability studies to determine projected suppressor unit requirements. We visited the Corpus Christi Army Depot to verify the adequacy and sufficiency of the repair activity. We reviewed depot repair activity reports and supply inventory records, and we interviewed depot personnel to determine that the repair activity was being reported accurately and was consistent with supply records. We verified that repairs were being made as reported and suppressors were being returned to serviceable status as gains into the supply system. The depot repaired and returned about 10 suppressor units per month to the supply system.

Allegation 3

The Army is attempting to repair the HMPPS failure rather than improve the design.

Results of Review by DoDIG

As noted in the response to allegation 1, the Army has an effort underway to improve reliability in production units. Also, as noted in the response to allegation 2, the Army has an active repair program underway at Corpus Christi Army Depot. Therefore, the Army is attempting to make design improvements in production units concurrent with depot repair of failed units.

Allegation 4

Insufficient assets are on hand and projected to meet the demand for the HMPPS suppressors. The Corpus Christi Army Depot receives 9 unserviceable units per month but they are only able to return 3 repaired units per month.

Results of Review by DoDIG

Our review of the repair activity at Corpus Christi Army Depot showed that approximately 10 suppressors were received and repaired each month rather than the receipt of 9 and repair of 3 per month as alleged. Depot management indicated that the capacity and capability existed to expand repair activity if necessary because of increased requirements or an increase in the return of unserviceable suppressor units.

Allegation 5

The accountability for all HMPPS suppressor units cannot be determined.

Results of Review by DoDIG

We determined that the suppressor was properly classified as a class IX item according to classification guidelines, consistent with its value and application. The suppressor is accountable at the depot level and is being tracked in the same manner as all class IX items. The suppressor unit is not visible to the supply system after it is issued to the field units, but it becomes visible when it is returned to the depot for repair. We determined that the suppressors located at the depot were included in the appropriate accounting records.

Allegation 6

The reliability failures of the AN/ALQ-144 infrared jammer were not adequately analyzed, defined, or corrected in the AN/ALQ-144A design.

Results of Review by DoDIG

In July and August 1988, two incident reports recorded that AN/ALQ-144 jammers experienced bearing failures. The ASE Project Management Office initiated an investigation to determine the cause of the bearing failures on the two units. On December 12, 1988, the investigation report disclosed that both of the failed systems were produced in 1979, had been in the Army inventory since 1980, and had individually accumulated less than 90 hours cumulative operational time during the eight year period. The report concluded that jammers which were in storage or were not operated for extended periods of time and were not lubricated, were susceptible to premature bearing failures. The grease used in the bearings had a shelf life of approximately 2 years, after which, it lost its lubricating properties. The report attributed the bearing failures in the two jammers identified in the incident reports to the depletion of grease from the bearings. A single test could not have been reasonably expected to detect the bearing failures, because the problem stemmed from protracted periods of disuse coupled with the failure to follow recommended operation and maintenance procedures. The operation and maintenance manuals, dated August 15, 1987, stated that the jammer was to be covered when not in use, operated at weekly intervals, and lubricated every

200 hours of operation. The AN/ALQ-144A has incorporated improvements as a result of the bearing failures experienced on the AN/ALQ-144. The improvements included self-contained bearings, increased resistance from exposure to the elements, and a bearing shield to help protect the bearings. However, until the aircraft are equipped with the "A" model, maintenance and operation procedures must be followed to insure that the AN/ALQ-144 jammer will operate effectively when needed. We found that the cause of the failures was adequately identified and corrective action was initiated in a timely manner.

Allegation 7

The Reliability Index Determination Test (Bench Test) has been used as a singular test to determine acceptance of the reliability of the AN/ALQ-144A.

Results of Review by DoDIG

The Reliability Index Determination Test is performed under simulated operational conditions. The test chamber is automatically cycled through environmental test conditions consistent with expected helicopter operational stresses and vibrations, in accordance with part 3 of the approved Engineering Design Test Plan, Reliability Test Plan for AN/ALQ-144A dated 1 October 1985 (Revision A). The Reliability Index Determination Test was conducted to establish a basis to evaluate and identify scheduled maintenance requirements and to assure compliance with reliability requirements of Equipment Specification MIL-C-49159(EL), dated 10 February 1979 using an approved test plan (IIIC) of MIL-STD-781C. The Army's testing procedures for the AN/ALQ-144A jammer follow the appropriate DoD and Army guidance for such tests.

Allegation 8

The Reliability Index Determination Test is not a true representation of the helicopter environment and has demonstrated testing inadequacies.

Results of Review by DoDIG

As stated in our response to allegation 7, the Reliability Index Determination Test is an approved test plan in accordance with military specifications and standards. The environmental conditions of the test were designed to approximate the actual operational environmental conditions of the helicopter. Also,

Lead-the-Fleet operational flight tests conducted during 1986 and 1987 at Ft. Rucker support the validity of the Reliability Index Determination test and the reliability of the jammer. The flight test results disclosed that the jammer was tested a total of 452 hours without a relevant failure. An AN/ALQ-144A jammer was installed and flown on an AH-1F COBRA helicopter for a total of 242 flight hours without a relevant failure. Another AN/ALQ-144A was installed and flown on a UH-1H Huey helicopter for 198 hours, a UH-60 Black Hawk helicopter for 4 hours, and a AH-64 Apache helicopter for 7.9 hours without a relevant failure. The minimum required mean time between failures for the AN/ALQ-144A jammer is 150 hours. The testing inadequacies referred to in the allegation are the two incidents discussed in our reply to allegation 6. As we stated, the two failures were attributable to improper maintenance and operation practices rather than reliability failures.

Allegation 9

The Electromagnetic Compatibility (EMC) between the AN/ALQ-144A and other helicopter systems has never been tested. Unless such satisfactory test results are provided, it will be considered a deficiency in testing in accordance with military specifications.

Results of Review by DoDIG

Electromagnetic Capability testing on prototype jammers was conducted during the Lead-the-Fleet testing conducted in 1986 through 1987 with aircraft that had full mission equipment on-board. Also, the Electromagnetic Capability test was defined as a first article test requirement in the Test and Evaluation Master Plan, dated July 25, 1988. The Electromagnetic Capability test existed as a deliverable requirement in the AN/ALQ-144A contract when it was awarded on September 28, 1989. Although the Electromagnetic Capability test was not completed on production units at the time of the allegation, the requirement was established at the time of contract award, in accordance with the 1988 Test and Evaluation Master Plan, and was scheduled to be conducted during the first article test. The Electromagnetic Capability test on production units was successfully completed in August 1990.

Allegation 10

The AN/ALQ-144A development efforts under Contract DAAK20-83-C-0900 require delivery of a competitive technical data package, and dual qualification requirements for selecting subcontractors.

Results of Review by DoDIG

The 1983 development contract did require delivery of a competitive technical data package (level 3 drawings). The contractor delivered the prototype jammers in accordance with the terms of the contract, but while the prototype AN/ALQ-144As were being tested, the threat changed. The new threat, which was promulgated in 1988, required further changes in the prototype model. The planned acquisition strategy was to incorporate the required changes into the prototype model and update the drawings as a part of the existing engineering development contract rather than award another engineering development contract. The technical data package was not validated at the time the production contract was awarded. The absence of validated technical drawings was sufficient justification to award the sole source production contract. It would have been inappropriate for the Army to initiate a competitive solicitation for production of AN/ALQ-144A jammers based on a technical data package which was not validated.

Allegation 11

If the solicitation has intentions to provide supplemental data for added changes necessary to compete, why is the solicitation loaded up with such a high quantity of hardware.

Results of Review by DoDIG

We determined that the contract quantities were consistent with established Army operational requirements, and were reviewed and approved by the Army Materiel Command and the Under Secretary of the Army. The contract quantities were based on a combination of quantities needed for projected deliveries of new helicopters and retrofitting of existing helicopters over the three year contract delivery schedule. The solicitation quantities were not excessive. For additional information refer to our discussion of Allegation 17.

Allegation 12

The Army is not promoting competition to the extent as required in the Government Code of Ethics.

Results of Review by DoDIG

The sole source production contract awarded by the Army for the production of the AN/ALQ-144A jammers was adequately documented and sufficiently justified. Proper approvals were obtained and procedures were followed. The contract was predicated on an operational requirement that was generated by a validated threat. The sole source award was appropriate, in the best interest of the Government, and did not violate the Government Code of Ethics. The specific facts leading to the award of the sole source production contract are discussed in our response to allegation 13.

Allegation 13

Higher headquarters (AMC) conducted an inadequate and unfair investigation regarding a competitor's protest.

Results of Review by DoDIG

The Army Materiel Command (AMC) conducted an independent review of the contract award process, and the General Accounting Office (GAO) rendered a protest ruling upholding the Army position concerning the propriety of the same contract award. The award was held to be proper by the Army AMC review team. The new threat required further changes in the AN/ALQ-144A prototype countermeasures set. The additional changes were incorporated in the production contract. The planned acquisition strategy was to make the required engineering changes in the prototype model, and update the technical level 3 drawings. The other two recent manufacturers of the AN/ALQ-144 were not considered technically capable by the Army of independently redesigning the AN/ALQ-144A to meet the revised threat. The Army awarded a sole source contract to develop the AN/ALQ-144A, and subsequent additional changes, to the original developer of the AN/ALQ-144. The AMC review team concluded that the Technical Data Package was incomplete and inadequate for competition at the time and that only the designer of the AN/ALQ-144 was capable of making the necessary engineering changes to develop the AN/ALQ-144A and upgrade the existing AN/ALQ-144A prototypes based on the further threat revision. The GAO denied the sole source award protest on June 16, 1989 because only a prototype of the AN/ALQ-144A had been developed and delivered by Sanders and development was not complete. Existing level 3 technical drawings were not suitable for manufacture and updated technical drawings were not available. Moreover, the protesting contractor was not a viable additional contractor because it lacked the required security clearance to perform.

Allegation 14

Who was at fault for not getting the latest changes as now desired into these drawings?

Results of Review by DoDIG

No one was at fault. The evolution of technology required a corresponding change in capability to defeat the emerging threat. The changes were incorporated into the AN/ALQ-144A in a timely manner, but additional changes were necessitated after the prototype AN/ALQ-144A jammers had been delivered. As a result of the further change in requirements, the technical data package was incomplete and inadequate for competition of the initial production contract.

Allegation 15

Since the Navy had incorporated these changes (now desired by the Army) on their special program why has not anyone asked or stated the time the Navy completed this effort? Or could it be that these latest changes were to meet a newer and later threat were really in existence for quite a while? What kind of a change is this?

Results of Review by DoDIG

The changes made to the AN/ALQ-144 by the Navy were not desired or needed by the Army. The Navy "Phase Lock" modifications had nothing in common with the modifications made by the Army to upgrade the AN/ALQ-144 to the AN/ALQ-144A. In 1988, the Navy was directed by the Joint Chiefs of Staff to develop a phase lock capability for a special program application. The phase lock configuration enabled an aircraft to simultaneously operate two AN/ALQ-144 jammers without producing mutual signal interference. The Navy procurement of the phase lock configuration was a non-recurring requirement. For additional information, refer to our discussion of allegation 16.

Allegation 16

If the change is phase lock capability why don't they just state that instead of repeatedly saying necessary for yet a newer threat? Or was the Government afraid that the competitor protestor could develop the technique by reverse engineering the Navy systems? Also if the Navy paid for a phase lock effort why doesn't the Government have a right to the data?

Results of Review by DoDIG

The phase lock configuration of the AN/ALQ-144 is separate and distinct from the upgrade of the AN/ALQ-144 to the AN/ALQ-144A. The Army's current plans include acquisition of the AN/ALQ-144A and upgrading existing AN/ALQ-144s to the AN/ALQ-144A configuration because of significant vulnerabilities caused by a change in the threat. Although the Army has no requirement for the phase lock configuration, the Army is the procuring activity for all services for the AN/ALQ-144A, and the provision for the phase lock configuration was included as a contingency for future DoD special applications. The Navy was directed to procure the phase lock configuration by the Joint Chiefs of Staff for a special application and did not procure the technical data from Sanders because the Navy did not envision the phase lock configuration to be a recurring requirement.

Allegation 17

If the Government wanted truly to compete the systems and modification kits, why are there so many systems being bought on the sole source contract? Since one of the options for modification kits has already been awarded (mod kit cost $17K each) and plans are underway to exercise more options, what is going to be left for competition to bid on? The Sanders sole source contract schedule shows the options expiring before Sanders delivers the updated TDP that the Government should have received years ago. Isn't this quite convenient?

Results of Review by DoDIG

The acquisition plan indicated that the acquisition quantities procured for Fiscal Years 1989, 1990 and 1991 were consistent with the quantities required for the period in order to meet aircraft production schedules for the UH-60 and AH-64 plus modernization of the UH-1 and AH-1 helicopters. Further, helicopters currently in the field needed to be upgraded from the AN/ALQ-144 to the AN/ALQ-144A for protection against the current threat. The Army acquisition strategy to procure the AN/ALQ-144A jammers and modification kits was consistent with requirements and based on a valid operational need to protect helicopters from the threat.

Allegation 18

With phase lock much more generating power is required. Has anyone checked the helicopter's capability? Is the cost for phase lock capability worth the few helicopters it can actually be installed on?

Results of Review by DoDIG

As stated in our response to allegation 15 above, the phase lock configuration was procured at the direction of the Joint Chiefs of Staff for a special application. The Army is the procuring activity for all services for the AN/ALQ-144A jammers. The inclusion of the phase lock configuration on the sole source production contract was a contingency to provide for exigent acquisition of the phase lock configuration if additional requirements are identified. The Army has no requirement for the phase lock configuration, but the Navy has used phase lock on a limited number of aircraft which use the same airframe and engines as Army helicopters (SH-60/UH-60).

Louvered Scarfed Shroud Suppression (LSSS) System

Allegation 19

Adverse flight characteristics on the OV-1D Mohawk have been reported by pilots when the LSSS system is installed on the aircraft.

Results of Review by DoDIG

The Louvered Scarfed Shroud Suppression (LSSS) system does introduce adverse flight handling characteristics into the operation of the OV-1D aircraft. The OV-1D aircraft does not have a stall warning system. The OV-1D pilots are trained to rely on the prestall buffeting, or vibration that is inherent in the aircraft design as the indicator that the aircraft is about to enter a stall. The LSSS similarly causes the aircraft to buffet at airspeeds approaching stall. The LSSS-induced buffeting masks the prestall buffeting and gives the pilot a false indication that the aircraft is about to enter a stall. The LSSS-induced buffeting occurs at airspeeds from 5 to 30 knots above the actual stall speed. Few incidents have been reported concerning the effects of the LSSS system on the OV-1D flight handling characteristics because the system is optional and is installed only when the aircraft is perceived to operate in an infrared

threat environment. We concluded that a potential problem does exist relating to the use of the LSSS system on the OV-1D aircraft because pilots are not trained to operate LSSS-equipped aircraft. Further, we believe that training must be supplemented with a stall warning system capable of indicating when the aircraft is at the stall threshold. The absence of a stall warning system could create a potential safety of flight hazard by causing the pilot to initiate inappropriate evasive or corrective action based on the pilot's learned response to the onset of buffeting. We are making these recommendations to the Army in our forthcoming report of audit.

Allegation 20

While running an upgraded T-704 engine at high torque, problems were experienced with the engine's fireseal, which prevents an engine compartment fire from burning the wing.

Results of Review by DoDIG

The upgraded T-704 engine was one of the improvements planned in the upgrade of the OV-1D to the OV-1E. The OV-1 upgrade program was canceled in 1990 because of budget constraints, and the OV-1D fleet will be retired over the next seven years. The fireseal problem was discovered during the course of a prototype test. The purpose of the prototype test was to expose problems such as the fireseal during the development stages of the upgrade program. The fireseal problem was properly disclosed by the test, and was recognized as an action item to be corrected. No further action was taken because the Army canceled the OV-1 upgrade program.

Allegation 21

Anomalies precluded the LSSS system from being considered in the prototyping of a multimillion dollar upgrade of the total Mohawk aircraft.

Results of Review by DoDIG

The OV-1 upgrade program was canceled by the Army in 1990. At the time of the audit we could not determine if LSSS would have been included in the upgrade because the LSSS system was considered to be an optional accessory to be used as required.

Conclusions. Based on the results of our inquiry and audit of the 21 allegations of the three systems mentioned in the complaints, we concluded that allegation 19 concerning the adverse flight handling characteristics of the OV-1D aircraft caused by the LSSS system had merit. We issued a Quick-Reaction Audit Report concerning the improper approval of a Value Engineering Change Proposal. Additionally, we are developing a comprehensive report of audit that will address the LSSS issue as well as issues disclosed during the audit relating to other aspects of the three systems. The issues in the audit report, excepting the LSSS related issue, stem from potential reportable conditions found during audit rather than the allegations presented to the hotline. In our opinion, the inquiries made of the allegations during previous reviews by other activities were fairly presented, resulted in disclosure of all relevant facts, and were accurate in their conclusions.

Recommendations. We recommend that the foregoing issues relating to the HMPPS, LSSS, and AN/ALQ-144A systems be closed and no further work relating to the issues presented in the 21 preceding allegations be initiated. The audit findings disclosed as a result of our related audit of these three systems will be presented in a separate report of audit, and will be resolved in accordance with DoD Directive 7650.3.

APPENDIX B: SURVEY AND AUDIT CONCLUSIONS

During the survey phase of our audit, we determined that additional audit work was not warranted in the areas of contract procedures and system design for the AN/ALQ-144 Infrared Jammer. A discussion of these areas follows.

Contract Procedures. We reviewed the September 30, 1989, sole source award to Sanders Associates, Inc., for the initial AN/ALQ-144A production contract. The Army Materiel Command conducted an independent review of the planned acquisition and found the award to be proper. A competing contractor protested the award to the General Accounting Office. The General Accounting Office denied the protest stating that the Communications-Electronics Command did not act unreasonably in concluding that only one known source could meet the Government's needs within the required time. We concluded that the acquisition strategy was consistent with requirements, and the contract award was proper.

System Design. Changes in the threat caused development of the prototype AN/ALQ-144A Infrared Jammers, and the Army had received six prototype models of the AN/ALQ-144A from the existing engineering development contract. Further changes in the threat necessitated additional changes to the prototype AN/ALQ-144A Infrared Jammers. As a result, the technical data package was incomplete and inadequate for competition of the initial production contract for the AN/ALQ-144A in time to meet the Army's delivery requirements. The Army asserted that the similarities that existed between the AN/ALQ-144 and the AN/ALQ-144A models coupled with the extensive design experience of the contractor on the original AN/ALQ-144 and the extensive reliability and operational testing completed on the prototype jammers were adequate basis to transition into production of the AN/ALQ-144A. The quantities and delivery requirements specified in the sole source contract were consistent with Army requirements. We concluded that design maturity had been sufficiently achieved before the production decision was made, and that adequate testing and evaluation quality assurance procedures existed to ensure the AN/ALQ-144A Infrared Jammer met the minimum reliability requirements.

We did not identify any significant reportable conditions in evaluating the audit objectives relating to reliability, availability, and maintainability of the Hot Metal Plus Plume Suppression system and operational testing of the AN/ALQ-144A Infrared Jammer. In these areas, additional audit work did not disclose any significant reportable problems. A discussion of these areas follows.

Hot Metal Plus Plume Suppression System reliability. The suppressor unit has experienced reliability problems since its unsuccessful first article test in 1979. The minimum reliability requirement was 300 hours mean time between failures, but the suppressor experienced thermal stress cracking and did not pass the test. The Army elected to accept the suppressor as it was designed and to execute a concurrent product improvement contract to increase the reliability of the suppressor. A prototype suppressor unit was fabricated that used the revisions recommended in the product improvement contract, and the Army claimed the prototype suppressor was operated for an estimated 1,500 hours without a relevant failure. We were unable to substantiate the validity of the 1,500-hour assertion. The changes to improve reliability were cut into production in 1990, and the Army was optimistic that the changes would improve the reliability beyond the minimum acceptable level of 300 hours. We concluded that the Army has initiated appropriate action to improve reliability beyond the minimum requirements, and that the simplification of the suppressor construction resulting from the reliability improvements will also reduce depot level suppressor maintenance.

Hot Metal Plus Plume Suppression System availability. The suppressor unit is the principal component of the Hot Metal Plus Plume Suppression system. A review of the suppressor demand history and the projected suppressor requirements disclosed that the quantity of projected reparable suppressors and the quantity of suppressors due in from an existing contract were adequate to meet the projected requirements. Responsible depot personnel stated that the depot was capable of expanding the repair program, if necessary, to meet an increase in requirements. Further, proliferation of suppressor units produced after implementation of the reliability improvements will cause increased repair actions to be completed at intermediate level maintenance activities and a corresponding decrease in depot repair actions. We concluded that availability was adequate.

AN/ALQ-144 Operational testing. Formal operational testing was not planned for the AN/ALQ-144A countermeasures set since it was a modification of the AN/ALQ-144 and maintenance procedures will be similar. Our review indicated tests for reliability have been, and will continue to be, conducted on a continuous basis throughout production. For example, four AN/ALQ-144A Jammers were subjected to over 3,442 cumulative hours of reliability testing without a relevant failure during the reliability index determination test conducted in late 1986. This equated to a system mean time between failures greater than or equal to 1,490 hours at a 90-percent confidence level. System requirements are for an upper test limit meantime between failures of 300 hours. In addition, an AN/ALQ-144A Jammer was installed and flown on an AH-1F aircraft for 242 flight hours. Another set was installed and flown for 198 hours on a UH-1H, 4 hours on a UH-60A, and 7.9 hours on an AH-064. Neither set experienced any relevant failure. The AN/ALQ-144 passed the first article test in August 1990. We concluded that testing was adequate. The Army completed the first article test on the AN/ALQ-144A in August 1990. We concluded future contractor reliability testing for the AN/ALQ-144A will adequately satisfy testing requirements.

APPENDIX C: SUMMARY OF POTENTIAL MONETARY AND OTHER BENEFITS RESULTING FROM AUDIT

Recommendation Reference	Description of Benefit	Amount and/or Type of Benefit
A.1. and A.2.	Program Results - Increased survivability of aircraft.	Nonmonetary.
B.1. and B.2.	Economy and Efficiency - Reduced operation and maintenance costs for the AN/ALQ-144 Infrared Jammer.	Undeterminable. Funds put to better use.
C.1. and C.2.	Program Results - Increased survivability of aircraft.	Nonmonetary.

APPENDIX D: ACTIVITIES VISITED OR CONTACTED

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition, Washington, DC
Assistant Secretary of Defense (Program Analysis and Evaluation), Washington, DC
Comptroller of the Department of Defense, Washington, DC

Department of the Army

Office of the Assistant Secretary of the Army (Research, Development and Acquisition), Washington, DC
Army Materiel Command, Alexandria, VA
Army Aviation Systems Command, St. Louis, MO
Army Communications-Electronics Command, Ft. Monmouth, NJ
Army Aviation Center, Fort Rucker, AL
Corpus Christi Army Depot, Corpus Christi, TX
Army Electronic Proving Ground, Fort Huachuca, AZ
224th MI, Fort Hunter, GA
82nd Airborne Brigade, Fort Bragg, NC
160th Special Operations Aviations Regiment, Fort Campbell, KY

Department of the Navy

Naval Air Systems Command, Washington, DC
Naval Air Test Center, Patuxent River, MD
Naval Research Laboratory, Washington, DC
Marine Aircraft Groups 26 and 29, Marine Corps Air Station, New River, NC
2nd Marine Aircraft Wing, Marine Corps Air Station, Cherry Point, NC

Department of the Air Force

Deputy Chief of Staff for Logistics and Engineering, Washington, DC
Secretary of the Air Force, Directorate of Strategic Programs, Washington, DC
Eglin Air Force Base, FL

Defense Agencies

Defense Contract Management Area Operations, Birmingham, AL
Defense Contract Administration Office, Birmingham, AL.

Contractor

Hays Targets, Leeds, AL

APPENDIX E: REPORT DISTRIBUTION

Office of the Secretary of Defense

Under Secretary of Defense for Acquisition
Assistant Secretary of Defense (Public Affairs)
Assistant Secretary of Defense (Program Analysis and Evaluation)
Comptroller of the Department of Defense

Department of the Army

Secretary of the Army
Assistant Secretary of the Army (Financial Management)
Assistant Secretary of the Army (Research, Development and Acquisition)
Assistant Secretary of the Army (Installations, Logistics and Environment)
Deputy Chief of Staff for Research, Development and Acquisition
Deputy Chief of Staff for Logistics
Commander, U.S. Army Materiel Command
Commander, Corpus Christi Army Depot, Corpus Christi, TX

Department of the Navy

Secretary of the Navy
Assistant Secretary of the Navy (Financial Management)
Assistant Secretary of the Navy (Research, Development and Acquisition)

Defense Logistics Agency

Commander, Defense Contract Management Area Operations

When the report is produced in final form, it will be distributed to additional interested parties in the Department of Defense, as well as to the following non-DoD Federal Organizations.

APPENDIX E: REPORT DISTRIBUTION (cont'd)

Non-DoD Activities

Office of Management and Budget

U.S. General Accounting Office, NSIAD Technical Information Center

Congressional Committees:
- Senate Subcommittee on Defense, Committee on Appropriations
- Senate Committee on Armed Services
- Senate Committee on Governmental Affairs
- Senate Ranking Minority Member, Committee on Appropriations
- House Committee on Appropriations
- House Subcommittee on Defense, Committee on Appropriations
- House Ranking Minority Member, Committee on Appropriations
- House Committee on Armed Services
- House Committee on Government Operations
- House Subcommittee on Legislation and National Security, Committee on Government Operations

PART IV - MANAGEMENT COMMENTS

Department of the Army Comments

Department of the Navy Comments

Management Comments: Department of the Army

DEPARTMENT OF THE ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS
WASHINGTON, DC 20310-0400

REPLY TO ATTENTION OF

DAMO-FDZ

28 MAY 1991

MEMORANDUM THRU ~~DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS~~ Don 28 MAY 1991
~~DIRECTOR OF THE ARMY STAFF~~ 28 MAY 1991
~~ASSISTANT SECRETARY OF THE ARMY (RESEARCH, DEVELOPMENT, AND ACQUISITION)~~ 31 May 91

FOR INSPECTOR GENERAL, DEPARTMENT OF DEFENSE (AUDITING)

SUBJECT: Draft Report on the Audit of Suppression Systems for the AH-1 Helicopter and OV-1 Aircraft, and the AN/ALQ-144 Jammer for Helicopters (Project No. OAL-8004)--INFORMATION MEMORANDUM

1. The purpose of this memorandum is to respond to SAIG-PA memorandum dated 9 April 1991, subject as above (Tab A), on the Draft Audit Report, 20 March 1991 (TAB E) for information to formulate an Army position on the subject referenced above.

2. HQ TRADOC and HQ AMC were tasked to provide input for developing a consolidated Army position (TAB F).

3. In accordance with DODD 7650.3 the following is the Army position for the Draft Report:

a. Recommendation A-2: Nonconcur with proposed finding and recommendation to re-evaluate the need for missile detection systems and automatic chaff and flare dispensers. Analysis of the requirement has been completed and the Army will install the missile detector only on the EH-60, CH-47D, MH-60L, MH-47E, RC-12K aircraft. Additional justification is attached at Tab B.

b. Recommendation B: Concur with recommendation; completion of the action was accomplished 30 Sep 90. Additional comments, to include actions taken during Operation Desert Shield /Storm, are addressed at Tab C.

c. Recommendation C-1: Nonconcur with proposed recommendation based upon the time required to obtain funding in conjunction with the planned retirement of the OV/RD-1D fleet to be completed by FY 97 (Tab D).

Recommendation C-2: Concur with recommendation as stated. Issue was discussed for resolution at the TRADOC Fixed Wing/SEMA Systems Program Review (SPR) held 8 - 10 Jan 91. TM 55-1510-213-10 has already been updated to reflect operational differences covered by the Louvered Scarfed Shroud Suppression (LSSS). TRADOC will be provided with one system by AVSCOM to

91028910

DAMO-FDZ
SUBJECT: Draft Report on the Audit of Suppression Systems for the AH-1 Helicopter and OV-1 Aircraft, and the AN/ALQ-144 Jammer for Helicopters (Project No. OAL-8004)--INFORMATION MEMORANDUM

familiarize and train pilots on the use and operation of the LSSS system. TRADOC will be tasked to comply with the recommendation to train aviators beginning FY92. Additional information is attached at Tab D.

4. ATCD-ATIR, AMCIR, SAFE-AV-AEC, AMCPM-ES, and SARD-SA concur.

5. Point of contact for this office is MAJ Mallory, DAMO-FDV, DSN 225-9636.

Encls

WILLIAM H. FORSTER
Major General, GS
Director of Requirements (Combat)

CF:
DAMO-ZQ (w/o TABS E and F)
SAIG-PA (w/o TABS E and F)

30 May 91 - Approved for forwarding, DAS.

STEPHEN V. REEVES
MAJ, GS
ADAS

-2-

91028910

DEPARTMENT OF THE ARMY
OFFICE OF THE INSPECTOR GENERAL
WASHINGTON, DC 20310-1700

S: 13 May 1991

SAIG-PA (36-2b) 9 April 1991

MEMORANDUM FOR DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS

SUBJECT: Draft Report on the Audit of Suppression Systems for the AH-1 Helicopter and OV-1 Aircraft, and the AN/ALQ-144 Jammer for Helicopters (Project No. 0AL-8004)

1. SAIG-PA memorandum, 3 April 1991, subject as above, is rescinded. Enclosed is IG, DOD memorandum, with draft report, for review and action. Mr. Dale Hanson, SARD-SA, and Major Robert Mallory, DAMO, mutually agreed to return this audit report to ODCSOPS for reply. Army Regulation 36-2 requires an information memorandum alerting the Secretary of the Army and the Chief of Staff if the report contains criticism of DA policy, procedures, or practices, which may result in adverse publicity. If required, submit the information NLT 16 April 1991.

2. If you require input from other Army elements to formulate an Army position, request that information from those organizations by separate correspondence. Send the correspondence through the internal review offices of other staff or command elements, where applicable.

3. Request that you forward your response through SARD NLT 13 May 1991 to IG, DOD (Auditing). Also, forward a copy of that response to SAIG-PA.

4. DODD 7650.3 requires that your comments indicate either agreement or disagreement for each finding, recommendation, or estimated monetary benefit. If you agree, describe the corrective actions taken or planned, the completion dates for actions already taken, and the estimated completion dates for the planned actions. Agreement with monetary benefits may necessitate the recovery of resources; if so, include the status of this recovery action in the DA comments. If you disagree with any of the findings, recommendations, or estimated monetary benefits, state the specific reason(s) for disagreement and provide revised estimates of monetary or other anticipated benefits. You you may suggest different methods for accomplishing needed improvements.

5. If you desire further information, contact Ms. Flanagan at 44646.

FOR THE INSPECTOR GENERAL:

Encl

JAMES A. PITTS
Colonel, IG
Acting Chief, Operations,
Plans and Analysis Division

CF: (w/d encl)

SAFM-FO	SARD-DE	SALL	DACS-DM	AMC (IR-A)
SAILE	SAAG-PRP	SAPA-PP	DALO-RMM	FORSCOM (FCCS-IR)
DAMO-ZXS	DAMO-ZXG	TRADOC (ATIR)	USASOC (AOIR)	

COMMAND COMMENTS
DEPARTMENT OF DEFENSE INSPECTOR GENERAL DRAFT REPORT
AUDIT OF THE SUPPRESSION SYSTEMS FOR THE
AH-1 HELICOPTER AND OV-1 AIRCRAFT, AND
THE AN/ALQ-144 JAMMER FOR HELICOPTERS
(Project No. OAL-8004) (AMC No. D9018)
(AVSCOM Project No. 04-1289-357)

Finding and Recommendation A--Threat Compared to System Requirements

Defensive infrared countermeasures systems were not always effectively employed to protect combat and combat support helicopters. This occurred because the Army did not always install missile detection systems, and the Navy and Marine Corps did not install suppression systems or upgrade existing Infrared Jammers. As a result, some combat and combat support helicopters could be exposed to infrared directed threat systems against which they have only limited effectiveness.

Additional Comments:

Comments are provided at enclosure 1.

Recommendation A-2.

We recommend that the Commander, U.S. Army Training and Doctrine Command (TRADOC), reevaluate the need for missile detection systems with automatic chaff and flare dispensers to release decoy devices and alert pilots to the presence of an imminent threat.

Action Taken:

We believe that TRADOC should nonconcur with the recommendation because of the very clear Army requirements that exist for infrared (IR) protection and the method by which the Army has implemented the appropriate IR protection suite. It is already very obvious to the Army what missile detection systems are needed and what platforms they are needed on. This is explained in more detail in the additional comments at enclosure 1.

Page 16 & 17, Missile Detection Systems

The overall description of missile detection systems implies that they are used in conjunction with both chaff and flares as well as being used to provide an alert to the pilot. This is not accurate. The Army was the first and only service to utilize missile detection systems on helicopters as part of an Infrared Countermeasures Suite. This was in the form of the AN/ALQ-156(V)1 system which was fielded on CH-47 helicopters in 1985. These same missile detectors, developed by the U.S. Army, were used on VIP aircraft operated by the Navy just prior to fielding to U.S. Army units.

The Army has found from extensive testing of chaff that utilization of a missile detector to dispense chaff is not effective. In order for chaff to be effective against radar threat systems it must be used to prevent track by the threat radar. This must be done before the missile is launched and therefore cannot be influenced by a missile detector. Additionally, the Army has found that chaff dispensing must be accompanied by maneuver based on Radar Warning indications for which the missile warning system can provide no useful information.

It should also be recognized that almost all IR missile firings take less than 6 seconds from launch to impact. Because of this extremely short time these is essentially no benefit to warn the pilot that a missile has been detected in flight. The missile detector must be set to automatically cue a flare at the appropriate time before impact to assure that the threat will be decoyed. If the time of dispensing and the direction of flare fire are not set to assure success without requiring maneuver the system is not properly designed and will not achieve maximum effectiveness.

Page 17, Army Implementation

This paragraph states that the Army did not install missile detectors on combat and combat support helicopters. This is not an accurate statement. As previously discussed the U.S. Army was the first and only service to install a missile detector on helicopters. In addition, to the AN/ALQ-156(V)1 which was installed on CH-47 aircraft beginning in 1985, the AN/ALQ-156(V)2 has been installed on all EH-60 aircraft.

The Army's decision to not put missile detectors on other helicopters was based on a combination of the mission performed by those helicopters and an analysis of the threat information. This analysis concluded, as these findings also conclude on page 15, that the use of infrared suppression or the combination of infrared suppression and the AN/ALQ-144A provide an effective countermeasure to all known threat systems. Therefore there is no requirement for missile detection on these helicopters.

The Army does recognize the need for a missile detection system in order to counter future projected threat systems. This is supported by development efforts for the Advanced Threat Infrared Countermeasures.

Page 18, Summary

Contrary to statements made in this summary, the Army does install missile detection systems in some helicopters today. There will be missile detection systems installed on MH-60K and MH-47E helicopters when delivered and the Army is currently embarking on a development program to develop an Infrared Countermeasures Suite for countering projected IR threats which will incorporate a missile detector. Additionally, it should be noted that the Air Force does not use missile detectors on its special operations helicopters and it has not purchased, although they have plans to purchase, AN/ALQ-144A jammers to replace their AN/ALQ-144 jammers. The Marine Corp and Navy currently have missile detectors installed only on limited numbers of CH-46 and SH-60 helicopters.

The statement made in this paragraph that the Army did use countermeasure systems that provided an adequate level of protection, seems to more accurately reflect the real situations rather than the conclusion drawn in the cover letter, executive summary and opening statements of these findings, that states that defensive infrared countermeasures were not always effectively employed.

COMMAND COMMENTS
DEPARTMENT OF DEFENSE INSPECTOR GENERAL DRAFT REPORT
AUDIT OF THE SUPPRESSION SYSTEMS FOR THE
AH-1 HELICOPTER AND OV-1 AIRCRAFT, AND
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(Project No. OAL-8004) (AMC No. D9018)
(AVSCOM Project No. 04-1289-357)

Finding and Recommendation B--Reliability of the AN/ALQ-144 Infrared Jammer

The AN/ALQ-144 Infrared Jammer experienced premature bearing failures. The bearing failures were caused by extended periods of disuse and the unit personnel's failure to adhere to recommended operation and maintenance procedures. As a result, the AN/ALQ-144 Infrared Jammer's reliability was severely degraded, which reduced the probability of mission success and increased aircraft vulnerability to infrared seeking threats.

Additional Comments:

None.

Recommendation B.

We recommend that the U. S. Army Deputy Chief of Staff for Operations and Plans (DCSOPS); and Commander, U. S. Air Force Logistics Command, issue supplemental guidance to ensure:

1. Operation and maintenance of AN/ALQ-144 Infrared Jammers according to the operation and maintenance procedures specified in TM 11-5865-200-12 or NAVAIR 16-35ALQ144-1.

2. Proper installation of the protective covers on the Infrared Jammers that are mounted on aircraft when the aircraft are not being operated.

Action Taken:

We believe that DCSOPS should concur with these recommendations. Implementation of the recommended actions was completed on 30 Sep 90 via a U.S. Army Communications and Electronics Command (CECOM) Supply and Maintenance Bulletin (Volume 16, No. 3, dated 30 Sep 90) issued to the field (enclosure 1). In addition to this corrective action there have been numerous advisory messages/discussions with aviation field units regarding proper

operation, maintenance, storage and shipping instructions for the ALQ-144A. In addition, during Operation Desert Shield and Desert Storm; weekly Aviation Corps level meetings were conducted with representatives from all aviation units present. It was emphasized many times during these meetings that the ALQ-144 IR Jammer had to be utilized, maintained, and covered in accordance with published technical manuals/maintenance manual procedures.

04/10/1991 12:54 CECOM Center for EWRSTA 201 544 3225 P.02

CECOM SUPPLY & MAINTENANCE BULLETIN

B16 MATERIEL MANAGEMENT DIRECTORATE
MAINTENANCE DIRECTORATE B16

vol. 16 no. 3 30 sept 1990

FAX: To Jerry Dettmer 3 Apr 91

From Projects

A small error was made in the ARIL which said all FIREFINDER unserviceables should go to TOBY when in all actuality they really should go to SAAD. SAAD and TOBY are only about 3000 miles apart so like I said only a small error. We are taking action to correct the next ARIL, but until the new one comes out, please refrain from shipping FIREFINDER unserviceables to TOBY. SACRAMENTO ARMY DEPOT is the place they should go.

POC Jane Sheridan DSN 992-4075

AN/TPX-46 V1-V6

In order to keep TOBY from feeling bad about having Jane take the FIREFINDER stuff away from them, Neal decided to let them take care of the Motor-Tachometer, NSN 6105-00-007-5758, part of the AN/TPX-46 V1-V6. Please send all your unserviceables to TOBY ASAP as Neal needs them to fill requisitions.

POC Neal D Reeves DSN 992-4075

AN/PPX-3,AN/GSX-1

TOBY's getting a lot of print today. They are doing a nice job on the AN/PPX-3 (A&E) Interrogators and the AN/GSX-1 (A) Programmers so we'd really like it if you'd ship any unserviceables you might have to TOBY real quick like.

After you turn in your unserviceables to TOBY, you are going to more than likely requisition a replacement. When you do, make sure you use TYPE REQUIREMENT CODE "26". The TRC of "26" indicates to Ellis and the rest of our folk that this is a replenishment demand and as such, you have first priority for release of equipment, providing we have stock on hand. Of course, if you don't use Type Requirement Code 26 like we've been telling you to these many years, it's liable to take many years before you get anything.

POC Ellis Mosely DSN 992-4076

AN/ALQ-144(V)

HELP, one more time. The Circuit Card Assembly, NSN 5865-01-087-3148, used on the AN/ALQ-144(V) Infrared Countermeasures Set, is in a critical backorder status, like lots and lots of them, because the returns of unserviceables has been extremely low. As we have pointed out a thousand times, when we depend on the return of unserviceables to supply your demands, we get big backorder lists when you don't turn them in. Send your unserviceable PCA's to Tobyhanna AD, SODAAC: W25G1W, M/F Condition Code "F".

POC William Spollen DSN 992-1560

IMPROVED HAWK

TOBY really is getting popular recently. Lori's been complaining that you haven't been returning your unserviceables that she needs for the Improved Hawk Program. Needless to say, she's not the only one having the same kind of problem. Root around in the bins or whatever and start sending in the following items to TOBY:

5895-00-165-1184 Receiver-Transmitter Group, OR-85/TPX-46(V)

5895-00-106-2877 Antenna, Radome, AS-2197A/TPX-46(V)

5895-00-350-5346 Synchronizer, Electrical SN-420/TPX-46(V)

5895-00-141-3606 Control, Antenna C-8736/TPX-46(V)

POC Lori Stanton DSN 992-4073/4

5

F. Q-144

In this one we shall rave and rant about both your packing procedures as well as a few maintenance type points of interest, so pay close attention because its your money and your skins.

When you have a Transmitter Assembly,T-1360(V)1/ALQ-144, NSN 5865-01-034-9117, that needs to be shipped to Tobyhanna (TOAD) for repairs, please be so good as to ship it in its Carry Can (shown in TM11-5865-200-12, pages 4-8 and 4-9) not in a cardboard box. When you use a cardboard box the Transmitter suffers a lot more additional damage with the resultant delay in getting it fixed. Toby also has to buy a new Carry Can to ship it back in and this in turn increases the cost of the repair program.

Now to shift gears a little. When the Transmitter is installed in a parked aircraft, it should be covered with its protective cover, NSN 5865-01-109-1800, as illustrated in TM11-5865-200-12, pages 3-11 and 3-12. This will prevent dust, grit, sand, and environmental debris from entering the Transmitter through the top air vent holes, causing premature / catastrophic bearing failures. Also, do not wash the aircraft without having the Transmitter covered or removing the Transmitter. Washing detergent is entering the Transmitter and causing extensive corrosion damage to the internal components, especially the gold plated modulators.

To extend bearing life and avoid premature bearing failures because the AN/ALQ-144 is not being turned 'on' by the operators during flight, the AN/ALQ-144 should be turned on and running during aircraft Pre-Flight.

POC William Spollen DSN 992-1560

GREMLINS AGAIN (TOOL KITS)

This is a friendly reminder that it is your responsibility to maintain your tool kits through replacement and/or requisition of broken tools on a component-by-component basis. In the event the tool kit should for some reason become excess, all components of the tool kit must be returned to the applicable depot. Depots have been reporting that many kits are being returned with a high percentage of missing components. Gremlins can account for a couple missing tools but something is wrong somewhere when you get over a 10 - 20 % loss.

POC Deborah Irland DSN 992-4166

JULIE'S JEWELS (OS-261/288)

I was desperate for a title, what other excuse can I use. The OS-288, Oscilloscope, NSN 6625-01-272-8054, LIN N32160, will supplement current assets of the OS-261 series of oscilloscopes. The OS-261 is no longer manufactured by Tektronix, however, the OS-261 will not be purged from the field. Tektronix will provide support for the item until 1998. The OS-288 will fill current backorder shortages. We expect to start filling OS-261 backorders in 1QFY91.

POC Julie Ann Palumbo DSN 992-4162

COMMAND COMMENTS
DEPARTMENT OF DEFENSE INSPECTOR GENERAL DRAFT REPORT
AUDIT OF THE SUPPRESSION SYSTEMS FOR THE
AH-1 HELICOPTER AND OV-1 AIRCRAFT, AND
THE AN/ALQ-144 JAMMER FOR HELICOPTERS
(Project No. OAL-8004) (AMC No. D9018)
(AVSCOM Project No. 04-1289-357)

Finding and Recommendations C--Operational Effectiveness.

Army military intelligence unit commanders did not install the Louvered Scarfed Shroud Suppression system on OV-1 Mohawk aircraft. Concerns stemming from suppression system induced buffeting, or aircraft vibration, at or near stall speeds coupled with the lack of stall warning instrumentation and incomplete flight manual documentation caused unit commanders to refrain from installing the suppression system. Further, pilots were not trained in flying the OV-1 configured with the Louvered Scarfed Shroud Suppression system. As a result, the aircraft were vulnerable to infrared seeking threats.

Additional Comments.

Reference page 28, paragraph titled: "Suppression System Problems." The following corrections and clarifications should be made.

-The date of the review was 14 Sep 89 instead of 21 Sep 89.

-Participants in the review included representatives from the following organizations:

Directorate for Engineering
Directorate for Maintenance
Special Electronics Mission Aircraft Project Management Office
Aircraft Survivability Equipment Project Management Office
Safety Office

-The conclusion that the buffeting characteristic from the Louvered Scarfed Shroud Suppression system did not pose a flight safety concern was caveated by the participants with a proposal

for unit training. The participants suggested that the Aviation Engineering Flight Activity provide training on the induced pre stall buffeting condition to units receiving OV-1 aircraft.

Recommendation C-1.

We recommend that the Assistant Secretary of the Army (Research, Development and Acquisition) (ASA (RDA)) restore funding to the OV-1 Mohawk program to reinstate the acquisition of a stall warning system.

Action Taken:

We believe that ASA (RDA) should nonconcur with Recommendation 1. We do not believe that restoration of Aircraft Procurement Appropriation (APA) and Operation and Maintenance, Army (OM&A) funding for the stall warning system by the DA, with the concurrence of HQ TRADOC, could take place until the FY 93 or FY 94 Program Objective Memorandum cycle. It would take another 12 to 14 months before retrofit kits would start to be delivered, and it would take at least 3 to 5 months to complete the retrofit. We do not think this would be cost effective, since the OV/RV-1D fleet will be completing retirement by FY 97.

Recommendation C-2.

We recommend that the Commander, U. S. Army Training and Doctrine Command:

a. Update OV-1 flight manuals to reflect operational differences covered by the Louvered Scarfed Shroud Suppression system.

b. Revise the OV-1 flight training program to include use of the Louvered Scarfed Shroud Suppression system on school aircraft.

Action Taken:

We believe that TRADOC should nonconcur with the first part of Recommendation 2. Operational information contained in TM 55-1510-213-10 Operators Manual concerning the LSSS has met with the approval of AVSCOM engineering from an airworthiness standpoint. To expound further on this issue, to provide additional data on the suppressed mode of operation over the complete flight regime will require additional performance flight testing at an estimated cost of $1 million and a 6-month

time frame to complete, with little to gain considering the flight testing done to date. At present there is no budget line for the OV/RV-1D Aircraft to undertake a project of this nature, nor would we consider it cost effective based on the retirement schedule for the OV/RV-1D aircraft.

3

SECTION III. ENGINES AND RELATED SYSTEMS

11. Engines.

The aircraft is powered by two T53-701 or T53-L-701A gas turbine engines (figure 2-22), turning three-bladed hydromatic propellers. No distinction is made between left and right installations. Refer to Chapter 5 for a description of the operating limitations.

NOTE

For the purpose of this manual, no distinction is made between the T53-L-701 and T53-L-701A engines.

The major systems of the engine are: the engine cooling and pressurization system, induction system, engine inlet anti-icing/deicing system, engine fuel control system, oil supply system, ignition system, and starting system.

12. Engine Cooling and Pressurization System.

Engine cooling and pressurization is provided by compressed air developed by the compressor rotor. The engine cooling system provides cooling air for internal engine components.

13. Induction System.

The induction system consists of the variable inlet guide vane system, the interstage airbleed system, and the infrared louvered scarfed shroud suppressor (IRLSSS) system.

a. Variable Inlet Guide Vane System. Variable inlet guide vanes change angle of incidence between inlet air and first compressor rotor blades to maintain airflow requirements of the compressor rotor assembly. From 0 to 80 percent N1 speed, the vanes are in a closed position. The vanes start to open at 80 percent N1 speed, and are fully open at 95 percent N1 speed at standard day conditions. At any steady state N1 speed between 80 and 95 percent at standard day conditions, the inlet guide vanes assume a constant position.

b. Interstage Airbleed System. To facilitate compressor rotor acceleration, an interstage airbleed system is provided. After the first stage of axial compression, a series of vent holes in the compressor housing allows air to bleed from the compressor section, enabling the compressor rotor to attain selected RPM faster.

c. Louvered Scarfed Shroud Suppressor (IR Suppressor) System. The IR suppressor system is a passive device installed in the nacelle of each engine. Its purpose is to decrease aircraft vulnerability to heat-seeking airborne missiles by reducing turbine engine exhaust infrared radiation. The IR suppressor interfaces with the engine firewall plenum, nacelle, and wing-mounted brackets. During engine operation, exhaust gases are diluted with ambient air before discharge to the atmosphere, thus lowering emitted infrared radiation. The system is installed in the form of a kit that can be removed, thus allowing conversion of the aircraft back to an unsuppressed configuration. It consists of three major assemblies: a ram air inlet, a louvered plug assembly, and a louvered scarfed shroud. These items replace the conventional engine shroud assembly, nacelle frames, and exterior skins. The ram air inlet directs cooling air into the exhaust gas flow path. Inlet air is simultaneously routed to the inner suppressor plug where it is also directed into the gas flow path via aft facing louvers. The mixture of ambient air and cooled exhaust gases is then routed overboard at the shroud exit. The system consists of no moving parts and requires no operation by the pilot.

2-14. Engine Inlet Anti-Icing/Deicing System.

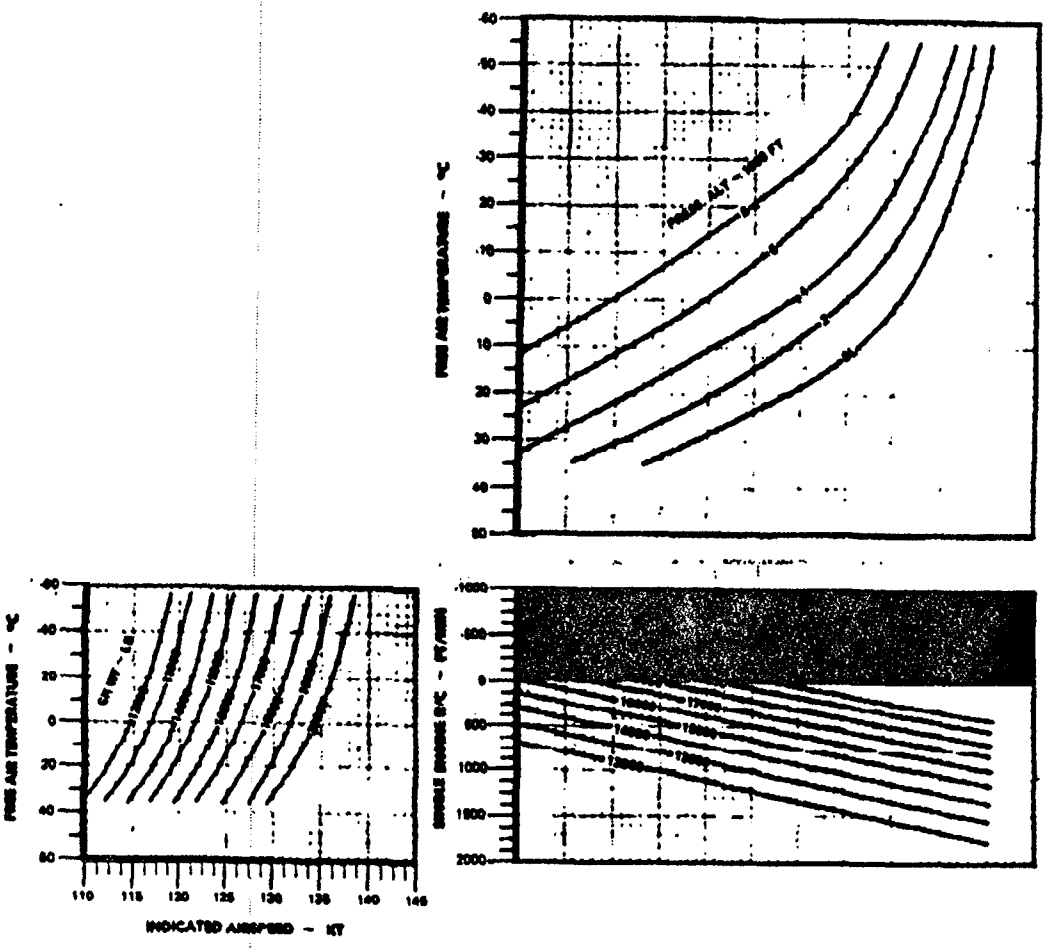
The engine inlet anti-icing/deicing system prevents ice formation in the engine inlet area by routing pressurized hot air from the engine air diffuser housing to the inlet housing. The flow of air is controlled by the normally closed hot-air solenoid valve. When anti-icing air is required, the valve is deenergized to open position by manually activating the ENGINE DE-ICING switch on the WEATHER CONTROL panel (figure 2-23) in the cockpit. In event of electrical power failure, the fail-safe, spring-loaded valve returns to the open position to provide continuous anti-icing air.

SINGLE ENGINE CLIMB

SINGLE ENGINE CLIMB OV 1D/RV 1D T53-L 701

CLIMB CONFIGURATION

GEAR UP FLAPS 0 DEGREES ALL STORES PROP FEATHERED POWER-MAX ALLOWABLE WITH LSSS IR SUPPRESSOR



DATA BASIS: DERIVED FROM FLIGHT TEST

7 1D-12-2

Figure 7-13. Single-Engine Climb (Flaps 0°/Gear Up) (Sheet 2 of 2)

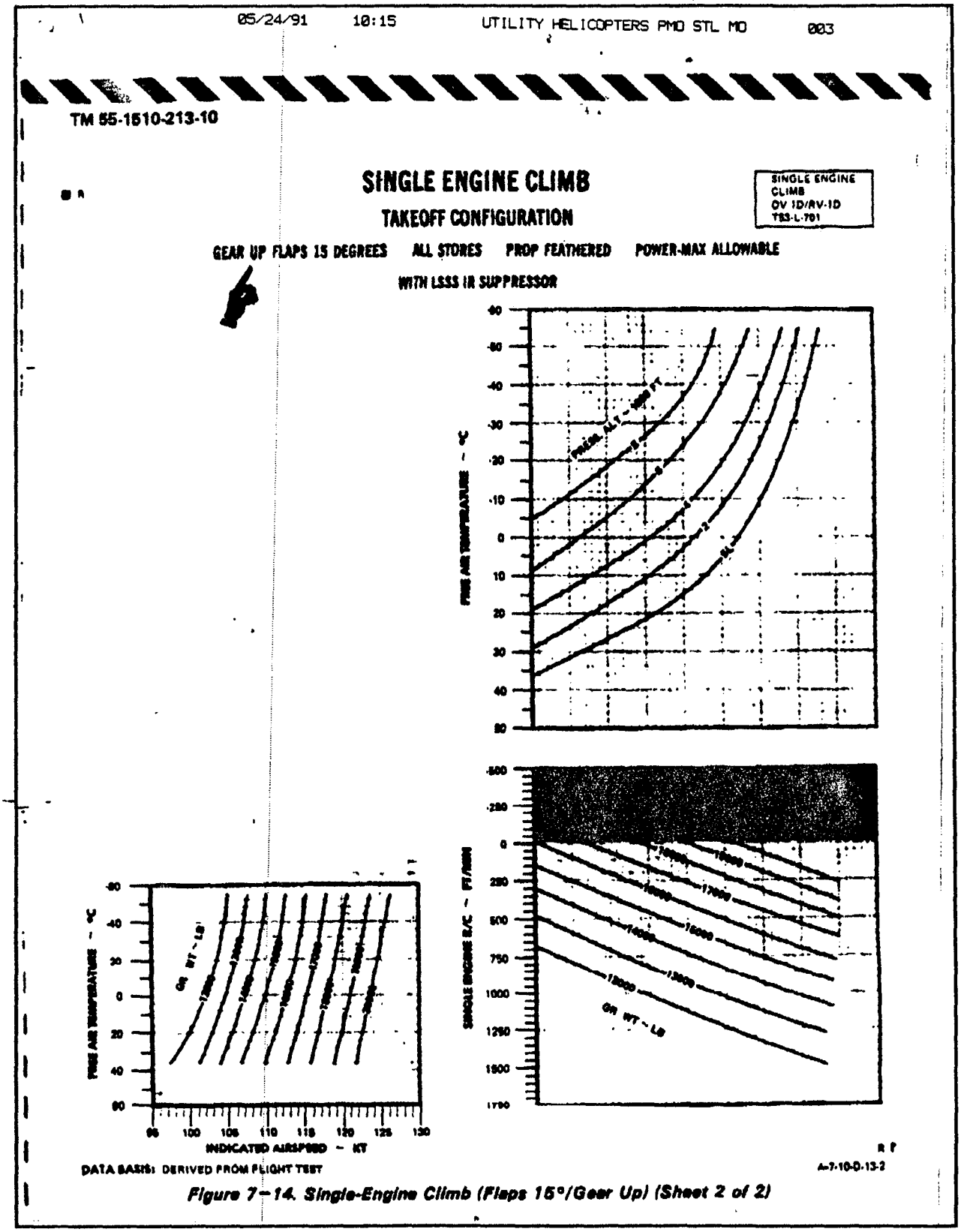


Figure 7-14. Single-Engine Climb (Flaps 15°/Gear Up) (Sheet 2 of 2)

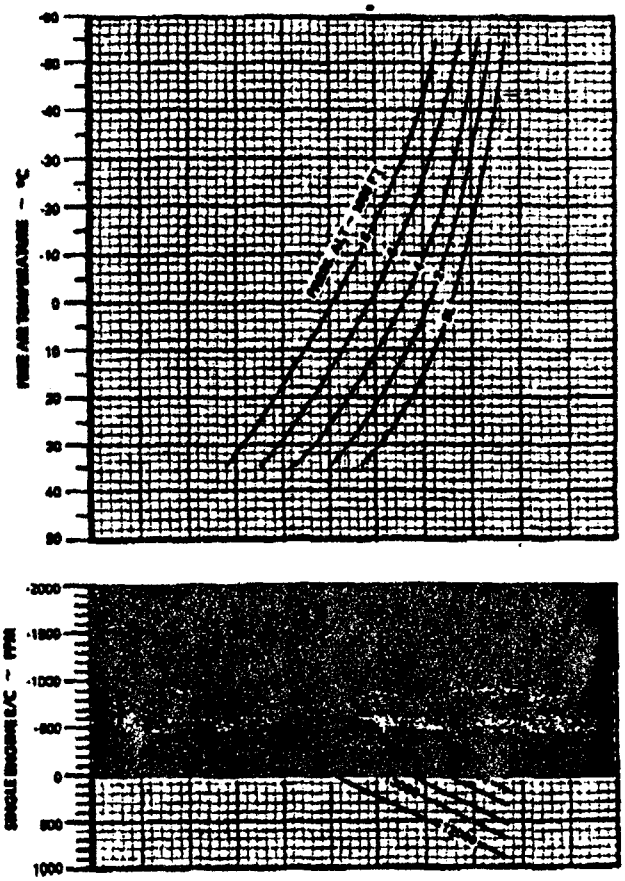
SINGLE ENGINE CLIMB

SINGLE ENGINE CLIMB OV-1D/RV-1D TS3-L-701

TAKEOFF CONFIGURATION AT TAKEOFF AIRSPEED

GEAR DOWN FLAPS 15 DEGREES ALL STORES PROP FEATHERED POWER-MAX ALLOWABLE WITH LSSS IR SUPPRESSOR

EXAMPLE XI – 1



WEIGHT – LB	IAS – KT OUT OF GROUND EFFECT
12000	87
13000	91
14000	96
15000	97
16000	101
17000	104
18000	107
19000	110
20000	112

DATA BASIS: DERIVED FROM FLIGHT TEST

7-10-D-14-2

Figure 7–16. Single-Engine Climb (Flaps Down, Gear Down) (Sheet 2 of 2).

CONTROL NO. 7-10-D-14-2 COLOR RED
POS. NO. REV. CH. INK
PAGE NO. FIG. NO. INSERT 2 of 2

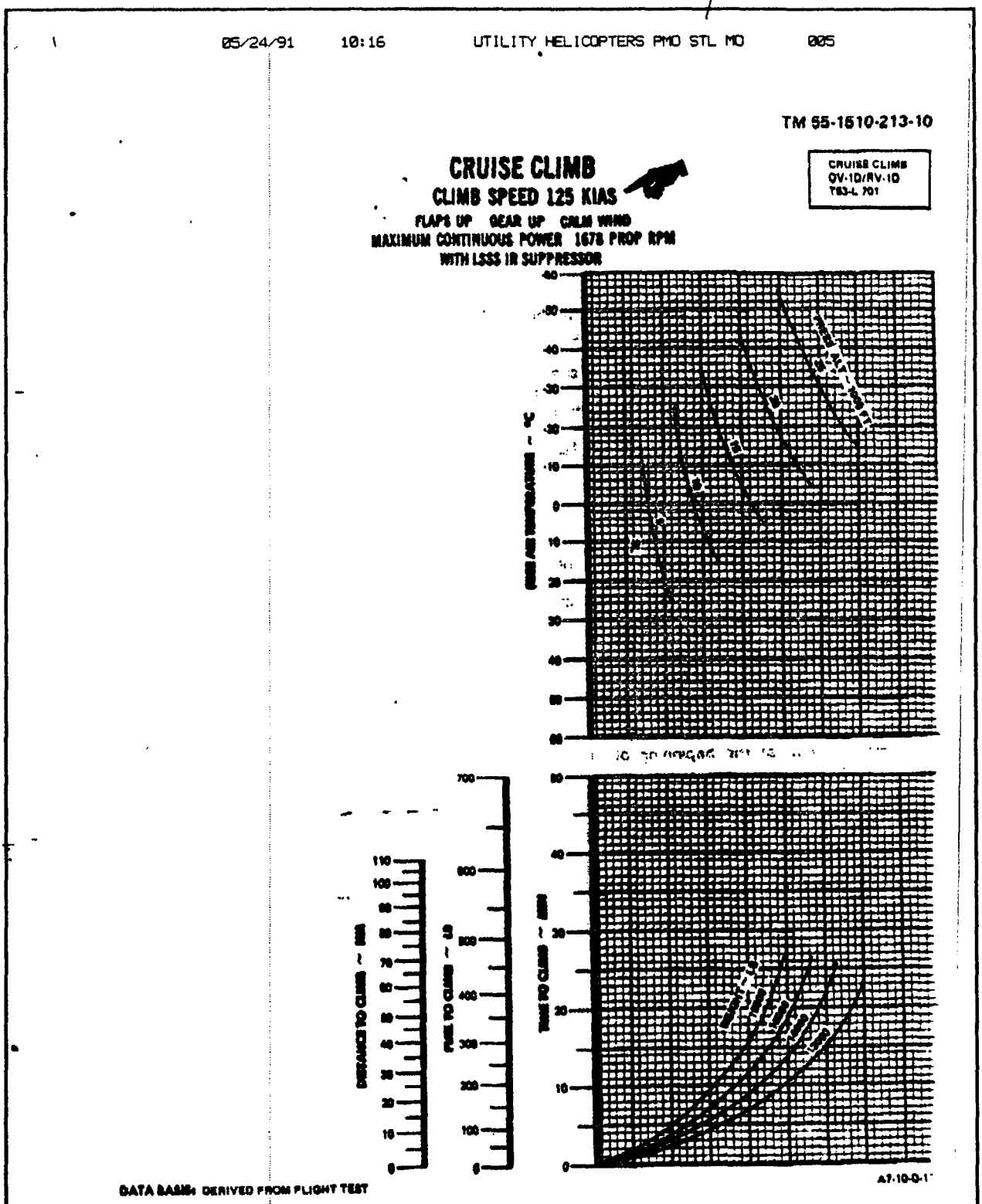


Figure 7-16. Cruise Climb (Sheet 2 of 2)

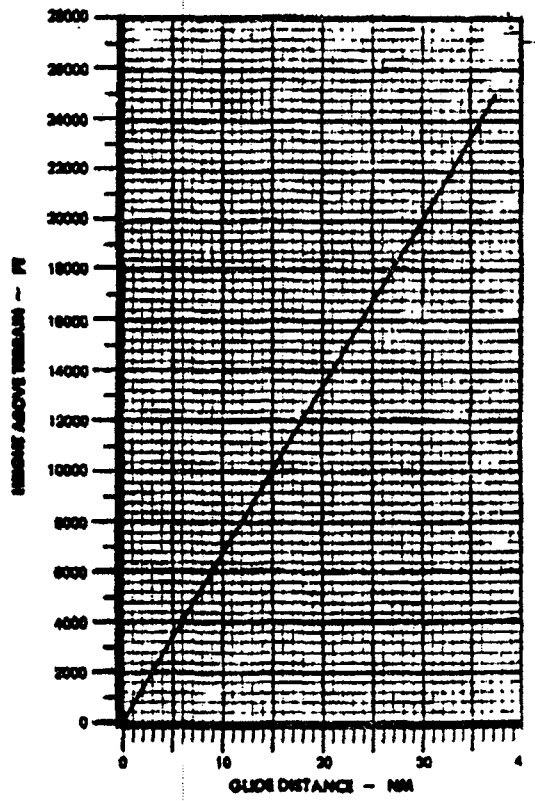
GLIDE DISTANCE

GLIDE DISTANCE
OV-1D/RV-1D
T53-L-701

FLAPS UP GEAR UP PROPS FEATHERED ALL STORES

WITH LSSS IR SUPPRESSOR

WEIGHT ~ LB	IAS ~ KT
18000	110
14000	119
10000	127
18000	136



DATA BASIS: ESTIMATED

9-10-D-3-2

Figure 9-3. Maximum Glide Distance (Sheet 2 of 2)

* U.S. GOVERNMENT PRINTING OFFICE: 1985-564-126/10105

Management Comments: Department of the Navy

THE ASSISTANT SECRETARY OF THE NAVY
(Research, Development and Acquisition)
WASHINGTON, D.C 20350-1000

MAY 24 1991

MEMORANDUM FOR THE DEPARTMENT OF DEFENSE ASSISTANT INSPECTOR GENERAL FOR AUDITING

Subj: DRAFT REPORT ON THE AUDIT OF SUPPRESSION SYSTEMS FOR THE AH-1G HELICOPTER, AND THE AN/ALQ-144 JAMMER FOR HELICOPTERS (PROJECT NO. 0AL-8004)

Ref: (a) DODIG memo of 20 Mar 91

Encl: (1) DON Response to Draft Audit Report No. 0AL-8004

In response to reference (a), Department of the Navy comments are provided in enclosure (1). The Navy has taken, or is planning to take, specific actions to ensure adequate management controls of similar systems in the future.

Gerald A. Cann

Copy to:
NAVINSGEN
NAVCOMPT (NCB-53)

Department of the Navy Response

to

DODIG Draft Report of March 20, 1991

Suppression Systems for the AH-1 Helicopter, and the AN/ALQ-144 Jammer for Helicopters Project No. OAL-8004

Finding A:

The Navy and Marine Corps did not install suppression systems or upgrade existing Infrared Jammers.

Recommendation A-1:

We recommend that the U.S. Navy Assistant Chief of Naval Operations (Air Warfare) install infrared suppression systems on combat and combat support helicopters to reduce the infrared signature and to increase the effectiveness of other countermeasures systems.

DON Position:

Concur with exceptions. Within real world budgetary constraints, the recommendation to install infrared suppressors on USMC/USN combat helicopters is valid and will be pursued. However, the requirement for suppressors (increased weight and reduced engine power) on USN combat support aircraft who face a greatly reduced threat is not justifiable. In this case, the defensive electronic countermeasure equipment already employed is adequate.

Recommendation A-2:

We recommend that the U.S. Navy Assistant Chief of Naval Operations (Air Warfare) upgrade the AN/ALQ-144 Infrared Jammers with the AN/ALQ-144A Infrared Countermeasures Set to provide adequate protection from the current infrared seeking threat.

DON Position:

Concur. The Navy is presently reviewing all programs in this area for applicability on Navy and Marine aircraft.

Finding B:

Unit personnel failed to adhere to recommended operation and maintenance procedures resulting in bearing failures caused by extended periods of system disuse and corrosion by not properly covering infrared jammers mounted on aircraft.

Enclosure (1)

Recommendation B-1:

We recommend that the U.S. Navy Assistant Chief of Naval Operations (Air Warfare) issue supplemental guidance to ensure operation and maintenance of the AN/ALQ-144 Infrared Jammers according to the operation and maintenance procedures specified in NAVAIR16-35ALQ144-1.

DON Position:

Nonconcur. Current directives in use adequately cover proper operation and maintenance of equipment. Fleet users utilize proper procedures to the greatest extent practicable and in accordance with published directives. Bearings on this system are historically replaced at 200 hours - excessive running of the system further accelerates replacement.

Recommendation B-2:

We recommend that the U.S. Navy Assistant Chief of Naval Operations (Air Warfare) issue supplemental guidance to ensure proper installation of the protective covers on the Infrared Jammers that are mounted on aircraft when the aircraft are not being operated.

DON Position:

Nonconcur. Current directives in use adequately cover proper installation of protective covers on the ALQ-144.

2

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