Audit Report

OFFICE OF THE INSPECTOR GENERAL

U.S. MARINE CORPS AIRCRAFT CORROSION PREVENTION AND CONTROL PROGRAM

Report No. 97-015

October 31, 1996

Department of Defense

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Acronyms

MOS	Military Occupational Specialty
SDLM	Standard Depot Level Maintenance

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

October 31, 1996

MEMORANDUM FOR ASSISTANT SECRETARY OF THE NAVY (FINANCIAL MANAGEMENT AND COMPTROLLER)

SUBJECT: Audit Report on U.S. Marine Corps Aircraft Corrosion Prevention and Control Program (Report No. 97-015)

We are providing this report for your review and comment. This report is the fourth in a series of reports that resulted from our DoD-wide Audit of Aircraft Paint Application and Removal Capabilities. We considered management comments on a draft of this report in preparing the final report.

DoD Directive 7650.3 requires that all recommendations and potential monetary benefits be resolved promptly. Although the Navy concurred with the audit recommendations, it did not provide completion dates for planned corrective actions. Therefore, we request that the Navy provide additional comments in response to the final report by January 10, 1997.

We appreciate the courtesies extended to the audit staff. Questions on the audit should be directed to Mr. John A. Gannon, Audit Program Director, at (703) 604-9427 (DSN 664-9427), or Mr. Gerald P. Montoya, Acting Audit Project Manager, at (703) 604-9430. See Appendix F for the report distribution. The audit team members are listed inside the back cover.

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Office of the Inspector General, DoD

Report No. 97-015 **October 31, 1996**
(Project No. 4LB-0027.04)

U.S. Marine Corps Aircraft Corrosion Prevention and Control Program

Executive Summary

Introduction. This report is the fourth in a series of reports that resulted from our DoD-wide Audit of Aircraft Paint Application and Removal Capabilities (Project No. 4LB-0027). Other reports discussed the repainting of the C-5 aircraft; construction of a plastic media blasting facility at Laughlin Air Force Base, Texas; and Air Force aircraft painting and corrosion control. All Marine Corps organizations responsible for aircraft maintenance are required to establish a comprehensive corrosion prevention and control program with trained personnel for the prevention, early detection, reporting, and repair of corrosion damage. Such a program requires a dedicated effort by all maintenance personnel to prevent corrosion before it starts. Those efforts will improve the operational readiness of aircraft and minimize costly repairs.

Audit Objectives. The primary audit objective for this phase of the DoD-wide audit was to evaluate the effectiveness of the Marine Corps Aircraft Corrosion Prevention and Control Program at the organizational level. We also evaluated the adequacy of the Marine Corps management control program as it applied to the primary audit objective.

Audit Results. Marine Corps squadrons can improve performance of aircraft corrosion control and preventive maintenance, including performing inspections and repairing corrosion damage in accordance with aircraft maintenance requirements. All 21 squadrons reviewed had incomplete inspection records, and of the inspections that had been performed, the Marine Corps did not perform 64 of 292 corrosion inspections within the required inspection frequency intervals. Further, as disclosed in depot inspection reports, organizational corrosion maintenance was inadequate for prevention of aircraft damage. As a result, Marine Corps aircraft depot repair costs related to corrosion damage increased by more than $49.4 million projected over the 6-year Future Years Defense Program. The costs may be avoided with improved corrosion control and preventive maintenance at the organizational level because it will minimize repairs at the depot. See Part I for a discussion of the audit results and Appendix D for a summary of potential benefits resulting from audit. We identified a material weakness related to the adequacy of aircraft corrosion inspections, staffing, and training of personnel in corrosion prevention and control (Appendix A).

Summary of Recommendations. We recommend that the Marine Corps reestablish an effective aircraft corrosion prevention and control program by using contractor support or providing sufficient personnel manning levels to perform corrosion control and preventive maintenance at the organizational level. If corrosion prevention and control is to be performed with military personnel, we recommend modifying existing military occupational specialties to include an additional skills identifier in aircraft corrosion prevention and control and assign personnel to those billets, and to implement a time-phase plan to train personnel to meet minimum corrosion control and preventive maintenance requirements.

Management Comments. The Navy concurred with the recommendations citing a number of possible solutions to carry out the recommendations. The long-range solutions it was considering were more manpower, induction of aircraft for rework when the aircraft reaches its service period end date, allocating more time for corrosion prevention and treatment, and more training. In the interim, contractors were supporting this effort through contracts awarded to wash aircraft at specific bases. The Navy did not agree with the projected $49.4 million in potential monetary benefits estimated in the audit. The Navy stated that historical trends show depot level repair costs increasing as the age of aircraft increases. Additionally, the Aircraft Service Period Adjustment (ASPA) Program increases the operating time before aircraft is inducted for depot rework. As a result, the Navy is faced with supporting aging aircraft that is not reworked for 5 to 7 years past the original service period end date. Therefore, the Navy would not support the projected cost savings. See Part I for a summary of management comments, and Part III for the complete text of management comments.

Audit Response. The Navy comments on the recommendations were partially responsive. Therefore, we request that the Navy provide a time-phased plan for implementing all planned corrective actions. While we agree with the Navy comments that historical trends indicate that depot level repair costs increase as the age of the aircraft increases, we considered the impact of age on aircraft when we estimated the monetary benefits. The monetary benefits projected are based on the Navy's own engineering estimates of depot rework costs that could have been saved if adequate preventive maintenance were performed at organizational level.

The ASPA program as a contributing factor for increasing depot costs is misleading because the intent of the ASPA program is to extend the aircraft service period; thereby, eliminating unnecessary depot rework and associated costs. However, the ASPA program was established under the premise that aircraft would receive adequate preventive maintenance at the organizational level to allow aircraft to remain in service longer. Instead, the Navy extended the aircraft service periods but adequate preventive maintenance did not occur. Based on our review, inadequate corrosion control and preventive maintenance at the organizational level were more of a factor in increasing rework costs than aging aircraft. We request that the Navy reconsiders its position and provide additional comments on the final report by January 10, 1997.

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Part I - Audit Results

Audit Background

All Marine Corps organizations responsible for aircraft maintenance are required to establish corrosion prevention and control programs. The type of program depends on the environment to which the aircraft may be exposed. At sea, where conditions are normally the most severe, aircraft are exposed to salt spray, ship stack gases, and aircraft engine exhaust. In other environments, land-based aircraft may be exposed to industrial gases, salts, rain, mud, and near salt water, mists containing sea salts. In accordance with Office of the Chief of Naval Operations Instruction 4790.2F, "Naval Aviation Maintenance Program," June 1995, a comprehensive corrosion prevention and control program includes either a corrosion control work center or corrosion control team with trained personnel for the prevention, early detection, reporting, and repair of corrosion damage. Such a program requires a dedicated effort by all maintenance personnel to prevent corrosion before it starts. Those efforts will improve the operational readiness of aircraft and minimize costly repairs.

To prevent corrosion, a constant cycle of cleaning, inspection, operational preservation, and lubrication must be followed. Preventive maintenance includes corrosion removal, paint removal, surface treatment, sealing, and painting. Prompt detection and removal of corrosion will limit the extent of damage to aircraft components.

Audit Objective

The primary objective for this phase of the DoD-wide audit was to evaluate the effectiveness of the Marine Corps Aircraft Corrosion Prevention and Control Program at the organizational level. We also evaluated the adequacy of the Marine Corps management control program as it applied to the primary audit objective. See Appendix A for a discussion of scope, methodology, and management control program and Appendix B for a discussion of prior audits and other reviews.

Corrosion Prevention and Control Program

Marine Corps squadrons can improve performance of aircraft corrosion control and preventive maintenance, including performing inspections and repairing corrosion damage in accordance with aircraft maintenance requirements. All 21 squadrons reviewed had incomplete inspection records, and of the inspections that had been performed, the Marine Corps did not perform 64 of 292 corrosion inspections within the required inspection frequency intervals. Further, as disclosed in depot inspection reports, organizational corrosion maintenance was inadequate for prevention of aircraft damage. Those conditions exist because commands did not provide emphasis needed to implement an effective program, including providing sufficient personnel trained to meet minimum requirements. As a result, Marine Corps aircraft depot repair costs related to corrosion damage increased by more than $49.4 million projected over the 6-year Future Years Defense Program. The costs may be avoided with improved corrosion control and preventive maintenance at the organizational level because it will minimize repairs at the depot.

Marine Corps Corrosion Prevention and Control Program Policy

Office of the Chief of Naval Operations Instruction 4790.2F, establishes the Navy and Marine Corps Corrosion Prevention and Control Program. The instruction requires that each command place special emphasis on the importance of the corrosion prevention and control program and ensure that corrosion prevention and control receives a priority for timely accomplishment, along with other required maintenance. Corrosion must be discovered and corrected by each level of maintenance in the very earliest stages of development. Detection and treatment of corrosion may reduce aircraft flight mishaps, flight related mishaps, excessive out-of-service time, and serious damage to the aircraft. It will increase operational readiness and reduce depot level maintenance costs.

Aircraft Corrosion Inspection Requirements. Naval Air Systems Command Technical Order 01-1A-509, "Aircraft Weapon Systems Cleaning and Corrosion Control," January 1, 1992, requires frequent corrosion inspections for an effective corrosion prevention and control program. Minimum frequency and the extent of those inspections have been established for each type of aircraft. Inspection intervals range from 28-day corrosion inspections for CH-46, CH-53, and UH-1N helicopters to 56-day corrosion inspection for AV-8 and KC-130 fixed wing aircraft. Additional inspections may be necessary in particularly corrosive environments, such as aboard ships at sea, and for aircraft structural areas that are particularly prone to corrosion.

Requirements for Repairing Corrosion Damage. Naval Air Systems Command Technical Order 01-01A-509 provides requirements for corrosion removal and treatment. When corrosion is detected, a specific and immediate program for corrective treatment is required. Each type of corrosion has its own peculiarities and requires special treatment. Complete treatment involves a thorough examination of all corroded areas, an evaluation of the corrosion damage, removal of paint and corrosion, an application of chemical surface treatments, sealing, and an application of paint finishes. By following those standards, damage to aircraft components will be minimized, therefore, reducing maintenance costs and improving readiness.

Corrosion Control and Preventive Maintenance

Marine Corps squadrons can improve performance of aircraft corrosion control and preventive maintenance, including performing inspections and repairing corrosion damage in accordance with aircraft maintenance requirements.

Squadron Corrosion Control Inspections and Preventive Maintenance. Squadron corrosion control inspection records were incomplete and inspections were not performed at required frequency intervals. Our review included aircraft corrosion control inspection records for AH-1, AV-8, CH-46, CH-53, KC-130, and UH-1N aircraft. We reviewed corrosion inspection records for the periods of October 1995 through May 1996 for 220 aircraft assigned to 21 of 83 active duty Marine Corps squadrons. Of the 220 aircraft corrosion inspection records, 163 were incomplete. The records did not show that aircraft corrosion inspections were being performed in accordance with maintenance requirements or that aircraft corrosion discrepancies were being identified and corrected. Each of the 21 squadrons had incomplete inspection records. Further, a review of corrosion inspections for the remaining 57 aircraft showed that 64 of 292 corrosion inspections were not performed within the required frequency intervals. Also, some inspection records that initially appeared complete were unreliable. According to maintenance personnel, while the inspections were recorded, corrective actions were not actually performed. Corrosion inspections are essential for performing preventive maintenance and discrepancies must be identified before preventive maintenance and other corrective action can occur.

Repair of Corrosion Damage. Based on depot inspection records, organizational corrosion maintenance was inadequate for prevention of aircraft damage. At our request, Naval Aviation Depot, Cherry Point analyzed records of aircraft inspections conducted at the organizational level and records of inspections of aircraft being inducted into depot for CH-46 and CH-53 standard depot level maintenance (SDLM). Depot inspectors noted that repair of corrosion damage to aircraft had not been performed at the organizational level. Inspectors further noted a significant increase in the number of corrosion discrepancies that squadrons were not repairing. Inspectors stated that it was routine to find aircraft discrepancies that were identified during an inspection performed 12 months earlier, but were not corrected at the organizational level.

CH-46 Depot Aircraft Repair Analysis. According to data provided by the Naval Aviation Depot, squadron level maintenance problems for CH-46 aircraft include corrosion and cracks that had been painted over and cracks filled using an unapproved repair compound resulting in nonstandard patches applied over corroded areas. Further in certain cases, metal frames had corroded beyond repair before the aircraft arrived at the depot for SDLM.

Review of CH-53 Corrosion Discrepancies. To determine the extent that aircraft corrosion discrepancies were not being repaired, we reviewed 252 aircraft inspection records for CH-53 helicopters. The aircraft inspections were conducted by depot inspectors at the organizational level as part of the Aircraft Service Period Adjustment program. Depot inspectors had identified 2,241 corrosion related discrepancies, such as surface corrosion of aircraft skin, exposed metal surfaces, corroded fasteners, panels, seams and other components. Each discrepancy identified by inspectors are coded as requiring a depot level repair or an organizational level repair. Of the 2,241 discrepancies, 1,933 should have been corrected at the organizational level. Aircraft corrosion discrepancies that are identified at the organizational level and go untreated increase damage to the aircraft.

CH-53 Material Condition Assessment. Concern over the material condition of the CH-53E aircraft had been raised as early as June 1995. A material condition assessment of 1st Marine Air Wing CH-53 aircraft showed that the aircraft was deteriorating faster than other aircraft in the fleet. The material condition assessment concluded that at the present rate of deterioration, the CH-53 aircraft would not reach its estimated operational service life of the year 2015. Although we did not perform a similar analysis of other Marine Corps aircraft, inspectors and depot planners confirmed that results of an analysis would be similar on other aircraft.

Prioritizing Corrosion Control and Preventive Maintenance

Commands did not provide emphasis needed to implement an effective corrosion prevention and control program, including providing sufficient personnel trained to meet minimum requirements.

Personnel Requirements for Effective Corrosion Prevention and Control. The Office of the Chief of Naval Operations Instruction 4790.2F requires that squadrons assigned seven or more aircraft, shore based in the continental United States, will establish a corrosion control work center at each squadron. The work center should be established under the aircraft division or a corrosion control team within the airframes branch. A minimum of eight personnel are required to be assigned to the corrosion control work center for squadrons that are assigned seven or more aircraft. A corrosion control work center should include:

o one aviation structural mechanic structures or aviation structural mechanic hydraulics, staff sergeant or equivalent military occupational specialty (MOS) and rank, qualified in corrosion control, assigned as work center supervisor.

o two aviation structural mechanic structures or aviation structural mechanic hydraulics, corporal or equivalent MOS and rank, qualified in corrosion control.

o two aviation structural mechanic structures or aviation structural mechanic hydraulics, lance corporal or equivalent MOS and rank, qualified in corrosion control.

o one of the following: aviation electricians mate; aviation electronics technician; or aviation antisubmarine warfare technician, corporal or equivalent MOS and rank.

o one aviation machinist mate, corporal or equivalent MOS and rank.

o one aviation ordinanceman, corporal or equivalent MOS and rank.

Further, all corrosion control work centers are required to have at least one qualified painter on staff. To meet this requirement, one of the above eight personnel assigned to a corrosion control work center would receive aircraft paint qualification training.

Number of Aircraft Versus Personnel Assignments. Marine Corps air squadrons did not comply with minimum personnel requirements needed for performing effective aircraft corrosion control and preventive maintenance. A review of 21 active duty Marine Corps squadrons showed that 17 squadrons did not meet minimum personnel requirements needed to perform effective corrosion control and preventive maintenance. A total of 392 aircraft were assigned to the 21 squadrons with a range of 9 to 30 aircraft assigned to individual squadrons. The average squadron reviewed had 19 aircraft assigned. Because all squadrons were assigned seven or more aircraft, each squadron should have established a corrosion control work center with a minimum of eight personnel assigned to the work center. The number of personnel assigned to each squadron ranged from 1 to 11 and the average squadron had 5 personnel, averaging 3 personnel short of the minimum requirement. (See Appendix C for a breakdown of the 21 squadrons reviewed.)

Impact of Downsizing. According to Marine Corps commanders, the military-wide reduction in the number of active duty personnel played a major role in the ability of the Marine Corps to cope with aircraft preventive maintenance. The Marine Corps has undergone a 33 percent reduction in force structure in the airframes division, which is typically where most of the personnel is drawn from to establish a corrosion control work center. In addition, worldwide operational commitments continue to increase further straining aircraft maintenance operations. Recognizing a need to alleviate some of the staff shortages, some squadrons had obtained contractor support to assist

in performing limited corrosion control and preventive maintenance. We believe that the use of contractor support for corrosion control and preventive maintenance can be increased.

Personnel Rotation. Another factor that contributed to the inability of the squadrons to fully staff their corrosion control work centers was the constant rotation of personnel assigned to perform corrosion control work. The Marine Corps did not have a dedicated military occupational specialty for corrosion control. Personnel were not permanently assigned to perform corrosion control. As a result, corrosion control work centers were made up of personnel temporarily assigned from various other job specialties. However, by modifying skill requirements of one or more existing military occupational specialties to include corrosion control and preventive maintenance, the Marine Corps would increase the number of personnel available for assignment to the corrosion control work centers.

Corrosion Prevention and Control Training. Marine Corps air squadrons personnel did not comply with minimum training requirements needed for performing effective aircraft corrosion control and preventive maintenance. Based on review of training records at the 21 active duty squadrons, 16 corrosion control supervisors had not completed the Naval Aviation Depot Course required by the Office of the Chief of Naval Operations Instruction 4790.2F. In addition, 8 of the 21 squadrons did not have a qualified painter in their corrosion control work center. (See Appendix C for a breakdown of the 21 squadrons reviewed.)

Training Requirements. The Office of the Chief of Naval Operations Instruction 4790.2F requires that all personnel engaged in aircraft, engine, component, or equipment maintenance complete one of the mandatory minimum corrosion control training courses administered by one of the following facilities.

- o Aviation rating specific "A" (basic aviation school)
- o Naval Air Maintenance Training Group, course C-600-3180 or C-100-4176
- o Naval Aviation Engineering Service Unit equivalent training

Corrosion Control Training for Supervisors. In addition to the above training requirements, the Office of the Chief of Naval Operations Instruction 4790.2F requires that corrosion control work center supervisors complete the Naval Aviation Depot Course N-701-0013 (Corrosion Control).

Paint Qualification Training. In accordance with the Office of the Chief of Naval Operations Instruction 4790.2F, to perform aircraft painting, individuals must complete the Naval Aviation Depot course N-701-0014 (Aircraft Paint Touch-up and Marking). Corrosion control work centers are required to have at least one qualified painter on staff.

Benefits From Improving Aircraft Corrosion Control and Preventive Maintenance

Marine Corps corrosion control and preventive maintenance were not fully effective in minimizing aircraft deterioration resulting from corrosion damage. Depot repair costs related to corrosion damage could increase by over $49.4 million for the CH-46 and UH-1N aircraft, projected over the 6-year Future Years Defense Program. We believe an additional $42 million in depot repair costs may be avoided for the CH-53 aircraft, but due to the small number of aircraft that were reviewed, these costs are not identified as potential monetary benefits. Increases in depot repair costs for these aircraft and the AV-8 and KC-130 aircraft may be avoided with improved preventive maintenance.

Aircraft Depot Rework Costs Increasing. According to the Naval Aviation Depot, Cherry Point and the Corpus Christi Army Depot, aircraft depot SDLM costs have steadily increased over the last 5 years.

CH-46 Corrosion Rework Requirements. The SDLM standard hours that are necessary to complete a CH-46 have steadily increased from 5,216 hours in FY 1990 to 6,171 hours in FY 1995. They are projected to increase to 8,621 hours by FY 1998. In 1993, 1,926 hours were added to the SDLM standard hours because of additional corrosion removal requirements alone. As a result, it will cost over $39.8 million in additional rework cost to repair corrosion damage projected over the 6-year Future Years Defense Program.*

UH-1N Rework Cost Overruns. The Corpus Christi Army Depot performs SDLM on UH-1N Marine Corps aircraft. At our request, Corpus Christi Army depot studied UH-1N rework cost data. The depot determined that the depot average cost overrun per aircraft is $646,300 per aircraft, of which $119,776 of the overrun dollars are for the repair of corrosion damage to aircraft. The depot estimates that for each aircraft that is reworked, $71,866 of the $119,776 (60 percent) is directly related to corrosion structural damage preventable at the organizational level. Projected over the Marine Corps UH-1N inventory of 79 aircraft and the 6-year Future Years Defense Program, the cost that may be avoided for the UH-1N aircraft exceeds $9.6 million.

CH-53 Rework Costs. The depots were revising aircraft rework specifications for other aircraft such as the CH-53. Depots revised their standard hours to reflect increased work requirements and hours necessary to complete aircraft SDLM, because of the material condition of aircraft that were inducted into the depots for a rework. They also revised SDLM specifications

*The $39.8 million is calculated by multiplying 1,926 by the average standard depot man hour rate, which equals the increased rework cost per aircraft. That amount is multiplied by the number of CH-46 aircraft in the Marine Corps fleet and multiplied by the SDLM frequency rate projected over 6 years. The offsetting costs to adequately staff the CH-46 corrosion control work centers are subtracted.

to reflect additional aircraft modifications being incorporated into aircraft. We reviewed SDLM hours for seven CH-53 aircraft completed during 1994 and 1995. The average cost overrun per aircraft was 3,227 hours for the aircraft reviewed. The depot estimated that 60 percent of the hours were directly related to aircraft corrosion damage preventable at the organizational level. Projected over the Marine Corps CH-53 inventory of 180 aircraft and projected over the 6-year Future Years Defense Program, the cost that may be avoided for the CH-53 aircraft is approximately $42 million.

AV-8 and KC-130 SDLM Costs. Although we were not able to obtain specific cost data for the AV-8 and KC-130 aircraft, they were also affected by inadequate preventive maintenance at the organizational level. As a result, we believe that additional depot repair costs may be avoided with adequate preventive corrosion maintenance at the organizational level.

Other Factors Contributing to Cost Overruns. Although many factors contributed to the increase in aircraft rework cost, all depots agreed that the lack of preventive maintenance at the organization level was a major contributor to the increased SDLM cost. Other contributing factors included the aging of the aircraft fleet; an increase in exposure to corrosive environments, such as salt water; aircraft in service for longer periods between SDLM visits; and the design of certain aircraft components, which were particularly prone to corrosion. However, all depots agreed that the effects of those other factors could be diminished with adequate corrosion control and preventive maintenance at the organizational squadron level.

Recommendations, Management Comments, and Audit Response

We recommend that the Commandant, Marine Corps, reestablish an effective aircraft corrosion prevention and control program by:

1. Using contractor support or providing sufficient personnel manning levels to perform corrosion control and preventive maintenance at the organizational level in accordance with the Office of the Chief of Naval Operations Instruction 4790.2F, "Naval Aviation Maintenance Program," June 1995. If corrosion prevention and control is to be performed with military personnel:

a. Modify existing military occupational specialties to include an additional skills identifier in aircraft corrosion prevention and control and assign personnel to those billets.

b. Determine the training provided to personnel in corrosion control and preventive maintenance and implement a time-phased plan to train personnel to meet minimum requirements as specified in Office of the Chief of Naval Operations Instruction 4790.2F.

Management Comments. The Navy concurred with the recommendations, citing a number of possible solutions to carry out the recommendations. The Navy was considering long-range solutions of more manpower, induction of aircraft for rework when the aircraft reaches its service period end date, allocating more time for corrosion prevention and treatment, and more training. In the interim, it was using contractors to support the corrosion prevention and control effort. For example, the Second Marine Aircraft Wing awarded aircraft wash contracts (aircraft washes are the keystone to an effective corrosion control and prevention program) and aircraft based in Iwakuni, Japan, used contractor support for aircraft washes. In addition, the Third Marine Aircraft Wing was in the process of obtaining contractor support for washing its aircraft.

Audit Response. The Navy comments were partially responsive. We request that the Navy provide a time-phased plan for implementing all planned corrective actions.

Management Comments on the Monetary Benefits and Audit Response

Management Comments. The Navy did not agree with the projected $49.4 million in potential monetary benefits estimated in the audit. The Navy stated that historical trends show depot level repair costs increasing as the age of aircraft increases. Additionally, the Aircraft Service Period Adjustment Program [the Program] increases the operating time before aircraft are inducted for depot rework. As a result, the Navy is faced with supporting aging aircraft that are not reworked for 5 to 7 years past the original service period end date. Therefore, the Navy would not support the projected cost savings identified in the audit.

Audit Response. While we agree with the Navy comments that historical trends indicate that depot level repair costs increase as the age of the aircraft increases, we considered the impact of age on aircraft when we estimated the monetary benefits. The monetary benefits were based on the Navy's engineering estimates of depot rework costs that could have been saved if adequate preventive maintenance were performed at the organizational level.

The Program as a contributing factor for increasing depot costs is misleading because the intent of the Program is to extend the aircraft service period; thereby, eliminating unnecessary depot rework and associated costs. However, the Program was established under the premise that aircraft would receive adequate preventive maintenance at the organizational level to allow aircraft to remain in service longer. Instead, the Navy extended the aircraft service periods without performing adequate preventive maintenance. Based on our review, inadequate corrosion control and preventive maintenance at the organizational level were more of a factor in increasing rework cost than aging aircraft. We request that the Navy reconsider its position and provide additional comments to the final report.

Part II - Additional Information

Appendix A. Audit Process

Scope

We reviewed policies and guidance on the Aircraft Corrosion Prevention and Control Program including the Office of the Chief of Naval Operations Instruction 4790.2F and Naval Air Systems Command Technical Order 01-1A-509. Additionally, we were provided aircraft corrosion damage analysis performed by Naval Aviation Depot, Cherry Point and Corpus Christi Army Depot. Those analysis were performed to determine the impact of inadequate organizational preventive maintenance on SDLM, Aircraft Service Period Adjustment program and associated cost.

Aircraft Corrosion Control Inspection Records. At 21 Marine Corps squadrons, we reviewed the aircraft corrosion inspection records for 220 of 392 aircraft for the periods of October 1995 through May 1996, to determine whether inspections were performed in accordance with Office of the Chief of Naval Operations Instruction 4790.2F.

Aircraft Service Period Adjustment Inspection Records. At Naval Aviation Depot, Cherry Point, we reviewed 252 aircraft service period adjustment inspection records for CH-53 aircraft inspections conducted from June 1991 through December 1995. The analysis covered 9,888 aircraft discrepancies, of which 2,241 discrepancies were corrosion related. We reviewed the records to determine the material condition of aircraft and the extent that organizational level discrepancies were being repaired.

Personnel Training Records. We reviewed the March through May 1996 training records for 105 military personnel assigned to corrosion control work centers at 21 squadrons to determine whether personnel received corrosion control and prevention training in accordance with the Office of the Chief of Naval Operations Instruction 4790.2F.

Use of Computer-Processed Data. To achieve the audit objective, we relied on computer-processed data contained in the Naval Air Logistics Command Maintenance Information System. Our review of system controls and the results of data tests showed an error rate that casts doubt on the validity of the data. However, when the data are reviewed in context with other available evidence, we believe the opinions, conclusions, and recommendations in this report are valid. Additionally, we used data provided by Information Spectrum Inc.,under contract to the Navy. We did not test the validity or system controls of the contractor systems. However, any unreliability on the data provided would not affect opinions, conclusions, and recommendations in this report.

Audit Period, Standards, and Locations. We performed this program results audit from February through May 1996, in accordance with auditing standards

issued by the Comptroller General of the United States, as implemented by the Inspector General, DoD. Accordingly, we included tests of management controls considered necessary. Appendix E lists the organizations we visited or contacted.

Methodology

We used nonstatistical sampling methods to select corrosion inspection records for review at each of the 21 Marine Corps squadrons. The selection criteria included, geographic location, squadron size, aircraft type, and other criteria in order to determine whether Marine Corps corrosion prevention and control policies and procedures were implemented consistently. Corrosion inspection records were not consistently recorded. As a result, we relied upon various sources of information to determine the adequacy of corrosion control inspections and preventive maintenance. We were provided aircraft corrosion repair data from Naval Aviation Depot, Cherry Point, and Corpus Christi Army Depot which included a comparative analysis of depot manhours, review of specific aircraft corrosion prone areas, engineering data, scheduled delays, manhour overruns, and excess expenditures. This data was supplemented with interviews of knowledgeable depot and squadron personnel. We also reviewed personnel training records for personnel assigned to corrosion control work centers at each squadron. Statistical sampling methods were not needed or applied.

Management Control Program

DoD Directive 5010.38, "Internal Management Control Program," April 14, 1987, requires DoD organizations to implement a comprehensive system of management controls that provides reasonable assurance that programs are operating as intended and to evaluate the adequacy of the controls.

Scope of Review of Management Control Programs. The audit evaluated management controls related to the aircraft corrosion control inspections at 21 Marine Corps squadrons. Specifically, we examined the management control procedures for corrosion control inspections in accordance with applicable Navy and Marine Corps guidance, policies, and procedures.

Adequacy of Management Controls. We identified a material management control weakness for the Marine Corps as defined by DoD Directive 5010.38. The Marine Corps management controls were not adequate to ensure that aircraft inspections and preventive maintenance were performed in accordance with aircraft maintenance requirements and that sufficient personnel were assigned and received required corrosion control training. All recommendations, if implemented, will improve procedures for ensuring that aircraft are inspected for early detection and prevention of corrosion damage

and that personnel are adequately trained in corrosion control. We identified potential monetary benefits of $49.4 million associated with the implementation of the recommendations. See Appendix D for a summary of potential benefits resulting from the audit. A copy of the report will be provided to the Navy senior management control official.

Adequacy of Management's Self-Evaluation. Marine Corps officials identified management and administration of the aircraft corrosion prevention and control program as an assessable unit. Marine Corps officials identified and reported the same material weaknesses identified by the audit; but did not develop a plan to correct those material weaknesses. Marine Corps officials stated that they did not take corrective action because of personnel and budget constraints.

Appendix B. Prior Audits and Other Reviews

During the last 5 years, the General Accounting Office and the Office of the Inspector General, DoD, each issued reports that discussed aircraft painting and corrosion control programs.

General Accounting Office

On July 19, 1994, the General Accounting Office issued a letter, B-257911, to the Chairman, House Subcommittee on Environment, Energy and Natural Resources, Committee on Government Operations. The letter indicated that the General Accounting Office had identified more than $24 million in potential reductions in the Air Force's FY 1995 programmed depot maintenance request. The General Accounting Office believed that the repaint requirements for the C-5 and C-141 aircraft were overstated by about $20.8 million and $3.5 million, respectively. The General Accounting Office made no recommendations in its letter.

Inspector General, DoD

The Inspector General, DoD, issued Report No. 96-062, "Air Force Aircraft Painting and Corrosion Control," January 24, 1996. The report stated that the Air Force major commands were painting aircraft primarily to improve aircraft appearance rather than to control and prevent corrosion. As a result, major commands incurred unnecessary expenses to paint 142 of 377 fighter and training aircraft more frequently than needed. They were also acquiring additional painting capacity even though existing Air Force facilities were not used to their maximum capacity. The Air Force can reduce costs of $16.1 million over the 6-year Future Years Defense Program by reducing the frequency with which aircraft are painted. Additional benefits savings may be realized through better utilization of existing painting facilities and by discontinuing the acquisition of new and unnecessary aircraft paint facilities. The report recommended that the Air Force reprogram funds for aircraft painting to other more pressing needs, direct a review of major command policies to ensure conformance with existing Air Force policy, place a moratorium on establishment of additional paint stripping and repainting facilities, make use of existing paint stripping and painting capacity before establishment of new capabilities, issue guidance to change aircraft painting cycles, and cancel plans for solicitation and award of a contract for stripping and painting of fighter aircraft. The Air Force concurred with the recommendation to reprogram funds identified for stripping and repainting aircraft to other more pressing Air Force needs. The Air Force concurred with the recommendation to direct a review of major command policies and initiated an Air Force-wide review of major command procedures. The Air Force partially concurred with the recommendation to place a moratorium on additional corrosion control facilities because consideration should be given to facilities that predate Environmental Protection Agency requirements.

The Air Force concurred with the recommendation to make use of existing paint stripping and painting capacity before pursuing contract support when it is more efficient to use organic resources. The Air Force concurred with the recommendations to change aircraft paint cycles by issuing guidance directing major commands to repaint aircraft based on the condition of aircraft.

The Inspector General, DoD, issued Report No. 95-183, "Construction of a Plastic Media Blasting Facility, Laughlin Air Force Base, Texas," May 3, 1995. The report stated that the Air Force was planning to construct a plastic media blasting facility at Laughlin Air Force Base to strip paint from aircraft even though existing Air Force facilities and equipment would accommodate the paint stripping work load. The report recommended that the Air Force terminate the planned construction of the plastic media blasting facility and the acquisition of related equipment for Laughlin Air Force Base and modify the paint stripping facility at Columbus Air Force Base, Mississippi, to accommodate the T-1 aircraft at the field level. The Air Force concurred with the recommendation to terminate the planned construction of the plastic media blasting facility and acquisition of related equipment for Laughlin Air Force Base, and to modify the paint stripping facility at Columbus Air Force Base to accommodate the T-1 aircraft. The Air Force partially concurred with the recommendation to discontinue plans to strip paint from F-15 and F-16 aircraft at the organizational level. It agreed to discontinue paint stripping of the F-15, but stated that it plans to continue stripping and repainting of F-16 aircraft at the field level because of the considerably less cost at the field level. The Air Force performed a study to validate costs associated with stripping and repainting F-16 aircraft. This issue was resolved when the Air Force implemented controls to ensure that F-16 aircraft are not painted unnecessarily.

The Inspector General, DoD, issued Report No. 94-198, "Quick-Reaction Report on Repainting of the C-5 Aircraft," September 29, 1994. The report stated that the Air Force was repainting C-5 aircraft ahead of their repainting service intervals even though the aircraft did not need repainting. By repainting C-5 aircraft prematurely, the Air Force was incurring unnecessary costs of approximately $59.3 million over the 6-year Future Years Defense Program. The report recommended that the Air Force suspend the accelerated painting of C-5 aircraft and paint only those aircraft that qualified for repainting. The Air Force concurred with the finding and recommendation and discontinued unnecessary painting of the C-5 aircraft. The Air Force implemented repainting guidelines to eliminate unnecessary painting.

Appendix C. Compliance with Staffing and Training Requirements

Squadron	Location	Type	Number of Aircraft	Number of Personnel	Qualified Painter	Sup.[1] Course
HMH-361	Tustin, CA	CH-53	12	3	No	No
HMH-461	New River, NC	CH-53	13	1	No	No
HMH-462	Tustin, CA	CH-53	15	3	No	No
HMH-464	New River, NC	CH-53	19	5	Yes	No
HMLA-169	Pendleton, CA	UH-1	26	5	Yes	Yes
HMLA-267	Pendleton, CA	UH-1	26	8	Yes	No
HMLA-269	New River, NC	UH-1	23	5	No	No
HMLA-369	Pendleton, CA	UH-1	26	6	Yes	No
HMM-364[2]	Pendleton, CA	CH-46	20	3	No	No
HMM-365	Cherry Pt., NC	CH-46	13	4	No	No
HMN-263	New River, NC	CH-53	14	1	Yes	No
HMT-303	Pendleton, CA	UH-1	30	8	Yes	No
VMA-203	Cherry Pt.[3], NC	AV-8	26	11	Yes	Yes
VMA-211[2]	Yuma, AZ	AV-8	20	3	Yes	No
VMA-214	Yuma, AZ	AV-8	21	9	Yes	No
VMA-223	Cherry Pt., NC	AV-8	20	7	Yes	Yes
VMA-231	Cherry Pt., NC	AV-8	20	6	Yes	No
VMA-311	Yuma, AZ	AV-8	14	3	No	No
VMA-542	Cherry Pt., NC	AV-8	11	2	No	No
VMGR-252	Cherry Pt., NC	KC-130	14	6	Yes	Yes
VMGRT-253	Cherry Pt., NC	KC-130	9	6	Yes	Yes

[1]This column represents whether the corrosion control supervisor (Sup.) has taken the required naval aviation depot course.

[2]These squadrons were visited at the Air Ground Support Element, Twenty-Nine Palms, CA.

[3]Cherry Pt. - Cherry Point

The Office of the Chief of Naval Operations Instruction 4790.2F requires a minimum of eight personnel for a corrosion control work center assigned seven or more aircraft, requires a qualified painter and requires the work center supervisor to complete the Naval Aviation Fleet Corrosion Control School training course.

Of the 21 squadrons reviewed, 17 (81 percent) did not have the minimum number of 8 personnel. In addition, 6 (38 percent) squadrons did not have a qualified painter assigned to their corrosion control work center and 16 (76 percent) corrosion control supervisors had not completed the Naval Aviation Depot Course.

Appendix D. Summary of Potential Monetary Benefits Resulting From Audit

Recommendation Reference	Description of Benefit	Amount and Type of Benefit
1.	Economy and Efficiency. Provides adequate resources to perform corrosion control inspections and preventive maintenance.	Funds put to better use. Reducing SDLM costs at the depot may result in $49.4 million put to better use in the Navy Operations and Maintenance Account, 50 during the 6-year Future Years Defense Program.
1.a.	Management Controls. Improves corrosion control work center performance for corrosion control and preventive maintenance.	Benefits included in Recommendation 1.
1.b.	Economy and Efficiency. Increases the efficiency and effectiveness of corrosion control and preventive maintenance.	Benefits included in Recommendation 1.

Appendix E. Organizations Visited or Contacted

Department of the Army

Corpus Christi Army Depot, Corpus Christi, TX

Department of the Navy

Naval Air Maintenance Office, Patuxent River, MD
Naval Aviation Depot, Cherry Point, NC
Naval Aviation Depot, North Island, CA
Naval Air Station, Miramar, CA

Marine Corps

2nd Marine Aircraft Wing, Cherry Point, NC
- Marine Corps Air Station, Cherry Point, NC
- Marine Corps Air Station, New River, NC

3rd Marine Aircraft Wing, El Toro, CA
- Marine Corps Air-Ground Support Element, Twenty-Nine Palms, CA
- Marine Corps Air Station, Camp Pendleton, CA
- Marine Corps Air Station, Tustin, CA
- Marine Corps Air Station, Yuma, AZ

Contractors

Capstone Corporation, Lexington Park, MD
Information Spectrum Inc., Havelock, NC

Appendix F. Report Distribution

Office of the Secretary of Defense

Under Secretary of Defense (Comptroller)
  Deputy Chief Financial Officer
  Deputy Comptroller (Program/Budget)
Deputy Under Secretary of Defense (Logistics)
Assistant to the Secretary of Defense (Public Affairs)
Director, Defense Logistics Studies Information Exchange

Department of the Army

Auditor General, Department of the Army

Department of the Navy

Assistant Secretary of the Navy (Financial Management and Comptroller)
Auditor General, Department of the Navy
Commander, Naval Air Systems Command

Marine Corps

Commandant, U.S. Marine Corps

Department of the Air Force

Assistant Secretary of the Air Force (Financial Management and Comptroller)
Auditor General, Department of the Air Force

Other Defense Organizations

Director, Defense Contract Audit Agency
Director, Defense Logistics Agency
Director, National Security Agency
  Inspector General, National Security Agency
Inspector General, Defense Intelligence Agency

Non-Defense Federal Organizations and Individuals

Office of Management and Budget
General Accounting Office
National Security and International Affairs Division
Technical Information Center

Chairman and ranking minority member of each of the following congressional committees and subcommittees:

Senate Committee on Appropriations
Senate Subcommittee on Defense, Committee on Appropriations
Senate Committee on Armed Services
Senate Committee on Governmental Affairs
House Committee on Appropriations
House Subcommittee on National Security, Committee on Appropriations
House Committee on Government Reform and Oversight
House Subcommittee on National Security, International Affairs, and Criminal Justice, Committee on Government Reform and Oversight
House Committee on National Security

Part III - Management Comments

Department of the Navy Comments

DEPARTMENT OF THE NAVY
OFFICE OF THE ASSISTANT SECRETARY
RESEARCH, DEVELOPMENT AND ACQUISITION
1000 NAVY PENTAGON
WASHINGTON DC 20350-1000

SEP 10 1996

MEMORANDUM FOR THE DEPARTMENT OF DEFENSE ASSISTANT INSPECTOR GENERAL FOR AUDITING

Subj: AUDIT REPORT ON U.S. MARINE CORPS AIRCRAFT CORROSION PREVENTION AND CONTROL PROGRAM (PROJECT 4LB-0027.04)

Ref: (a) DODIG memo dtd 3 Jul 96

Encl: (1) DON comments

The reference transmitted the draft of the subject audit report. The Department of the Navy comments are provided at enclosure (1).

The response generally concurs with the audit report findings and recommendations with the exception of the value of the projected savings.

M. P. Sullivan
Rear Admiral, SC, USN
Principal Deputy

Copy to:
NAVINSGEN (02)
FMO-31
CMC(RFR)

DON COMMENTS
ON
DODIG DRAFT AUDIT REPORT
ON
MARINE CORPS AIRCRAFT CORROSION
PREVENTION AND CONTROL PROGRAM
PROJECT 4LB-0027.04

FINDING: The auditors reviewed aircraft corrosion control and preventive maintenance at Marine Corps aircraft squadrons, and found that all 21 squadrons reviewed had incomplete inspection records, and of the inspections that had been performed, the Marine Corps did not perform 64 of 292 corrosion inspections within the required inspection frequency intervals. The auditors concluded that aircraft depot repair costs related to corrosion damage increased by more than $49.4 million projected over the 6-year Future Years Defense Program.

DON RESPONSE: Generally concur. The reduction in force structure, aging aircraft, and longer intervals between depot rework result in a greater probability for corrosion problems to occur. Add fleet operational requirements to this equation and it becomes evident why corrosion problems have increased. The audit emphasizes the importance of reexamining and refining the Marine Corps corrosion prevention and control program.

The DON does not, however, support the projected $49.4M savings estimated in the audit. Historical trends indicate that depot level repair costs increase as the age of aircraft increases (the average age of the CH-46E is 28 years; CH-53E is 25.9 years; the UH-1N is 22 years). Additionally, the Aircraft Service Period Adjustment (ASPA) Program increases the operating time period before aircraft are inducted for rework. In other words, the fleet is faced with supporting aging aircraft that are not reworked for periods of 5-7 years past the original Period End Date (PED). Therefore, it is difficult to support the projection that a cost savings can be identified. Aging aircraft cost significantly more to support.

RECOMMENDATION: "We recommend that the Commandant, Marine Corps reestablish an effective aircraft corrosion prevention and control program by:

"1. Using contractor support or providing sufficient personnel manning levels to perform corrosion control and preventive maintenance at the organizational level in accordance with the the Office of the Chief of Naval Operations Instruction 4790.2F, 'Naval Aviation Maintenance Program,' June 1995. If corrosion prevention and control is to be performed with military personnel:

"a. Modify existing military occupational specialties to include an additional skills identifier in aircraft corrosion prevention and control and assign personnel to those billets.

"b. Determine the training provided to personnel in corrosion control and preventive maintenance and implement a time-phased plan to train personnel to meet minimum requirements as specified in Office of the Chief of Naval Operations Instruction 4790.2F"

DON RESPONSE: Concur. There are a number of possible solutions: more manpower, induction of aircraft for rework at the end of the aircraft PED (i.e. eliminate ASPA deferrals), allocating more time for corrosion prevention/treatment, and more training. These are long-term solutions and are being considered. In the interim, contractor support is being, and will continue to be, used. The Second Marine Aircraft Wing has aircraft wash contracts (aircraft washes are the keystone to an effective corrosion control and prevention program). Aircraft based in Iwakuni, Japan also use contractor support for aircraft washes. The Third Marine Aircraft Wing is in the process of obtaining contractor support for washing its aircraft.

Audit Team Members

This report was prepared by the Logistics Support Directorate, Office of the Assistant Inspector General for Auditing, DoD.

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