United States Government Accountability Office

Report to Congressional Requesters

September 2013

DEFENSE MANAGEMENT

DOD Should Enhance Oversight of Equipment-Related Corrosion Projects

DEFENSE MANAGEMENT

DOD Should Enhance Oversight of Equipment-Related Corrosion Projects

Why GAO Did This Study

According to DOD, corrosion can significantly affect the cost of equipment maintenance and expected service life of equipment. Corrosion affects military readiness by taking critical systems out of action and creating safety hazards. GAO was asked to review DOD's military-equipment corrosion-prevention and mitigation projects. In this report, GAO addressed the extent to which DOD has (1) ensured the submission of required reports for equipment-related corrosion projects; (2) collected the information needed to determine whether benefits and other measures have been achieved from equipment-related corrosion projects; (3) tracked the status of equipment-related corrosion projects; and (4) identified, shared, and incorporated lessons learned from equipment-related corrosion projects into future planning to prevent or mitigate corrosion. To conduct this work, GAO reviewed DOD policies and plans and met with DOD corrosion officials.

What GAO Recommends

GAO recommends four actions to improve the oversight of DOD's corrosion-prevention and control program. DOD concurred with two recommendations, partially concurred with one, and did not concur with one. DOD plans to develop a database to collect data and lessons learned on corrosion projects and to revise guidance on how to report the ROI for discontinued projects. DOD did not agree that guidance should be revised to ensure military departments consistently report projects' benefits. GAO maintains that this recommendation is warranted for project oversight.

View GAO-13-661. For more information, contact Zina Merritt at (202) 512-5257 or merrittz@gao.gov.

What GAO Found

The Department of Defense (DOD) has invested more than $63 million in 88 projects in fiscal years 2005 through 2010 to demonstrate new technology or methods addressing equipment-related corrosion. DOD's Office of Corrosion Policy and Oversight (Corrosion Office) has collected a majority of required final and follow-on reports on the results of equipment-related corrosion projects and is taking steps to obtain outstanding reports. As of May 2013, GAO found project managers had submitted final reports for 55 of the 88 projects (about 63 percent) funded in fiscal years 2005 through 2010 and submitted follow-on reports for 27 of the 41 projects (about 66 percent) funded from 2005 through 2007.

DOD requires the military departments to collect and report to the Corrosion Office key information from equipment-related corrosion projects about new technologies or methods; however, DOD does not have complete information about the benefits of all projects. GAO found that the military departments inconsistently reported measures of achievement other than the return on investment (ROI), such as when outcomes prompted changes to military equipment specifications. Further, the military departments did not always collect required information needed to recompute the estimated ROI and were unable to determine whether projects had achieved their estimated ROI. Corrosion Office officials plan to revise guidance on how project managers should be reassessing the ROI. Without specific guidance to require that follow-on reports include details of measures of achievement other than ROI, the Corrosion Office will be missing the opportunity to know whether equipment-related corrosion projects have achieved outcomes to prevent corrosion.

DOD has taken steps to improve oversight of its equipment-related corrosion projects, such as revising its *DOD Corrosion Prevention and Mitigation Strategic Plan* to provide additional guidance on reporting requirements. However, DOD does not have a comprehensive overview of the status of all equipment-related corrosion projects. While the reports provide the status for each project, GAO found that the Corrosion Office does not consolidate information to monitor the status of all these projects, such as if a project has not transitioned to service use or has been discontinued. Further, GAO found that project managers vary in how they reported the ROI for discontinued projects. Without a mechanism to consolidate projects' status to facilitate monitoring and guidance for reporting ROIs for discontinued projects, the Corrosion Office and the military departments may not have timely information of whether the corrosion projects produced proven methods and products to prevent the corrosion of military equipment.

DOD has identified and incorporated lessons learned from equipment-related corrosion projects and shared some lessons with the corrosion community; however, DOD has no centralized and secure database or other source to share lessons from all project reports, including those with sensitive information. While DOD has begun to develop a database that would contain lessons learned on all projects, development is in the early stages, and DOD is unsure when it will be completed. Until a comprehensive, centralized, and secure database is developed that includes lessons learned from all completed projects, officials from DOD's corrosion community will not have full and complete information on lessons learned, including proven methods or products to prevent or mitigate corrosion of military equipment.

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Abbreviations

Corrosion Executive	Corrosion Control and Prevention Executive
Corrosion Office	Office of Corrosion Policy and Oversight
DOD	Department of Defense
DTIC	Defense Technical Information Center
ERDM2	Engineering Resource Data Management
FY	fiscal year
MRAP	Mine Resistant Ambush Protected (vehicle system)
ROI	return on investment

GAO

U.S. GOVERNMENT ACCOUNTABILITY OFFICE

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September 9, 2013

The Honorable Robert J. Wittman
Chairman
The Honorable Madeleine Z. Bordallo
Ranking Member
Subcommittee on Readiness
Committee on Armed Services
House of Representatives

The Honorable J. Randy Forbes
House of Representatives

In 2013, the Department of Defense (DOD) reported that the estimated cost of corrosion was about $20.8 billion[1] annually to prevent and mitigate corrosion of all of its assets, including military equipment and weapons, and facilities and other infrastructure.[2] The vast majority of these costs, approximately $19 billion, are related to corrosion issues on military equipment and weapons.[3] Corrosion is defined in Section 2228 of Title 10 of the United States Code as the deterioration of a material or its properties due to a reaction of that material with its chemical environment.[4] Corrosion affects military readiness by taking critical systems out of action and creating safety hazards. DOD funds military demonstration projects for both military equipment and infrastructure to identify new technologies or methods to prevent or mitigate corrosion.

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[1]This cost estimate, which was produced by a DOD contractor, LMI, and is based on data from fiscal years 2006 through 2010, is the latest estimate available on DOD corrosion costs.

[2]Infrastructure is defined in Section 2228 of Title 10 of the United States Code as all buildings, structures, airfields, port facilities, surface and subterranean utility systems, heating and cooling systems, fuel tanks, pavements, and bridges.

[3]In May 2013, GAO reported that DOD estimated the cost of corrosion at DOD facilities and other infrastructure to be about $1.9 billion annually. See GAO, *Defense Infrastructure: DOD Should Improve Reporting and Communication on Its Corrosion Prevention and Control Activities*, GAO-13-270 (Washington, D.C.: May 31, 2013).

[4]Corrosion takes varied forms such as rusting; pitting; galvanic reaction; calcium or other mineral buildup; degradation due to ultraviolet light exposure; and mold, mildew, or other organic decay.

Military equipment includes all weapon systems, weapon platforms, vehicles, and munitions of DOD and the components of such items.

Congress has taken a series of legislative actions aimed at enhancing DOD's ability to effectively address corrosion prevention and mitigation and provide Congress with greater transparency over the department's efforts. In 2002, Congress passed legislation that led to the creation of the Office of Corrosion Policy and Oversight (hereafter referred to as the Corrosion Office) within the Office of the Under Secretary of Defense for Acquisition, Technology and Logistics. The Corrosion Office is responsible for the prevention and mitigation of corrosion of military equipment and infrastructure.[5] Among other things, Section 2228 of Title 10 of the United States Code requires the Secretary of Defense to develop and implement a long-term strategy to reduce corrosion and the effects of corrosion on the military equipment and infrastructure of the department, including, among other things, (1) uniform application of requirements and criteria for testing and certifying new technologies for equipment and infrastructure with similar characteristics, missions, or operating environments; (2) implementation of programs to ensure a focused and coordinated approach to collect, review, validate, and distribute information on proven corrosion-prevention methods and products; and (3) establishment of a coordinated research and development program for the prevention and mitigation of corrosion for new and existing military equipment and infrastructure that includes a plan to transition new corrosion-prevention technologies into operational systems. Additionally, the statute requires the Secretary of Defense to annually submit, along with the defense budget materials, a report to Congress on corrosion funding, including funding requirements for the long-term strategy, and including the returns on investment (ROI)[6] for corrosion-control demonstration projects.

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[5]The Bob Stump National Defense Authorization Act for Fiscal Year 2003 required the Secretary of Defense to designate an officer, employee, board, or committee as the individual or office with this responsibility. See Pub. L. No. 107-314, § 1067 (2002) (codified at 10 U.S.C. § 2228). The National Defense Authorization Act for Fiscal Year 2008 amended this requirement by designating the Director of Corrosion Policy and Oversight as the official with these responsibilities. See Pub. L. No. 110-181, § 371 (2008) (amending 10 U.S.C. § 2228).

[6]While the statute does not define "return on investment" (ROI) for its corrosion-control technology demonstration projects, DOD defines the estimated ROI as the ratio of the present value of benefits to the present value of the project total cost.

In 2008, section 903 of the Duncan Hunter National Defense Authorization Act for Fiscal Year 2009 required the Departments of the Army, Navy, and Air Force to each designate a Corrosion Control and Prevention Executive (hereafter referred to as Corrosion Executive) to be the senior official in each military department with responsibility for coordinating department-level corrosion-prevention and control program activities.[7] Section 903, among other things, assigned responsibility to the three Corrosion Executives for (1) coordinating department-level corrosion prevention and control activities (including budget programming) with the Office of the Secretary of Defense, the program executive officers of the military departments, and relevant major subordinate commands of the military departments; (2) ensuring that corrosion prevention and control is maintained in each department's policy and guidance, including military infrastructure design, construction, and maintenance; (3) identifying the funding levels necessary for accomplishing certain corrosion-related priorities in their departments; and (4) submitting an annual report to the Secretary of Defense containing recommendations pertaining to the corrosion-prevention and control program of their departments. Section 903 also designated each military department's Corrosion Executive as that department's principal point of contact with the Director of the Corrosion Office.

To carry out its responsibilities, the Corrosion Office took a number of actions, including developing an instruction to establish policy, assign responsibilities, and provide guidance for corrosion-prevention and control within DOD; and developing a strategic plan to describe policies, strategies, objectives, and plans aimed toward an effective DOD-wide approach to prevent and mitigate corrosion of military equipment and infrastructure. Also, the Corrosion Office and military departments have identified and funded corrosion projects in which the military departments demonstrated new technology to address corrosion. Additionally, the Corrosion Office has required military departments' project managers to submit periodic reports on the status and outcomes of these projects.

In response to your request, we reviewed DOD's military-equipment corrosion projects and DOD's validation of the ROI of these projects. The *DOD Corrosion Prevention and Mitigation Strategic Plan* uses the phrase

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[7]The Duncan Hunter National Defense Authorization Act for Fiscal Year 2009, Pub. L. No.110-417, § 903 (2008).

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"return-on-investment (ROI) validation" to describe how project managers recompute the ROI estimate included in a project's status report. This recomputation is based on revised cost data after the project has been completed and the new technology has been transitioned to the services' use and tracked for 2 years. We are using the terms "reassessment" or "reassessed" rather than "validation" or "validated" because these terms more closely describe the process that the project managers are to use to review and update, if necessary, the assumptions used to recompute the initial ROI estimate. Additionally, Corrosion Office officials told us that they are planning to use the term "reassessment" in the revised DOD strategic plan. The reassessment is not an update based on actual results of the cost savings achieved by the project.

This report addresses to what extent DOD (1) has ensured the submission of required reports for equipment-related corrosion projects; (2) has collected the information needed to determine whether benefits and other measures have been achieved from equipment-related corrosion projects; (3) has tracked the status of equipment-related corrosion projects; and (4) has identified, shared, and incorporated lessons learned from equipment-related corrosion projects into future planning to prevent or mitigate corrosion.

To determine the extent to which DOD has ensured the submission of required reports for equipment-related corrosion projects, we reviewed the *DOD Corrosion Prevention and Mitigation Strategic Plan*[8] and its revised versions, and used the reporting milestones outlined in the plan to identify the types of reports required for each project. We obtained project information for 128 equipment-related corrosion demonstration projects[9] funded by the Corrosion Office for fiscal years 2005 through 2012. We requested and reviewed the project documentation—project proposals, final reports, and follow-on reports—to determine whether the data and related reports met the Corrosion Office's reporting requirements. We interviewed officials from the Corrosion Office, as well as the Army, Navy, and Air Force Corrosion Executives, to understand how projects are

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[8]Corrosion Policy and Oversight Office, Department of Defense, *DOD Corrosion Prevention and Mitigation Strategic Plan*. The strategic plan was first issued in November 2004, and was subsequently revised in 2007, 2008, 2009, and in 2011.

[9]We originally received project documentation for 129 projects, from which we selected our sample. However, one project was eliminated because it was funded in fiscal year 2013.

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tracked if required reports have not been submitted and to determine why some required reports were not submitted at the prescribed deadlines. We selected a nongeneralizable random systematic sample[10] of 43 projects for further review and conducted an in-depth analysis of the projects selected. We used a semistructured interview tool to obtain information from project managers to understand reporting requirements and time frames as well as challenges and limitations, if any, in completing the reports.

To determine the extent to which DOD has collected the information needed to determine whether benefits and other measures have been achieved from equipment-related corrosion projects, we reviewed key documents, including DOD Instruction 5000.67 and DOD's strategic plan to gain an understanding of the roles and responsibilities to develop procedures for corrosion planning and implementation and the department's strategy to justify funding for corrosion projects by verifying the initial investment of corrosion projects.[11] We reviewed all follow-on reports provided by the Corrosion Office and the military departments, which included 30 follow-on reports on projects funded in fiscal years 2005 through 2008, to determine whether the military departments have collected and reported measures of achievement of their completed corrosion projects, including a reassessed ROI to verify the initial investment. We interviewed officials from the Corrosion Office as well as the military departments' Corrosion Executives to understand whether and how data are collected in order to determine whether the estimated ROIs have been achieved. Additionally, from our nongeneralizable random systematic sample of 43 projects, we interviewed project managers and project personnel to understand how they verify the initial investment of corrosion projects and how the assumptions were tracked during the first few years of the projects.

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[10]Our nongeneralizable sample selection methodology ensured selection of a variety of projects over all fiscal years, locations, and services. Results from nongeneralizable samples cannot be used to make inferences about a population, because in a nongeneralizable sample some elements of the population being studied have no chance or an unknown chance of being selected as part of the sample. See app. I for more details on the sample selection methodology.

[11]Department of Defense Instruction 5000.67, *Prevention and Mitigation of Corrosion on DOD Military-equipment and Infrastructure* (Feb. 1, 2010).

To determine the extent to which DOD has tracked the status of equipment-related corrosion projects, we reviewed relevant law to understand legislative requirements, including the requirement that the *DOD Corrosion Prevention and Mitigation Strategic Plan* include a plan to transition new corrosion-prevention technologies into operational systems.[12] We also examined DOD policy, including DOD Instruction 5000.67, to gain an understanding of the roles and responsibilities of the Corrosion Office and Corrosion Executives to collect, review, reassess, and distribute information on proven methods and products that are relevant to prevent corrosion of military equipment. We conducted analysis of each of the 43 projects in our sample, specifically reviewing the project plans, final reports, and follow-on reports, to determine the status of each project, including whether it was recommended to be transitioned to service use. We interviewed Corrosion Office officials to determine what status information is collected for each project, how such information is consolidated, and what analysis is done to oversee the status and outcomes of each project. We also interviewed Corrosion Executives to determine their approach to collect, review, reassess, and distribute information on proven methods and products that are relevant to prevent corrosion of military equipment.

To determine the extent to which DOD has identified, shared, and incorporated lessons learned from equipment-related corrosion projects into future planning to prevent or mitigate corrosion, we reviewed DOD policy, including DOD Instruction 5000.67, to understand the department's policy to ensure a focused and coordinated approach throughout DOD to collect, review, reassess, and distribute information on relevant proven methods and products. Also, we reviewed DOD's strategic plan to understand the department's guidance for capturing, documenting, and sharing lessons learned. We analyzed all final reports to determine whether lessons learned were being included and the extent to which they were being incorporated into future planning and guidance. We interviewed Corrosion Office officials and Corrosion Executives to gain an understanding of how they ensure lessons learned are collected, shared throughout DOD, and incorporated into future projects. Likewise, from our nongeneralizable random systematic sample of 43 projects, we interviewed project managers and project personnel to gain an

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[12]10 U.S.C. §2228(d)(2)(D).

understanding of how lessons learned are collected, documented, shared, and incorporated into future corrosion planning.

We determined that the project documentation, including required reports, were sufficiently reliable for the purposes of determining the extent to which DOD ensured completion of required reports, collected the information needed to determine whether benefits and other measures have been achieved from military-equipment corrosion projects, tracked the status of military-equipment corrosion projects, and identified, shared, and incorporated lessons learned from military-equipment corrosion projects into future planning to prevent or mitigate corrosion. We determined that the data used to select the projects included in our sample were sufficiently reliable for the purposes of our review. We provide additional information about our project-selection methodology and data-collection efforts in our detailed scope and methodology in appendix I.

We conducted this performance audit from July 2012 to September 2013 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

DOD's Strategic Planning and Guidance for Corrosion Prevention and Control

DOD submitted the first version of its long-term corrosion strategy to Congress in December 2003. DOD developed this long-term strategy in response to direction in the Bob Stump National Defense Authorization Act for Fiscal Year 2003.[13] In November 2004, DOD revised its long-term corrosion strategy and issued its *DOD Corrosion Prevention and Mitigation Strategic Plan*. DOD strives to update its strategic plan periodically, most recently in February 2011, and officials stated the next update is planned for 2013. The purpose of DOD's strategic plan is to articulate policies, strategies, objectives, and plans that will ensure an

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[13]Pub. L. No. 107-314, Div. A, § 1067.

effective, standardized, affordable DOD-wide approach to prevent, detect, and treat corrosion and its effects on military equipment and infrastructure.

In January 2008, the department first issued DOD Instruction 5000.67, Prevention and Mitigation of Corrosion on DOD Military Equipment and Infrastructure, which was revised and reissued with the same title in February 2010. The stated purpose of the instruction is to establish policy, assign responsibilities, and provide guidance for the establishment and management of programs to prevent or mitigate corrosion of DOD's military equipment and infrastructure. This instruction assigns the military departments' Corrosion Executives responsibility for certain corrosion-prevention and control activities in their respective military departments. It requires the Corrosion Executives to submit information on proposed corrosion projects to the Corrosion Office with coordination through the proper military department chain of command, as well as to develop support, and provide the rationale for resources to initiate and sustain effective corrosion-prevention and mitigation programs in each military department.

Corrosion Office Operations

According to statute and DOD guidance, the Director of the Corrosion Office is responsible for the prevention and mitigation of corrosion of DOD equipment and infrastructure. The Director's duties include developing and recommending policy guidance on corrosion control, reviewing the corrosion-control programs and funding levels proposed by the Secretary of each military department during DOD's annual internal budget review process, and submitting recommendations to the Secretary of Defense regarding those programs and proposed funding levels. To accomplish its oversight and coordination responsibilities, the Corrosion Office has ongoing efforts to improve the awareness, prevention, and mitigation of corrosion of military equipment and infrastructure, including (1) hosting triannual corrosion forums; (2) conducting cost-of-corrosion studies; (3) operating two corrosion websites; (4) publishing an electronic newsletter; (5) working with industry and academia to develop training courses and new corrosion technologies; and (6) providing funding for corrosion-control demonstration projects proposed and implemented by the military departments. According to the Corrosion Office, these corrosion activities enhance and institutionalize the corrosion-prevention and mitigation program within DOD. In addition, the Director of the Corrosion Office

periodically holds meetings with the DOD Corrosion Board of Directors and serves as the lead on the Corrosion Prevention and Control Integrated Product Team.[14] The Corrosion Prevention and Control Integrated Product Team includes representatives from the military departments, the Joint Staff, and other stakeholders who help accomplish the various corrosion-control goals and objectives. This team also includes the seven Working Integrated Product Teams, which implement corrosion prevention and control activities. These seven product teams are organized to address the following areas: corrosion policy, processes, procedures, and oversight; metrics, impact, and sustainment; specifications, standards, and qualification process; training and certification; communications and outreach; science and technology; and facilities. Appendix A of DOD's strategic plan contains action plans for each product team, including policies, objectives, strategies, planned actions, and results to date.

Development of Corrosion Projects

The Corrosion Office began funding military-equipment and infrastructure corrosion-prevention projects in fiscal year 2005. Projects, including equipment-related projects, are specific corrosion-prevention and mitigation efforts, funded jointly by the Corrosion Office and the military departments, with the objective of developing and testing new technologies. To propose a project for Corrosion Office funding, the military departments first refer to requirements in DOD's strategic plan. The requirements include initial submission of a project plan, and, if approved, future submissions of final and follow-on reports. The military departments' proposals are evaluated by a panel of experts assembled by the Director of the Corrosion Office. The Corrosion Office generally funds up to $500,000 per project, and the military departments generally pledge matching or complementary funding for each project that they propose.[15] The level of funding by each military department and the estimated return on investment (ROI) are two of the criteria used to evaluate the proposed projects. For the project-selection process, the

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[14]The Corrosion Executives for each of the military departments are members of the Corrosion Board of Directors, and they or their delegates are participants on DOD's Corrosion Prevention and Control Integrated Product Team. The Corrosion Board of Directors is not identified in DOD's strategic plan; however, Army and Navy corrosion documents acknowledge their Corrosion Executives' membership on the Corrosion Board.

[15]According to Corrosion Office and Corrosion Executive officials, the military departments' matching funds may be more or less than 50 percent of total costs.

military departments submit preliminary project proposals in the fall and submit final project proposals in the spring, and the Corrosion Office considers the final proposals for funding. Projects that meet the Corrosion Office's criteria for funding are announced at the end of each fiscal year. Figure 1 provides an overview of DOD's process for corrosion projects and notes which reports are required in each period.

Figure 1: Overview of DOD's Process for Corrosion Projects

Year 0 Military departments prepare project plans for submission to the Corrosion Office	Years 1 and/or 2 Demonstration of the new technology	Years 3, 4, and/or 5 Implementation of the new technology
• The military departments prepare project plans identifying new technologies to prevent or mitigate corrosion of military equipment, and include an initial estimated Return on Investment (ROI).[a] • Project plans are submitted to the Corrosion Office, and include an explanation of how the project will be transitioned to service use (implemented) as well as plans and methods to track the ROI during the first two years the new technology is implemented.	• Once the project is approved by the Corrosion Office, the research and development phase (demonstration) commences. • Upon completion of the demonstration phase for each project, a final report is submitted to the Corrosion Office. The final report should include lessons learned.	• After the demonstration phase, the project may be transitioned to service use (implemented). • After the new technology has been in service use (implemented) for two years, a follow-on report, which is a checklist, is completed to evaluate the project. • This report is a project review checklist, with a focus to reassess the overall effect and ROI, as well as assess other benefits of the project. For example, the ROI reassessment consists of a review and assessment of assumptions used earlier in computing the initial estimated ROI; a comparison between the initial estimated ROI and the reassessed ROI, and recommendations for continued review of ROI. • If an alternative ROI method is used, data should continue to be collected and used throughout the life of the new technology to maintain records and provide an accurate assessment of costs (including capital, operating, maintenance, and repair) as well as cost avoidance.

Source: GAO analysis of DOD data.

Notes: The data are from the *DOD Corrosion Prevention and Mitigation Strategic Plan*.

[a]DOD defines the estimated return-on-investment (ROI) as the ratio of the present value of benefits to the present value of the project total cost.

Specifically, project plans include several elements to be considered for funding by the Corrosion Office, according to DOD's strategic plan. The project plans include a statement of need, a proposed solution, assumptions used to estimate the initial ROI, and a cost-benefit analysis of the project's initial estimate of ROI. DOD's strategic plan describes estimation steps for the cost-benefit analysis to include (1) calculating the project costs—such as up-front investment costs and operating and support costs, (2) calculating the benefits that are expected to result from the project—such as reduction of costs like maintenance hours and

inventory costs, and (3) calculating the net present value of the annual costs and benefits over the projected service life of the proposed technology.[16]

According to Corrosion Office officials, once a project is approved and funded, project managers are typically responsible for overseeing the project and completing the reporting requirements. First, the project manager begins the research and development phase, also known as the demonstration phase. During this phase, project managers and project personnel test new technology, both in military laboratory and real-world settings. Typically, the demonstration phase takes 1 to 2 years, and the Corrosion Office requires submission of a final report upon completion of the demonstration.[17] In this final report, project managers document test conditions, performance of the new technology, lessons learned, and their recommendations for the new technology to be transitioned to a military service's use. Finally, project managers submit a follow-on report, which is a checklist, to evaluate a project within 2 years after a project is completed and the technology has transitioned to use within the military department.[18] The purpose of the follow-on report is to inform the Corrosion Office of the overall outcome of the project and to reassess the ROI. The Strategic Plan provides detailed instructions on how to reassess the ROI. For example, the ROI reassessments consist of

- reviewing assumptions used earlier in computing the estimated ROI;
- updating the costs and benefits associated with the new technology resulting from the project;
- recalculating the ROI based on reassessed data; and

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[16]DOD's strategic plan includes a template spreadsheet for project managers to use to calculate the net present value of the projects. This template accounts for the time value of money by discounting the future benefits expected by the project in terms of their net present value, and computes the ratio of these benefits to the present value of the costs. The discount rate used by the template is 7 percent, recommended by Office of Management and Budget, *Circular No. A-94: Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs* (Washington, D.C.: October 1992) for use in analyzing benefits and costs of public investments.

[17]Corrosion Office officials stated that these reports are typically due within 2 years after the receipt of funding for the corrosion demonstration projects.

[18]According to Corrosion Office officials, the transition period to implement the demonstrated technology in a military department can be up to 1 year and the officials expect the follow-on reports to be completed within 5 years of initial project funding.

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- providing an assessment of the difference, if any, between the estimated ROI and the reassessed ROI.

Figure 2 provides a breakout of the number of projects that have reached various reporting milestones, as of May 2013. There were 128 equipment-related corrosion projects funded from fiscal years 2005 through 2012, in which

- 41 projects had reached the milestone for submitting final and follow-on reports, including ROI reassessments;
- 88 projects had only reached the milestone for submitting final reports; and
- 40 projects were not yet complete, thus they have not reached the milestone for submitting final or follow-on reports.

Figure 2: Breakout of the Number of Projects That Reached Various Reporting Milestones (as of May 15, 2013)
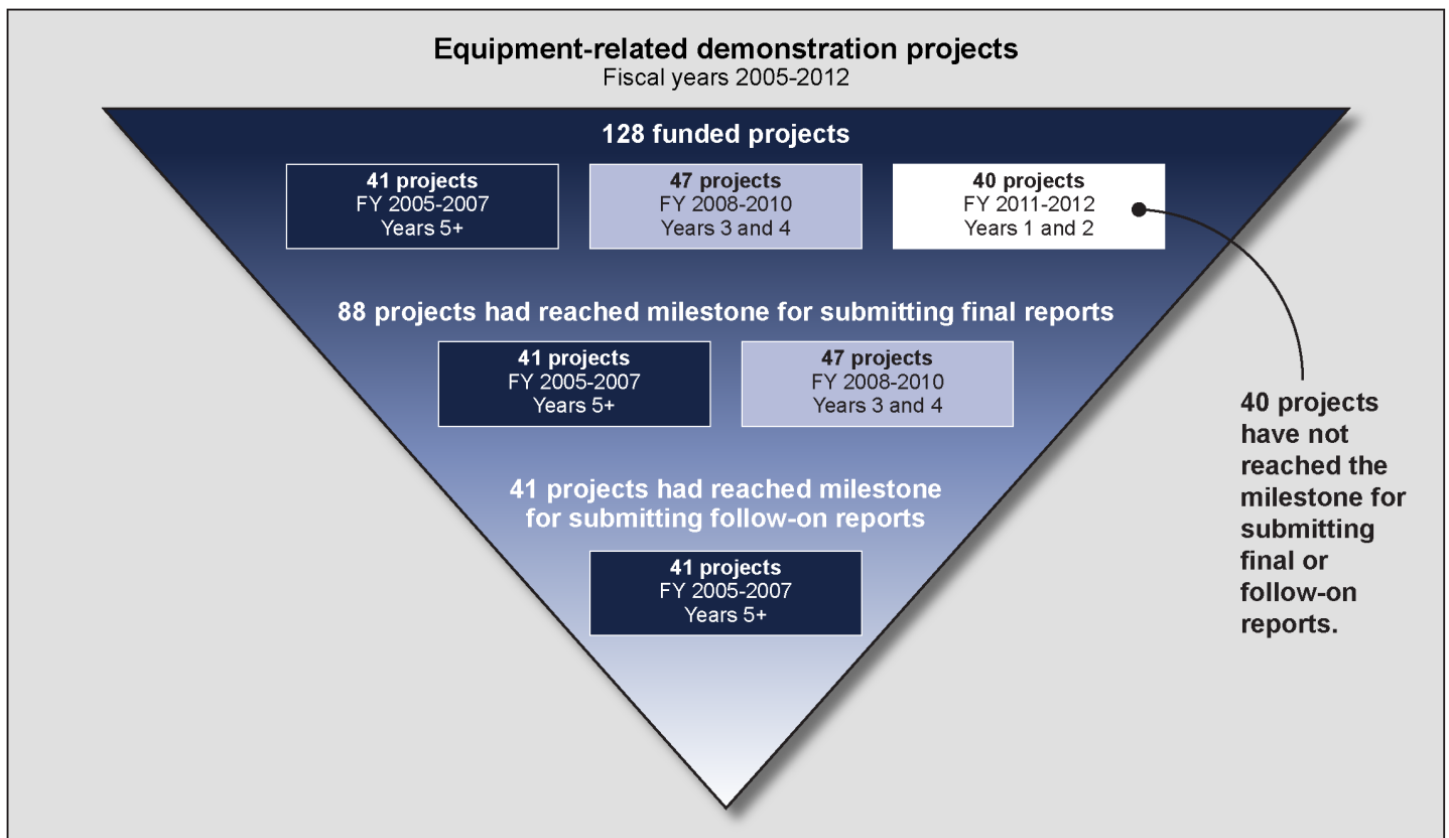
Source: GAO analysis of DOD data.

Prior GAO Work on DOD's Corrosion-Prevention and Control Program

In December 2010,[19] we analyzed the extent to which the military departments have reassessed the ROI for funded corrosion-prevention projects. We found that the military departments did not complete required validations of ROI estimates and were unable to fully demonstrate the costs and benefits of their corrosion-prevention and control projects. We recommended, in part, that DOD fund and complete ROI validations. DOD concurred and noted that plans were already underway to address this requirement within the Corrosion Office and with the Corrosion Executives. Also, in September 2012, we reported that the Corrosion Office performs an analysis to determine the average ROI estimates for projects that it cites in its annual corrosion-control budget report to Congress.[20] Additionally, we reported that the Corrosion Office did not use the most up-to-date data for the projects' ROIs or provide support for the projects' average ROI that was cited in its fiscal year 2013 corrosion-control budget report to Congress. We recommended that DOD provide an explanation of its ROI methodology and analysis, including the initial and, to the extent available, the reassessed ROI estimates. However, DOD did not agree with our recommendation. In its written comments, DOD generally restated the methodology included in DOD's strategic plan, which the military departments use to estimate the projected ROI of each project. DOD did not provide any additional reasons why it did not use current return-on-investment estimates in its report to Congress. We reported in April 2013 that DOD has made some progress in completing the ROI validations but it needs to continue to follow through on completing the validations to fully demonstrate the costs and benefits of the corrosion projects.[21]

In May 2013, we reported that the Corrosion Office had not ensured that all reports on the results of its infrastructure-related corrosion projects

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[19]GAO, *Defense Management: DOD Has a Rigorous Process to Select Corrosion Prevention Projects, but Would Benefit from Clearer Guidance and Validation of Returns on Investment*, GAO-11-84 (Washington, D.C.: Dec. 8, 2010).

[20]GAO*, Defense Management: The Department of Defense's Annual Corrosion Budget Report Does Not Include Some Required Information*, GAO-12-823R (Washington, D.C.: Sept. 10, 2012).

[21]See GAO, *2013 Annual Report: Actions Needed to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits,* GAO-13-279SP (Washington, D.C.: Apr. 9, 2013), GAO Action Tracker, accessed April 9, 2013; http://www.gao.gov/duplication/action_tracker/Corrosion_Prevention/action1.

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were submitted.[22] We recommended four actions to improve DOD's project reporting and tracking, and the accuracy of its ROI data. However, DOD partially agreed with our recommendation to take steps to enhance the tracking and reporting of its infrastructure-related corrosion projects. In written comments, DOD stated it is developing a web-based tracking tool for the Corrosion Office, Corrosion Executives, and project managers to input and extract project-related data. In regard to the recommendation that DOD take action to ensure that its records reflect complete, timely, and accurate data on the projects' ROI, DOD partially agreed with the recommendation and stated the web-based system would provide data including ROI estimates. While DOD cited the web-based system to address our recommendations, DOD did not state when the new system would be available for use. Further, DOD did not agree with our recommendation that the Corrosion Office use its existing authority to identify and implement possible options or incentives for addressing reasons cited by project-management offices for not meeting reporting milestones. In written comments, DOD did not state what actions it would take to improve submission of completed reports from the military services that DOD's strategic plan requires for infrastructure-related corrosion projects. Also, DOD did not agree with our recommendation to revise guidance to clearly define the role of Corrosion Executives to assist the Corrosion Office in holding departments' project-management offices accountable for submitting reports in accordance with DOD's strategic plan. DOD stated that further guidance is not necessary as the requirements are clearly stated in the strategic plan. All the related GAO products are listed at the end of this report.

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[22]GAO, *Defense Infrastructure: DOD Should Improve Reporting and Communication on Its Corrosion Prevention and Control Activities,* GAO-13-270 (Washington, D.C.: May 31, 2013).

DOD Has Collected a Majority of Required Reports on the Results of Equipment-Related Corrosion Projects and Is Taking Steps to Obtain Those Outstanding

DOD's Corrosion Office has collected a majority of required final and follow-on reports from project managers on the results of equipment-related corrosion projects and is taking steps to obtain outstanding reports. As of May 2013, our review found that the military services submitted the majority of the required reports. Project managers had submitted the required final reports for 55 of the 88 projects (about 63 percent) funded from fiscal years 2005 through 2010. Also, for 27 of the 41 projects (about 66 percent) that were funded from 2005 through 2007, we found that the project managers had submitted the required follow-on reports on whether the corrosion-control technologies were effective and the overall effect of the projects. Military departments' Corrosion Executives and project managers described various reasons for not meeting milestones for all reports, such as personnel turnover, funding, and demonstration phases lasting longer than anticipated. To improve the collection of reports, DOD is taking steps to obtain outstanding reports.

Project Managers Submitted a Majority of the Required Final and Follow-on Reports

DOD has invested more than $63 million in 88 equipment-related corrosion projects funded from fiscal years 2005 through 2010. Project managers submitted a majority, but not all, of the required reports on whether the corrosion-control technologies were effective and the overall effect of the projects.[23] The *DOD Corrosion Prevention and Mitigation Strategic Plan*[24] states that project plans should include a schedule milestone for reporting, including final reports and follow-on reports. The DOD strategic plan requires a final report at project completion, and requires a follow-on report 2 years after project completion and transition to use within the military departments. According to Corrosion Office officials, these reports provide valuable information on the results of corrosion projects and in planning future projects.

About Two-Thirds of Final Reports Were Submitted

Corrosion Office officials stated that project managers must submit final reports at project completion, which is typically within 2 years after the receipt of the funding of each project. As stipulated in DOD's strategic plan, final reports should include certain content, such as an executive

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[23]DOD also invested $21 million in 40 additional corrosion projects funded in fiscal years 2011 and 2012. These DOD expenditures have not been adjusted for inflation. We did not include these 40 projects because their reporting milestones had not occurred.

[24]Department of Defense, *DOD Corrosion Prevention and Mitigation Strategic Plan*, app. D (Washington, D.C.: February 2011).

summary, lessons learned, recommendations, and conclusions. We found that 55 of the 88 required final reports (63 percent) for projects funded in fiscal years 2005 through 2010 had been submitted. There was variation, by military service, in the number of submitted final reports. For example, the Marine Corps had not submitted three-quarters of its final reports. The Air Force, in contrast, had submitted all but one final report. Table 1 shows the status of final reports submitted by each service for equipment-related projects.

Table 1: Status of Final Reports for the 88 Equipment-Related Corrosion Projects Funded in Fiscal Years 2005 through 2010

Military service	Total number of projects	Number of submitted final reports	Number of outstanding final reports
Army	18	12	6
Navy	41	25	16
Marine Corps	13	3	10
Air Force	16	15	1
Total	**88**	**55**	**33**

Source: GAO analysis of DOD data.

Note: Data as of May 2013.

About Two-Thirds of Follow-on Reports Were Submitted

We found that project managers submitted 27 of the 41 required follow-on reports (66 percent). The military services varied in the number of outstanding follow-on reports. For example, the Navy had not submitted half of its follow-on reports. In contrast, the Army, Marine Corps, and Air Force had only one outstanding follow-on report. DOD's strategic plan requires the submission of follow-on reports within 2 years after a project is completed and transitioned to use in the military department. According to Corrosion Office officials, this transition period includes up to 1 year to implement the technology in a military department. Corrosion Office officials also told us that they expected the follow-on reports to be submitted within 5 years of initial funding. Therefore, follow-on reports for 41 completed projects funded in fiscal years 2005 through 2007 were due on or before the end of fiscal year 2012. DOD's strategic plan states that the follow-on reports should include an assessment of the following areas: project documentation, project assumptions, responses to mission requirements, performance expectations, and a comparison between the initial ROI estimate included in the project plan and the new estimate. Table 2 shows the status of follow-on reports submitted by each service.

Table 2: Status of Follow-on Reports for the 41 Equipment-Related Corrosion Projects Funded in Fiscal Years 2005 through 2007

Military service	Total number of projects	Number of submitted follow-on reports	Number of outstanding follow-on reports
Army	7	6	1
Navy	21	10	11
Marine Corps	1	0	1
Air Force	12	11	1
Total	**41**	**27**	**14**

Source: GAO analysis of DOD data.

Note: Data as of May 2013.

According to officials in the Corrosion Office, final and follow-on reports are used to assess the effectiveness of the corrosion projects and determine whether continued implementation of the technology is useful. As Corrosion Office officials review project managers' final reports, they stated that they focus on any lessons learned, technical findings, conclusions and recommendations, and whether the results from the report should trigger follow-on investigations of specific technology and a review for broader applications of the technology. Officials stated that they review follow-on reports to assure necessary implementation actions have been taken and to review changes in the ROI estimates.

Corrosion Officials Have Taken Steps to Obtain Outstanding Reports

Corrosion Office officials stated that they are taking steps to obtain the completion and submission of all outstanding reports. For example, according to the Corrosion Office, its officials regularly send the military departments' Corrosion Executives a report listing final and follow-on reports that have not yet been completed and submitted and requesting that the Corrosion Executives follow up with project managers to complete the reports. According to Corrosion Executives, they coordinate through their department and if the reports have not yet been completed, they obtain an explanation and expected completion date and provide the information to the Corrosion Office. Finally, according to Corrosion Executives, they communicate any delays to the Corrosion Office verbally and by e-mail to ensure the Corrosion Office is aware if a demonstration period takes longer than originally anticipated or if a project has been delayed due to unexpected laboratory or field testing issues

Corrosion officials in the military departments described various reasons why project managers did not complete and submit mandatory final and

follow-on reports within expected time frames, including personnel turnover, funding, and demonstration phases lasting longer than anticipated, all delaying the completion and submission of the reports. For example, Air Force and Marine Corps corrosion officials stated that most teams retain key personnel throughout each project, but at times, turnover results in teams delaying completion of their reports. Additionally, Army corrosion officials stated that while their project was approved by the Corrosion Office to start its demonstration at the beginning of the fiscal year, the demonstration started much later than expected because funding from the Corrosion Office for the project was delayed due to the use of continuing resolutions to fund government operations.[25] Finally, the Navy's Corrosion Executive stated that some demonstrations last at least 3 years because the new technology or method is tested on at least two carrier deployments, and each deployment cycle can last 18 months.

DOD Collects Information on the Benefits of Corrosion Projects, but Is Not Always Reporting Details of the Benefits or Determining Whether Projects Achieve Their Estimated ROI

DOD requires the military departments to collect and report key information from corrosion projects about new technologies and methods to prevent and mitigate corrosion in military equipment to the Corrosion Office; however, DOD does not have complete information about the benefits of all of its projects and is sometimes unable to determine whether projects achieve their estimated ROI. Specifically, the military departments are collecting and reporting some measures of achievement of the projects, including results, but do not always report details in follow-on reports about features and benefits of completed projects, such as when outcomes prompted changes to specifications, standards, and various reference and guidance documents. Further, the military departments are not collecting required information on the assumptions used to compute the estimated ROI in the project plan, and are unable to determine whether the projects are achieving the estimated ROI.

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[25]A continuing resolution is an appropriation act that provides budget authority for federal agencies, specific activities, or both to continue in operation when Congress and the President have not completed action on the regular appropriation acts by the beginning of the fiscal year.

Military Departments Use a Checklist to Note Some Projects' Achievements, but Do Not Always Report Details of the Benefits of Projects

The military departments have collected and reported measures of achievement of completed corrosion projects other than ROI, such as when outcomes prompt changes in specifications, standards, technical manuals, and other reference or guidance documents. However, the departments' follow-on reports do not always include details of the achievements, including specific benefits. DOD Instruction 5000.67 requires the military departments' Corrosion Executives to develop procedures for corrosion planning, process implementation, management, review, and documentation of results. Additionally, the *DOD Corrosion Prevention and Mitigation Strategic Plan* requires the submission of a checklist, which the department refers to as a follow-on report, to note specific information about the corrosion project. The follow-on report, which consists of a checklist, shows items to be reviewed on the status and the results of corrosion projects that have completed research and development, transitioned to service use, and been in use for 2 years. Project managers have the option to include comments on details about items on the checklist. Appendix II shows a copy of the checklist used for project review. According to the strategic plan, the checklist is to focus not only on reassessing the ROI, but also on examining and assessing other benefits of the project. Project managers are required to review documentation, such as specifications, technical manuals, and other guidance; implementation, maintenance, and other sustainability costs; and actual or intended application of the technology by others. Then, project managers are to check "yes" or "no" for each item, but are not required to write details about any benefits of the project. DOD's strategic plan allows the project managers the option to provide detailed comments in the follow-on report, but does not provide specific guidance requiring them to document benefits. Finally, according to Standards for Internal Control in the Federal Government, control activities—including appropriate documentation of transactions that should be clearly documented and keeping documentation readily available for examination—are an integral part of an entity's planning, implementing, reviewing, and accountability for stewardship of government resources and for achieving effective results.

During our review of all available follow-on reports,[26] we found that the nearly three-quarters (22 of the 30 follow-on reports) contained

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[26]We reviewed all available follow-on reports provided by the Corrosion Office and the military departments, which included 30 Army, Navy, and Air Force follow-on reports on projects funded in fiscal years 2005-2008. Some follow-on reports remain outstanding, as discussed earlier in this report.

information on some measures of achievement, such as whether new technology or methods were incorporated in maintenance manuals, technical orders,[27] or engineering change proposals.[28] These project managers for these reports modified the follow-on report to include additional details that clearly acknowledge the benefits of the project, such as incorporation into specifications, technical manuals, and other guidance. For example, a joint Army and Navy project in our sample examined aircraft corrosion prevention and control by testing gaskets to prevent corrosion of antenna wiring. The project resulted in the Army communicating the benefit of the antenna gasket by authorizing its use, giving it a part number, and revising a technical manual. Also, the Navy assigned the gasket a part number, authorized its use, and revised a maintenance manual.

However, we also found that one quarter (8 of 30) of the follow-on reports contained little to no narrative detail and did not document the benefits of the project. For example, an Army project's follow-on report contained no information about achievements, and a Navy project's follow-on report provided little details about the project's outcomes that could reduce cost and reinforce mission readiness. Without specific guidance to require that follow-on reports include details of measures of achievements other than ROI, including benefits, the Corrosion Office will be missing the opportunity to know whether equipment-related corrosion projects have achieved outcomes to prevent or mitigate corrosion.

Military Departments Are Not Collecting Information to Determine Whether Projects Are Achieving Estimated ROI

The military departments' project plans include an initial estimated ROI for each equipment-related corrosion project that is based on specific assumptions, but the departments' project managers and project personnel have not collected data to determine whether each project achieved its estimated ROI. DOD's strategic plan provides guidance on estimating the ROI, collecting information to verify the ROI, and achieving the ROI. First, the strategic plan states that project plans include assumptions that are used to initially estimate the ROI, and provides a list of assumptions that includes: replacement costs and intervals;

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[27]Technical orders are Air Force publications that give specific technical directives and information on inspection, storage, operation, modification, and maintenance of given Air Force items and equipment.

[28]An Engineering Change Proposal is a document used to describe, justify, and (if approved) implement a proposed engineering change.

maintenance costs, including unscheduled maintenance and repair cost; labor and other operating costs; and readiness savings. Second, the strategic plan provides guidance on collecting information on the estimated ROI for corrosion projects that have completed research and development and transitioned to service use (i.e., whether a service implemented the demonstrated technology or method). Specifically, project managers are required to collect information to check on any changes to the assumptions used in the initial estimated ROI in order to compare, or recompute, the ROI and determine if the ROI is higher than, lower than, or as originally estimated. Finally, the strategic plan identifies a strategy to justify funding for corrosion projects by verifying the initial investment[29] of corrosion projects and cites a long-term objective to achieve ROI for equipment-related corrosion projects, thus providing a metric to assess progress.

During our review, we found that all project plans in our sample included required assumptions as well as plans and methods to collect information on those assumptions. Our sample included the following examples in which the project managers and project personnel estimated the ROI in the project plan based on certain assumptions and indicated they would collect information when the technology or method was transitioned to service use.

- Army—Officials projected an ROI (i.e., benefit) of $46.75 for every dollar invested in this project to prevent corrosion. The project, funded in fiscal year 2008, tested a commercially available dehumidification technology to protect the radar system on Patriot missile systems, whose internal components generate extreme amounts of heat. According to the project plan, the ROI was based on assumptions including reduced labor and material maintenance costs. The project plan stated that staff would collect ROI-related data by tracking the rate of corrosion, including visual inspections of units with and without the technology and by an examination of maintenance logs. However, according to project personnel, they reassessed only some of the original assumptions—such as the annual cost of corrosion maintenance costs for the Patriot radar system—and did not track or

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[29]The first *DOD Corrosion Prevention and Mitigation Strategic Plan* was issued in 2004, prior to funding the first military-equipment corrosion projects that began in 2005. The original strategic plan, as well as subsequent revisions in 2007, 2008, 2009, and 2011, identifies a strategy to justify funding for corrosion projects.

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collect data to verify the assumptions used for the estimated ROI in the project plan. Thus, they will be unable to compare or recompute the ROI as required by the strategic plan.

- Marine Corps—Officials projected an ROI of $189.74 for every dollar invested in this project to prevent corrosion. The project, funded in fiscal year 2010, tested supplemental coatings to protect tactical and armored ground weapon systems against corrosion. According to the project plan, the ROI was based on assumptions including testing on the Mine Resistant Ambush Protected (MRAP) vehicle system, a 50 percent reduction in annual maintenance costs, and a 15-year service life. The project plan stated that data would be collected by annually monitoring weapon systems with and without these particular coatings to verify the estimated ROI in the project plan. However, according to project personnel, they plan only to provide an update of the original assumptions. Thus, they will be unable to compare or recompute the ROI as required by the strategic plan.

- Air Force and Navy—Officials of the joint project predicted an ROI of $61.32 for every dollar invested in this project to prevent corrosion. The project, funded in fiscal year 2005, tested the use of aerosol paint cans to address potential corrosion of aircraft coatings and meet the requirements of rapid cure and rapid application in austere environments when spray-application equipment is not available.[30] According to the project plan, the ROI was based on assumptions including the estimated cost of paint and repair, the expectation to save approximately 5 percent of the paint cost in reductions in material preparation and clean-up, and decreased manpower requirements associated with applying paints and repairing corrosion. According to the project manager, he could collect certain data, such as how many cans were ordered through the supply system, but could not determine if personnel purchased aerosol paint cans from other sources to estimate savings. Thus, they will be unable to compare or recompute the ROI as required by the strategic plan.

Additionally, project managers and project personnel in our sample stated that they have not collected information on the assumptions used in the initial estimated ROI to compare or recompute the ROI, such as

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[30]According to the final report for this project, there still remains a need for brush or roller applied coating systems for maintainers who must repair and repaint aircraft in locations where local environmental regulations restrict the use of aerosol-applied coatings.

information on the quantity of military equipment that has transitioned to service use. Rather, the Corrosion Executives and the majority of project managers and project personnel whom we interviewed stated that their procedure has been to reassess only the accuracy of the assumptions of the estimated ROIs.

Further, Corrosion Executives as well as project managers and project personnel for 40 of the 43 projects in our sample (or 93 percent) stated that they have not collected information to verify the initial investment and determine if a project is achieving the estimated ROI stated in each project plan because of the difficulties in doing so. For example, some project managers and project personnel explained that they rely on repair personnel to collect and record data on the performance of a new technology or method, which would provide data to verify the initial investment in corrosion projects. However, according to Corrosion Executives, project managers, and project personnel, the repair personnel do not have a consistent way to collect and record the data. Also, some project managers and project personnel stated it is difficult to monitor progress of a new corrosion-related technology or method because the maintenance and repair community does not always note in maintenance records the reason for repair or replacement. For example, officials on an Air Force project noted that when electronic circuit cards failed and were removed from aircraft, repair personnel removed them and inserted new ones, but did not take the time to figure out why they failed (such as whether sand and salt corroded the electronic circuit cards). In some cases, the new technology or method goes beyond affecting one military service, and effective recordkeeping would involve the other services tracking, collecting, and reporting back information on their use of the new technology or method, but we found that such recordkeeping is not done consistently. Further, some equipment-related projects are driven by environmental concerns, such as those aimed at finding an alternative chemical to use to prevent corrosion. According to officials, these concerns, such as measuring the environmental effect on reducing pollution, are difficult to measure.

Consequently, the military departments and DOD management have been unable to determine whether the projects are achieving their estimated financial benefits. Officials from the Corrosion Office acknowledged that project managers have not followed DOD's strategic plan regarding collecting information to verify whether projects are achieving the benefits initially estimated in project plans because of challenges in collecting and monitoring relevant data. Corrosion Office officials stated that their original intent was for the project managers to

monitor the assumptions and collect updated information, but now the Corrosion Office officials recognize that project managers did not always collect all the needed data. On the basis of the identified challenges, Corrosion Office officials stated that they plan to revise the strategic plan to eliminate the guidance on validating the ROI and to provide revised guidance on how the project managers should be reassessing the ROI. They stated that the revision is planned for late 2013.

DOD Has Taken Steps to Improve Oversight, but Does Not Have a Comprehensive Overview of the Status of All Equipment-Related Corrosion Projects

DOD has taken steps to improve oversight of its equipment-related corrosion projects, such as revising its *DOD Corrosion Prevention and Mitigation Strategic Plan* to provide additional guidance on reporting requirements. However, DOD does not have a comprehensive overview of the status of all equipment-related corrosion projects. While the reports provide the status for each project, GAO found that the Corrosion Office does not consolidate information to monitor the status of all these projects, such as if a project has not transitioned to service use or has been discontinued.[31] Further, we found that project managers vary in how they reported the ROI for discontinued projects.

Corrosion Office Has Taken Steps to Improve Oversight of Equipment-Related Corrosion Projects

DOD's Corrosion Office has taken steps to develop and revise policies and guidance to help improve the management and oversight of equipment-related corrosion projects. For example, the Corrosion Office developed, and has subsequently revised the *DOD Corrosion Prevention and Mitigation Strategic Plan*. Also, officials from the Corrosion Office stated that they have updated reporting requirements to include quarterly status reports on the technical, programmatic, and financial status of the projects. Further, Corrosion Office officials explained that the establishment of the military department Corrosion Executives has helped improve their management of corrosion programs. Starting in 2009, each military department designated a Corrosion Executive to be the senior official in the department with responsibility for coordinating corrosion-prevention and control program activities.[32] For example, Corrosion

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[31]Hereafter, in this report, these projects that have not been recommended for transition will be referred to as "discontinued" projects.

[32]The Duncan Hunter National Defense Authorization Act for Fiscal Year 2009 (Pub. L. No. 110-417) required each military department to designate a Corrosion Executive.

Executives and the Corrosion Office do an annual review of equipment-related corrosion projects to review project status and transition as well as deadlines for final reports, follow-on reports, and ROI reassessments. According to the Corrosion Office, each Corrosion Executive coordinates through the respective military department's chain of command to provide information on corrosion projects to the Director of the Corrosion Office. Further, quarterly status reports are required starting the first week of the fiscal quarter after the contract award and every 3 months thereafter until the final report is submitted,[33] and officials from the Corrosion Office also conduct an annual review of each project. Finally, the military departments have developed and implemented service-specific strategic plans for corrosion prevention.[34]

The Corrosion Office Does Not Consolidate Information to Monitor the Status of Its Projects

The Corrosion Office collects reported details of individual corrosion projects, including some status information, but does not consolidate the information for an overview of the status of all its projects, which is a key part of its oversight role. Project managers submit many project details in their reports to the Corrosion Office, such as whether a project has been recommended for transition to service use and the status of the transition; whether a project has been recommended for transition to service use but did not transition; and whether a project has not been recommended for transition or discontinued. Corrosion Office officials stated that they maintain some consolidated data in a spreadsheet, such as the project's identification number, fiscal year, funded amount, and ROI. However, the office has not consolidated all key information about the projects so that officials can regularly monitor their status and plan to implement new corrosion-prevention technology or methods into the military departments' operations. Instead, most key information on the status is listed in individual final and follow-on reports.

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[33]From fiscal years 2005 through 2009, DOD's strategic plan required the military departments to provide bimonthly updates for all incomplete corrosion projects. Since fiscal year 2010, the Corrosion Office has required updates on a quarterly basis.

[34]H.R. Rep. No. 112-78, at 104-105 (May 17, 2011). GAO was directed to review the military departments' corrosion strategies. See GAO, *Defense Management: Additional Information Needed to Improve Military Departments' Strategies for Corrosion Prevention and Control,* GAO-13-379 (Washington, D.C.: May 16, 2013).

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DOD Instruction 5000.67 requires that the Corrosion Office develop an overarching, long-term corrosion-prevention and mitigation strategy. The instruction also requires that the Corrosion Office implement programs to ensure that military departments throughout DOD take a focused and coordinated approach to collect, review, reassess, and distribute information on proven methods and products that are relevant to prevent corrosion of military equipment. Also, the instruction requires Corrosion Executives to develop procedures for corrosion planning and implementation, and to review, manage, and document results.

During our review of the 43 projects in our sample, we found 14 (approximately 33 percent) of the projects performed well and each one's technology or method was implemented for use by a military department, and 7 (approximately 16 percent) of the projects performed well and were recommended for use by a military department but the military department was not using it. We found varying reasons for military departments not using a proven technology or method, such as the need for additional field testing. Finally, we found 4 (approximately 9 percent) of the projects did not perform as expected during the demonstration phase, and were discontinued. The remaining projects in our sample, 18 (approximately 42 percent of the projects), were still in the demonstration phase. However, Corrosion Office officials stated that they could not readily provide information on the status of the projects' implementation, including whether projects were demonstrated successfully; were recommended for a military department's use but are not yet in use; or had been discontinued. To provide an overview of the detailed status of all projects, the officials stated that they would have to review each final report and compile a list because the Corrosion Office does not use a tool or method to consolidate such information when the office receives each project's report. Without a mechanism to consolidate projects' status to facilitate monitoring of whether the projects' demonstrated technology or methods are being used by military departments, the Corrosion Office and the Corrosion Executives may not have timely information to know whether the technology demonstrations produced proven methods and products to prevent the corrosion of military equipment.

Project Managers Vary in How They Report Discontinued Projects, Including the ROI

During our review, we found that project managers varied in how they reported discontinued projects and how they reported reassessed ROIs for projects that had technology or methods recommended for a military department's use but were not being used. According to the DOD strategic plan, a final report is required at project completion and is to include certain content, such as recommendations on whether to

transition the technology or method to use in the military department. The plan also requires the submission of follow-on reports within 2 years after a project is completed and transitioned to use in the military department, and is to include a reassessed ROI. In reviewing project reports, we found seven instances of projects that had technology or methods recommended for a military department's use, but were not being used; however, the Corrosion Office provided documentation that the ROIs were reassessed for three of the projects. In one example, a follow-on report showed one project's results were awaiting validated data on benefits so it had not yet been implemented by a military department. By contrast, Corrosion Office records showed the project's ROI was verified as a cost benefit of $141.30 for every dollar invested in this project, which suggested that the office considered the project to be implemented. Additionally, we identified four projects that did not perform as expected during the demonstration phase and were discontinued. According to Corrosion Office officials, project managers still needed to submit follow-on reports, including verifying the estimated ROI. In interviews with project personnel, we found differences in how the military departments reported reassessed ROIs for discontinued projects in the follow-on reports.[35] For example, the Air Force reported the reassessed ROI for discontinued projects as zero, while the Army reported the reassessed ROI for discontinued projects to be the same as in the initial project plan. Army officials stated that they believed they were following DOD guidance in how they report ROI for discontinued projects. However, we found no guidance in DOD's strategic plan about how to report the ROI when a project is discontinued, and Corrosion Office officials confirmed that they have not provided such guidance. Corrosion Officials were unaware of specific discontinued projects and were unable to readily provide us a list of these projects. Without guidance to specify how project managers should report the ROI for discontinued projects, the Corrosion Office may receive varying reports about ROIs and have an incomplete picture of the success of projects.

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[35]On the basis of our review, we found that the Marine Corps had not discontinued any projects.

DOD Has Incorporated Lessons from Equipment-Related Corrosion Projects, but Does Not Have a Comprehensive Database to Share Lessons of All Projects

The military departments have identified lessons learned from their equipment-related corrosion projects and shared some lessons with corrosion-related personnel; however, DOD has no centralized and secure database or other source to share lessons from all project final and follow-on reports, including those with sensitive information. The military departments have incorporated some lessons from proven technologies or methods into maintenance guidance and repair procedures for military equipment. DOD uses both formal and informal methods to share lessons learned from corrosion projects, and is in the early stages of developing a single database that can share the lessons from final and follow-on reports, and do so in a secure system that can archive sensitive information about projects.

DOD Has Identified and Recorded Lessons in Maintenance Guidance and Procedures

The military departments have identified lessons learned from their projects to prevent or mitigate corrosion of military equipment. These lessons are described in the projects' final reports. Further, military departments have used the lessons learned to change maintenance guidance and repair procedures in some cases.

Identifying and Recording Lessons Learned

The military departments have followed guidance in DOD's strategic plan to include lessons learned in the final report for each corrosion project.[36] We found that project managers and project personnel were identifying lessons learned in the demonstration phase in lab books, journals and final reports. Also, during our review of all submitted final reports, we found that every final report included lessons learned. Additionally, project managers and project personnel stated that they identify lessons learned by an examination of testing conditions, observations and analysis of successful and unsuccessful trials, and examining problems. For example, one Navy project was successful in the lab, but the project manager found that personnel in the field were not completing all the steps necessary to make a particular protective paint coating effective to prevent corrosion. The project was discontinued because the corrosion

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[36]GAO's prior work states that a lesson learned is knowledge or understanding gained by experience. The experience may be positive, such as a successful test or exercise, or negative, such as a mishap or failure. From GAO, *Federal Real Property: Interagency Security Committee Should Implement a Lessons Learned Process,* GAO-12-901 (Washington, D.C.: Sept. 10, 2012).

method would not be successful in the field. Further, project managers told us that they collect these lessons learned throughout project demonstration, by recording analysis in lab books, which become part of the laboratory record, as well as collecting data in the field. For example, the project manager and project personnel who examined corrosion of electronic circuit cards due to sand and salt stated that they collected lessons learned while the weapon system was deployed. Also, they collected lessons learned as the weapon systems were returned to their home station, and found humidity at the home station greatly increased corrosion, an unexpected result that was documented in the final report.

Incorporating Lessons Learned

The military departments have incorporated lessons learned in guidance or other information that will allow them to use the proven methods and products. All project plans in our sample included plans or methods to transition projects to military department use and incorporate what they learned to change maintenance and repair procedures or allow the use of new technology. During our review of final and follow-on reports, we found that lessons learned from equipment-related corrosion projects were incorporated primarily through the military performance specifications; proposals for engineering changes; services' technical orders; or through DOD-wide military specifications. For example,

- A Navy project developed cost-effective, corrosion-resistant boxes to protect electrical equipment, indicator lights and connectors used on Navy ships. The Navy issued a message, established stock numbers, made drawings, and changed specifications to replace the boxes.

- An Army project tested a protective covering for cable connectors on the Patriot Missile System. As a result of the demonstration, the Army's Aviation and Missile Command's corrosion officials recommended the covers be part of repair kits and installed during scheduled depot overhauls. Project personnel are working to develop an Engineering Change Proposal to incorporate kits for these protective coverings into repair procedures at an Army depot, and plan to coordinate the assignment of National Stock Numbers for the kits when the Engineering Change Proposal is approved.

- An Air Force project tested and evaluated several rapid-cure roller/brush and aerosol-applied coating systems for airplanes. The final report recommended the aerosol system for implementation. As a result of the project, the Air Force modified a technical order to authorize the use of aerosol cans to apply protective coatings to an aircraft.

Finally, changes to DOD-wide military specifications are another way for lessons learned to be incorporated. For example, the Air Force created a DOD standard to be used by industry and DOD for screening new material technologies. Similarly, the Marine Corps created a DOD standard to provide protective coatings for tactical and armored vehicles.

In addition, some lessons learned were incorporated into planning for future projects. For example, a Marine Corps project was examining improved methods to remove specialty coatings on vehicles in a corrosion repair facility or depot. The process can take 32 hours to complete, during which time the vehicle is unavailable for other repair activities. According to the project manager, the project benefitted from lessons learned during a prior Marine Corps project examining coating repairs. In another example, the Air Force established a requirement for outdoor testing of protective coatings for aircraft after several project managers found that some protective coatings yielded contradictory results in the laboratory as compared to outdoor exposure.

DOD Has Informal and Formal Methods to Share Some Lessons Learned

DOD has several methods for informally or formally sharing some lessons learned from corrosion projects. Most lessons learned are shared informally through conferences, working groups, and personal contacts, according to Corrosion Executives, project managers, and project personnel. While DOD has taken steps for a structured, formal process to share information, such as by establishing a DOD corrosion website and archiving final reports in the Defense Technical Information Center (DTIC) database,[37] neither the website nor the database has all lessons learned from equipment-related corrosion projects.

Informal Methods for Sharing Lessons Learned

Military departments' Corrosion Executives, project managers, and project personnel stated that lessons learned are shared in specific ways, such as through past conferences, working groups, and personal contacts. For example:

- Conferences: The Corrosion Office has hosted the triannual DOD Corrosion Forum—involving the military departments, private industry, academia, and other government agencies—to share information on

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[37]According to DTIC's website, DTIC serves the DOD community as the largest central resource for DOD and government-funded scientific, technical, engineering, and business-related information.

the negative effects of corrosion on readiness and safety. Corrosion officials whom we interviewed emphasized the importance of sharing lessons learned at past conferences. Conferences have also included briefings on project ideas and project submissions. For example, the Air Force Corrosion Managers Conference included a briefing on the results of a project on rapid-cure coating for aircraft. However, according to a 2013 DOD budget memorandum, conferences have been curtailed except those for mission-critical activities and must be approved by component heads or senior officials designated by the component head. Subsequently, DOD plans to hold for the first time the DOD Corrosion Conference 2013 by means of a webinar.

- Working Groups: The Corrosion Office has a number of Working Integrated Product Teams to discuss and share corrosion information, such as the Corrosion Policy, Processes, Procedures, and Oversight; Communications and Outreach; and Science and Technology teams. Further, officials supporting weapon systems have working groups examining corrosion for their specific systems. For example, Air Force officials examining the use of specific gaskets on C-17 aircraft presented the project's results, including lessons learned, to the C-17 Corrosion Prevention Advisory Board. Furthermore, these Air Force officials explained that most major weapon systems have a Corrosion Prevention Advisory Board, which consists of a team of engineers, depot personnel, and industry officials, as a best practice to discuss technology issues related to corrosion and corrosion management for their weapon system.

- Personal Contacts: During interviews with project managers and project personnel, we found examples of sharing corrosion information through emails, phone calls, and coordination on joint projects. For example, Marine Corps corrosion officials stated that because they share equipment with the Army through acquisition and other processes, they are knowledgeable of Army lessons learned from corrosion projects.

Formal Methods to Share Lessons

DOD has established formal methods to share many lessons learned with officials working to prevent or mitigate corrosion of military equipment, such as through websites or databases. In 2003, the department established a DOD corrosion website[38] that includes an online library,

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[38]DOD's corrosion website is www.corrdefense.org.

information on submitting project plans, some nonsensitive final reports,[39] and a members-only section for sharing working-group findings. Additionally, project managers and project personnel stated that they post some information on lessons learned on service-specific corrosion websites, including the Air Force Corrosion Prevention and Control Office website and the Army Aviation and Missile Command Corrosion Program Office website. Further, according to corrosion officials and project managers, the final reports are being archived, as required, at DTIC. We also found lessons learned are shared in departmental databases, such as the Naval Surface Warfighter Center database.

DOD Does Not Have a Comprehensive Database to Share Lessons from All Completed Projects, Including Sensitive Information

DOD officials have methods to share some lessons from projects, such as information in final reports, but do not have a centralized and secure database in which corrosion personnel across DOD can access lessons from reports about all completed corrosion projects, including projects involving sensitive information. DOD has archives of final reports in DTIC, but the DTIC system does not include other information about corrosion projects, such as follow-on reports that contain information on the implementation of the projects. The DOD website has some final reports, but it does not post other information that is considered sensitive. The establishment of the website is cited as an accomplishment for one of the goals in the DOD strategic plan.[40] However, currently DOD has not consolidated all project data and outcomes in a way that is available and accessible to all relevant personnel.

DOD's strategic plan states that DOD and the military departments should use rapid and effective web-based strategies for communicating and sharing best practices, including a centralized database to capture corrosion-related technical information across the services to enhance communication, leverage problems, and minimize duplication. Also, DOD Instruction 5000.67 requires that the Corrosion Office's long-term strategy

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[39]Some of the reports have distribution limitations or include proprietary information.

[40]According to the strategic plan, the website enables the accomplishment of numerous objectives including supporting and improving communication, collaboration, and coordination within the corrosion community; increasing the effectiveness of corrosion prevention and control; research and operations identification and dissemination of lessons learned; developing, maintaining, and expanding the web-based information aggregation and sharing capabilities of the website; and maintaining a content-rich, collaborative enabled, on-line environment for all members.

for corrosion prevention and mitigation of military equipment provide for the implementation of programs, including supporting databases, to ensure a focused and coordinated approach throughout DOD to collect, review, reassess, and distribute information on relevant proven methods and products. Finally, Standards for Internal Control in the Federal Government states that federal program managers should have pertinent information distributed in a form and time frame that permits them to perform their duties efficiently.[41]

According to Corrosion Executives, project managers, and project personnel, DOD and the military departments could benefit from a coordinated, centralized approach to archive all relevant information, including sensitive information that should not be disclosed to the general public, on methods and products proven to prevent or mitigate corrosion of military equipment. Also, a Defense Science Board report on corrosion control stated "when properly implemented, lessons learned from the corrosion program will drive future design, acquisition, and performance specifications."[42] To meet its goal to share lessons throughout the department, DOD has begun work to develop a database that would contain relevant information, including lessons learned, on all projects and their outcomes—including sensitive or proprietary information. However, officials at the Corrosion Office stated they are in the early stages of developing the database and are unsure when it will be completed. For example, they are still considering how the information would be accessible in a secure way, such as through a nonpublic portal of its corrosion website or through another DOD portal. Until a comprehensive, centralized, and secure database is developed that includes lessons learned from all completed corrosion projects, including those with sensitive information, officials from DOD's corrosion community will not have full and complete information on lessons learned, including proven methods or products to prevent or mitigate corrosion of military equipment.

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[41]GAO, *Standards for Internal Control in the Federal Government,* GAO/AIMD-00-21.3.1 (Washington, D.C.: November 1999).

[42]Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, *Defense Science Board Report on Corrosion Control* (Washington, D.C.: October 2004).

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Conclusions

DOD relies on the outcomes of its corrosion projects to reduce the life-cycle costs of its military equipment through the timely sharing of information about successful projects with all relevant officials in DOD's corrosion community. Corrosion Office officials have provided assistance to project managers for the submission of required reports on whether specific corrosion-control technologies are effective; however, project managers have not consistently followed DOD's strategic plan regarding collecting and reporting information to verify whether all projects are achieving benefits other than the ROIs that were estimated in project plans. Without specific guidance to require that follow-on reports include details of measures of achievements other than ROI, including benefits, the Corrosion Office will be missing the opportunity to know whether equipment-related corrosion projects have achieved outcomes to prevent or mitigate corrosion. Further, the Corrosion Office has not consolidated information on projects' status, such as whether a project was recommended for transition to military departments' use or has been discontinued, and was unaware of which projects were discontinued. Without a mechanism or tool to assist in monitoring and consolidating status information about whether the technology or method demonstrated by each equipment-related corrosion project has transitioned to the military departments' use, the Corrosion Office and the Corrosion Executives may not have timely information about whether the corrosion projects produced proven methods and products to prevent the corrosion of military equipment. Also, the Corrosion Office may not have a complete understanding of the success of projects if the military departments do not have specific guidance for reporting the ROIs of discontinued projects, and therefore report the ROIs in varying ways. Finally, DOD has not consolidated all lessons learned in a way that is available and accessible to all relevant personnel. Until a comprehensive, centralized, and secure database is developed that includes lessons learned from all completed corrosion projects, officials from DOD's corrosion community will not have full and complete information on lessons learned, including proven methods or products to prevent or mitigate corrosion of military equipment.

Recommendations for Executive Action

We are making four recommendations to improve DOD's corrosion-prevention and control program:

To enhance DOD in its oversight of the status and potential benefits of its equipment-related corrosion projects, we recommend that the Under Secretary of Defense for Acquisition, Technology and Logistics require the Director, Corrosion Policy and Oversight Office, to

- Revise the *DOD Corrosion Prevention and Mitigation Strategic Plan* or other guidance to require that the military departments include in all follow-on reports the details of measures of achievement other than ROI, such as the features, results, and potential benefits of the project.

To enhance tracking of DOD's equipment-related corrosion projects, we recommend that the Under Secretary of Defense for Acquisition, Technology and Logistics require the Director, Corrosion Policy and Oversight Office, to

- develop a tool or mechanism to assist in monitoring and consolidating the status information for each equipment-related corrosion project about whether the demonstrated technology or method has transitioned to military departments' use.

To ensure consistent reporting for all equipment-related corrosion projects, we recommend that the Under Secretary of Defense for Acquisition, Technology and Logistics require the Director, Corrosion Policy and Oversight Office, to

- revise guidance to specify how project managers should report the ROI for discontinued projects.

To enhance planning for corrosion prevention and mitigation, we recommend that the Under Secretary of Defense for Acquisition, Technology and Logistics require the Director, Corrosion Policy and Oversight Office, to

- establish a time frame for completing the comprehensive and secure database so that all relevant officials of DOD's corrosion community have access to the proven technology methods, products, and other lessons learned from all corrosion projects to prevent or mitigate corrosion of military equipment.

Agency Comments and Our Evaluation

We provided a draft of this report to DOD for comment. In its written comments, which are reprinted in appendix III, DOD concurred with two of our four recommendations. DOD partially concurred with one recommendation, and based on additional information provided in its comments, we revised that recommendation. Finally, DOD did not concur with one recommendation.

DOD concurred with our second recommendation that the Director, Corrosion Policy and Oversight Office, enhance tracking of DOD's

equipment-related corrosion projects by developing a tool or mechanism to assist in monitoring and consolidating the status information for each equipment-related corrosion project about whether the demonstrated technology or method has transitioned to military departments' use. As DOD notes in its comments, the Corrosion Policy and Oversight Office will monitor transition status using the corrosion Engineering Resource Data Management (ERDM2) database program currently under development.   According to DOD, ERDM2 is designed to collect, classify, and file data on all aspects of corrosion projects and to provide the DOD corrosion community access to information and tailored status reports.

DOD concurred with our fourth recommendation that the Director, Corrosion Policy and Oversight, could enhance planning for corrosion prevention and mitigation by establishing a time frame for completing the comprehensive and secure database so that all relevant officials of DOD's corrosion community have access to the proven technology methods, products, and other lessons learned from all corrosion projects to prevent or mitigate corrosion of military equipment. DOD stated in its comments that the development of the comprehensive and secure ERDM2 data-management tool is underway and is a high priority. According to DOD, development and deployment will occur incrementally and simultaneously to ensure that needs of all stakeholders are met. DOD anticipates that the initial phase of ERDM2 will contain data from completed projects and will be in place by December 31, 2013.

DOD partially concurred with our third recommendation in the draft report that the Director, Corrosion Policy and Oversight Office, revise guidance to specify how the military departments' Corrosion Executives and project managers should report the ROI for discontinued projects to ensure consistent reporting for all equipment-related corrosion projects. In partially concurring with this recommendation, DOD stated that the military departments' Corrosion Executives do not actively execute projects or engage in the calculation of the ROI process, so the next revision of DOD's Corrosion Prevention and Mitigation Strategic Plan will address only how project managers will calculate and report ROI on discontinued projects to the Director, Corrosion Policy and Oversight. While we found that the military departments' Corrosion Executives review and coordinate through their respective chain of command to provide information on corrosion projects to the Director of the Corrosion Office, we agree that the military executives do not actively execute the corrosion projects or engage in the calculation of the ROI. Thus, we have revised the recommendation to include only the project managers.

DOD did not concur with our first recommendation that the Director, Corrosion Policy and Oversight Office, revise the *DOD Corrosion Prevention and Mitigation Strategic Plan* or other guidance to require that the military departments include in all follow-on reports the details of measurements of achievement other than ROI, such as the features, results, and potential benefits of the project. In its response, DOD stated that the *DOD Corrosion Prevention and Mitigation Strategic Plan* currently provides sufficient guidance in this regard and believes it is not necessary to revise this guidance. DOD cited instructions in section 3, appendix D of the strategic plan about the 2 year follow-on reporting, which is to include a focus on assessing the ROI computed at project completion, as well as other features and benefits of the projects. Additionally, this appendix accompanying the strategic plan includes instructions on completing and submitting a checklist, also regarded as the follow-on report, to fulfill the requirements. We noted in our report that the checklist for the follow-on report that shows items to be reviewed on the status of the projects allows project managers to check "yes" or "no" for each item, but project managers are not required to write details about any benefits of the project. During our review, we found that about three-fourths of the completed checklists for the follow-on reports were modified by project managers on their own accord to include some measures of achievement of completed projects, such as when outcomes prompted changes to military equipment specifications and standards. However, one-fourth of the follow-on reports did not include information about features and benefits of completed projects. Specifically, we found that 8 of 30 follow-on reports contained little to no narrative detail because there was no requirement to do so. While DOD's strategic plan provides instructions for the 2 year follow-on reporting, the plan with its accompanying instructions for completing the follow-on reports does not require that project managers include details about any benefits of the project. We maintain that DOD could enhance its oversight of corrosion projects by providing additional, specific guidance to require that follow-on reports include details of measures of achievements other than ROI, including project benefits, to allow the Corrosion Office to have additional information about whether equipment-related corrosion projects have achieved outcomes to prevent or mitigate corrosion.
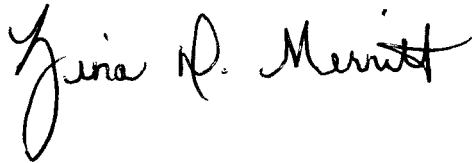
We are sending copies of this report to appropriate congressional committees; the Secretary of Defense; the Secretaries of the Army, Navy, and Air Force and the Commandant of the Marine Corps; the Director of the DOD Office of Corrosion Policy and Oversight; and other interested

parties. In addition, the report is available at no charge on the GAO website at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-5257 or merrittz@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made key contributions to this report are listed in appendix IV.

Zina D. Merritt
Director
Defense Capabilities and Management

Appendix I: Scope and Methodology

To determine the extent to which the Department of Defense (DOD) has ensured the submission of required reports for equipment-related corrosion projects, we reviewed the *DOD Corrosion Prevention and Mitigation Strategic Plan*[1] and its revised versions, and used the reporting milestones outlined in the plan to identify the types of reports required for each project. We originally received project documentation for 129 projects, from which we selected our sample. However, one project was eliminated because it was funded in fiscal year 2013. We obtained project information for 128 equipment-related corrosion demonstration projects funded by the DOD Corrosion Policy and Oversight Office (hereafter referred to as the Corrosion Office) for fiscal years 2005 through 2012. We requested and reviewed the project documentation—project proposals, final reports, and follow-on reports—to determine if the data and related reports met the Corrosion Office's reporting requirements. For the purposes of our work in reviewing projects funded in fiscal years 2005 through 2010, we considered a final or follow-on report to be submitted as required if the Corrosion Office had a copy of the report in its records system, and confirmed the accuracy with the Corrosion Control and Prevention Executives (hereafter referred to as Corrosion Executives). We did not consider the timeliness of the submitted reports. We received project documentation through May 15, 2013. Additionally, for follow-on reports, we could assess only the projects funded in fiscal years 2005 through 2007 because the DOD strategic plan's milestone requires submission of follow-on reports for completed projects within 2 years after the projects have been completed and transitioned to use within the military departments. We determined that the project-reporting data were sufficiently reliable for the purposes of determining the extent to which the military departments met the Corrosion Office's reporting requirements. We did not assess elements of the actual report. We interviewed officials from the Corrosion Office, as well as the Army, Navy, and Air Force Corrosion Executives, to understand the process of what reports are required and when; challenges and limitations, if any, in completing the reports; and how projects are tracked if required reports have not been submitted. Further, we interviewed these officials to determine why the required reports were not submitted. Also, we determined what actions, if any, they planned to take to complete the reports. Moreover, we selected

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[1]Corrosion Policy and Oversight Office, Department of Defense, *DOD Corrosion Prevention and Mitigation Strategic Plan*. The strategic plan was first issued in November 2004, and was subsequently revised in 2007, 2008, 2009, and in 2011.

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a nongeneralizable sample of 43 projects[2] for further review and conducted an in-depth analysis of the projects selected. We selected the sample using a random systematic approach. We ordered the population first by service, then by fiscal year, location, and project manager. Next we selected a random starting point and then selected every third project. Our nongeneralizable, sample-selection methodology ensured selection of a variety of projects over all fiscal years, locations, and services. We used a semistructured interview tool to obtain information from project managers and project personnel to understand reporting requirements and time frames as well as challenges and limitations, if any, that they had in completing the reports. We also reviewed prior GAO work on DOD's corrosion-prevention and mitigation program.[3]

To determine the extent to which DOD has collected the information needed to determine whether benefits and other measures have been achieved from equipment-related corrosion projects, we reviewed key documents, including DOD Instruction 5000.67[4] and DOD's strategic plan. We examined DOD Instruction 5000.67 to gain an understanding of the roles and responsibilities to develop procedures for corrosion planning and implementation, and to review, manage, and document project results. We examined DOD's strategic plan to gain an understanding of the department's strategy to justify funding for corrosion projects by verifying the initial investment of corrosion projects and guidance on collecting information to check on any changes to the assumptions used in the initial estimated return on investment (ROI) in order to compare, or

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[2]Our nongeneralizable sample-selection methodology ensured selection of a variety of projects over all fiscal years, locations, and services. Results from nongeneralizable samples cannot be used to make inferences about a population, because in a nongeneralizable sample some elements of the population being studied have no chance or an unknown chance of being selected as part of the sample.

[3]See GAO, *Defense Management: DOD Has a Rigorous Process to Select Corrosion Prevention Projects, but Would Benefit from Clearer Guidance and Validation of Returns on Investment*, GAO-11-84 (Washington, D.C.: Dec. 8, 2010); *Defense Management: The Department of Defense's Annual Corrosion Budget Report Does Not Include Some Required Information*, GAO-12-823R (Washington, D.C.: Sept. 10, 2012); *2013 Annual Report: Actions Needed to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits*, GAO-13-279SP (Washington, D.C.: Apr. 9, 2013), http://www.gao.gov/duplication/action_tracker/Corrosion_Prevention/action1; and *Defense Infrastructure: DOD Should Improve Reporting and Communication on Its Corrosion Prevention and Control Activities*, GAO-13-270 (Washington, D.C.: May 31, 2013).

[4]Department of Defense Instruction 5000.67, *Prevention and Mitigation of Corrosion on DOD Military-equipment and Infrastructure* (Feb. 1, 2010).

recompute, the ROI and determine whether the ROI is lower than expected, as expected, or better than expected. Finally, we examined guidance on internal controls[5] to identify relevant responsibilities and practices that could be used as criteria. We reviewed all follow-on reports provided by the Corrosion Office and the military departments, which included 30 follow-on reports on projects funded in fiscal years 2005 through 2008, to determine whether the military departments have collected and reported measures of achievement of their completed corrosion projects other than ROI, such as when outcomes prompt changes in specifications, standards, technical manuals, and other reference or guidance documents. We compared the amount of detail provided in the follow-on reports. Additionally, we interviewed officials from the Corrosion Office as well as the military departments' Corrosion Executives to understand whether and how they collect data in order to determine whether the estimated ROIs have been achieved. Additionally, from our nongeneralizable random systematic sample of 43 projects, we interviewed project managers and project personnel to gain an understanding of how they provide information on the status and the results of corrosion projects that have completed research and development, transitioned to a service's use, and been in use for 2 years. Specifically, we interviewed these officials to understand how they verify the initial investment of corrosion projects, including what the project's assumptions were, how the assumptions were tracked during the first few years of the project, and the extent to which the implementation affected the ROI recomputation. For projects that were still in the demonstration phase, or had just been transitioned to a service's use, we interviewed the officials to understand their plans to collect information to verify the initial investment.

To determine the extent to which DOD has tracked the status of equipment-related corrosion projects, we reviewed relevant law[6] to understand legislative requirements, including a long-term strategy and a coordinated research and development program for the prevention and mitigation of corrosion for new and existing military equipment, which includes a plan to transition new corrosion prevention technologies into operational systems. Further, we examined DOD Instruction 5000.67 to

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[5]GAO, *Standards for Internal Control in the Federal Government,* GAO/AIMD-00-21.3.1 (Washington, D.C.: November 1999).

[6]Section 2228 of Title 10 of the United States Code.

gain an understanding of the department's policy on the prevention and mitigation of corrosion on DOD military equipment as well as roles and responsibilities of the Corrosion Office and Corrosion Executives to collect, review, reassess, and distribute information on proven methods and products that are relevant to prevent corrosion of military equipment. We analyzed documentation for each of the 43 projects in our sample, specifically reviewing the project plans, final reports, and follow-on reports, to analyze variables, including assumptions, initial estimated ROI and the reassessed ROI, recommendations to transition to service use, project status, and benefits and outcomes other than the ROI, among others. We interviewed Corrosion Office officials to determine what status information is collected for each project, how such information is consolidated, and what analysis is done to oversee the status and outcomes of each project. Likewise, we interviewed Corrosion Executives to determine their approach to collect, review, reassess, and distribute information on proven methods and products that are relevant to prevent corrosion of military equipment. Specifically we interviewed these officials to gain an understanding on how project results were reviewed, managed, and documented.

To determine the extent to which DOD has identified, shared, and incorporated lessons learned from equipment-related corrosion projects into future planning to prevent or mitigate corrosion, we reviewed key documents, including relevant law[7] to understand legislative requirements, and DOD policy and guidance. For example, we examined DOD Instruction 5000.67 to understand the department's policy to ensure a focused and coordinated approach throughout DOD to collect, review, reassess, and distribute information on relevant proven methods and products. We also examined DOD's strategic plan to understand the department's guidance on using rapid and effective web-based strategies for communicating and sharing best practices, capturing corrosion-related technical information across the services, and to determine the requirements for lessons learned to be incorporated into project documentation, specifically the final report. Finally, we examined guidance on internal controls[8] to identify relevant responsibilities and practices that could be used as criteria. We analyzed all final reports to determine whether lessons learned were being included and the extent to

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[7]Section 2228 of Title 10 of the United States Code.

[8]GAO/AIMD-00-21.3.1.

which they were being incorporated into future planning and guidance. We interviewed Corrosion Office officials to learn about their efforts to develop a centralized database for project information that included lessons learned. We interviewed Corrosion Executives and their staffs to learn about how lessons learned are shared and incorporated. Additionally, from our nongeneralizable random systematic sample of 43 projects, we interviewed project managers and project personnel to gain an understanding of how lessons learned are collected, documented, shared, and incorporated into future corrosion planning. Specifically, we interviewed these officials to gain an understanding of what data are collected and how they are analyzed, archived, and disseminated across the department.

We visited or contacted the following offices during our review:[9]

Department of Defense

- Office of Corrosion Policy and Oversight

Air Force

- Air Force Corrosion Control and Prevention Executive
- Air Force Corrosion Prevention and Control Office, Robins Air Force Base, Georgia
- Air Force Materiel Command, Air Force Research Laboratory, Wright-Patterson Air Force Base, Ohio

Army

- Army Corrosion Control and Prevention Executive
- Army Research Lab, Aberdeen Proving Ground, Maryland
- Aviation and Missile Command Corrosion Program Office, Redstone Arsenal, Alabama
- Corpus Christi Army Depot, Texas
- Office of the Assistant Secretary of the Army, Acquisition, Logistics and Technology
- Tobyhanna Army Depot, Redstone Arsenal, Alabama
- U.S. Army Armament Research, Development and Engineering Center, Picatinny Arsenal, New Jersey

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[9]Unless otherwise specified, these organizations are located in or near Washington, D.C.

- U.S. Army Tank-Automotive Research, Development and Engineering Center, Michigan

Marine Corps

- Navy Corrosion Control and Prevention Executive
- Naval Surface Warfare Center, Carderock Division

Navy

- Navy Corrosion Control and Prevention Executive
- Naval Air Systems Command, Patuxent River Naval Air Station, Maryland
- Naval Sea Systems Command

We conducted this performance audit from July 2012 through September 2013 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Appendix II: Follow-on Report, also known as the Project Review Checklist

The *Department of Defense Corrosion Prevention and Mitigation Strategic Plan* includes the template of the follow-on or project review checklist for project managers to document the reassessed return on investment and other features and benefits of the equipment-related corrosion projects.

Figure 3: Project Review Checklist

Source: DOD.

Appendix III: Comments from the Department of Defense

OFFICE OF THE UNDER SECRETARY OF DEFENSE
3000 DEFENSE PENTAGON
WASHINGTON, DC 20301-3000

ACQUISITION,
TECHNOLOGY
AND LOGISTICS

Ms. Zina D. Merritt
Director
Defense Capabilities and Management
U.S. Government Accountability Office
441 G Street, NW
Washington, DC 20548

AUG 1 6 2013

Dear Ms. Merritt:

This is the Department of Defense (DoD) response to the Government Accountability Office (GAO) Draft Report, GAO-13-661, "DEFENSE MANAGEMENT: DOD Should Enhance Oversight of Equipment-Related Corrosion Projects," dated July 16, 2013 (GAO Code 351750.

We have reviewed GAO Draft Report, GAO-13-661 and concur with recommendations 2 and 4, non-concur with recommendation 1 and partially concur with recommendation 3. Written comments addressing each recommendation are provided as an enclosure to this letter. Although we do not concur with all recommendations, we have found this engagement beneficial and will consider the information contained in the GAO draft report when developing new or revising existing DoD corrosion prevention strategies in the future.

Sincerely,

Daniel J. Dunmire
Director,
DoD Corrosion Policy and Oversight

Enclosure:
As stated

GAO Draft Report Dated July 16, 2013
GAO-13-661 (GAO CODE 351750)

"DEFENSE MANAGEMENT: DOD SHOULD ENHANCE OVERSIGHT OF
EQUIPMENT-RELATED CORROSION PROJECTS,"

DEPARTMENT OF DEFENSE COMMENTS
TO THE GAO RECOMMENDATION

RECOMMENDATION 1: To enhance DoD in its oversight of the status and potential benefits of its equipment-related corrosion projects, the Government Accountability Office (GAO) recommends that the Under Secretary of Defense for Acquisition, Technology, and Logistics require the Director, Corrosion Policy and Oversight Office to revise Department of Defense (DOD) Corrosion Prevention and Control Strategic Plan or other guidance to require that the military departments include in all follow-on reports the details of measures of achievement other than return on investments (ROI), such as the features, results and potential benefits of the project.

DoD RESPONSE: Non-concur. The DoD Corrosion Prevention and Mitigation Strategic Plan currently provides sufficient guidance in this regard. Instructions for two-year follow-on reporting are contained in Appendix D. Section 3 states "...submit a project review to certify completion of implementation documentation requirements and to assess overall impact and return on investment. Focus on assessing the ROI computed at project completion, **as well as other features and benefits of the project**. Fill out the following checklist and submit to fulfill reporting requirements. Details regarding the checklist items are found in the paragraphs following the checklist." Revision of this guidance is not necessary.

RECOMMENDATION 2: To enhance tracking of DoD's equipment-related corrosion projects, the GAO recommends that the Under Secretary of Defense for Acquisition, Technology, and Logistics to require the Director, Corrosion Policy and Oversight Office to:

o   Develop a tool or mechanism to assist in monitoring and consolidating the status of information for each equipment-related corrosion project about whether the demonstrated technology or method has transitioned to military departments' use.

DoD RESPONSE: Concur. The Corrosion Policy and Oversight Office will monitor transition status using the corrosion Engineering Resource Data Management (ERDM2) database program currently under development. ERDM2 is designed to collect, classify and file data on all aspects of corrosion projects and to provide information access and tailored status reports to the DoD corrosion community.

RECOMMENDATION 3: To enhance tracking of DoD's equipment-related corrosion projects, the GAO recommends that the Under Secretary of Defense for Acquisition, Technology, and Logistics to require the Director, Corrosion Policy and Oversight Office to:

o   Revise guidance to specify how the military departments' Corrosion Executives and project managers should report ROI for discontinued projects.

DoD RESPONSE: Partially Concur.   Since the Military Departments' Corrosion Executives do not actively execute corrosion projects or engage in the calculation ROI process, the next revision of the Corrosion Prevention and Mitigation Strategic Plan will only address how project managers will calculate and report ROI on discontinued projects to the Director, Corrosion Policy and Oversight.

RECOMMENDATION 4: To enhance planning for corrosion prevention and mitigation, the GAO recommends that the Under Secretary of Defense for Acquisition, Technology, and Logistics require the Director, Corrosion Policy and Oversight Office to, establish a timeframe for completing the comprehensive and secure database so that all relevant officials of DoD's corrosion community have access to the proven technology methods, products and other lessons learned from all corrosion projects to prevent or mitigate corrosion of military equipment.

DoD RESPONSE: Concur. Development of the comprehensive and secure ERDM2 data management tool described in the response to recommendation 2 above is well underway and is a high priority undertaking. Development and deployment will occur incrementally and simultaneously to ensure the needs of all stakeholders will be met. The initial phase of ERDM2 will contain data from completed projects and will be in place by 31 December 2013.

Appendix IV: GAO Contact and Staff Acknowledgments

GAO Contact

Zina D. Merritt, (202) 512-5257 or merrittz@gao.gov

Staff Acknowledgments

In addition to the contact named above, Carleen Bennett, Assistant Director; Clarine Allen; James Ashley; Laura Czohara; Mark Dowling; Linda Keefer; Charles Perdue; Carol Petersen; Richard Powelson; Amie Steele; and John Van Schaik made key contributions to this report.

Related GAO Products

Defense Infrastructure: DOD Should Improve Reporting and Communication on Its Corrosion Prevention and Control Activities. GAO-13-270. Washington, D.C.: May 31, 2013.

Defense Management: Additional Information Needed to Improve Military Departments' Corrosion Prevention Strategies. GAO-13-379. Washington, D.C.: May 16, 2013.

Defense Management: The Department of Defense's Annual Corrosion Budget Report Does Not Include Some Required Information. GAO-12-823R. Washington, D.C.: September 10, 2012.

Defense Management: The Department of Defense's Fiscal Year 2012 Corrosion Prevention and Control Budget Request. GAO-11-490R. Washington, D.C.: April 13, 2011.

Opportunities to Reduce Potential Duplication in Government Programs, Save Tax Dollars, and Enhance Revenue. GAO-11-318SP. Washington, D.C.: March 1, 2011.

Defense Management: DOD Needs to Monitor and Assess Corrective Actions Resulting from Its Corrosion Study of the F-35 Joint Strike Fighter. GAO-11-171R. Washington, D.C.: December 16, 2010.

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