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United States Government Accountability Office

Report to the Subcommittee on Readiness and Management Support, Committee on Armed Services, U.S. Senate

September 2008

DOD BUSINESS SYSTEMS MODERNIZATION

Important Management Controls Being Implemented on Major Navy Program, but Improvements Needed in Key Areas

GAO

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DOD BUSINESS SYSTEMS MODERNIZATION

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Why GAO Did This Study

The Department of Defense (DOD) has long been challenged in implementing key information technology (IT) management controls on its thousands of business system investments. For this and other reasons, GAO has designated DOD's business systems modernization efforts as high-risk. One of the larger business system investments is the Department of the Navy's Enterprise Resource Planning (Navy ERP) program. Initiated in 2003, the program is to standardize the Navy's business processes, such as acquisition and financial management. It is being delivered in increments, the first of which is to cost about $2.4 billion over its useful life and be fully deployed in fiscal year 2013. GAO was asked to determine whether key IT management controls are being implemented on the program. To do this, GAO analyzed, for example, requirements management, economic justification, earned value management, and risk management.

What GAO Recommends

GAO is making recommendations to the Secretary of Defense aimed at improving cost and schedule estimating, earned value management, and risk management weaknesses. DOD largely agreed with GAO's recommendations and described actions planned or under way to address them.

What GAO Found

DOD has implemented key IT management controls on its Navy ERP program to varying degrees of effectiveness. To its credit, the control associated with managing system requirements is being effectively implemented. In addition, important aspects of other controls have at least been partially implemented, including those associated with economically justifying investment in the program and proactively managing program risks. Nevertheless, other aspects of these controls, as well as the bulk of what is needed to effectively implement earned value management, which is a recognized means for measuring program progress, have not been effectively implemented. Among other things, these control weaknesses have contributed to the more than 2-year schedule delay and the almost $600 million cost overruns already experienced on the program since it began, and they will likely contribute to future delays and overruns if they are not corrected. Examples of the weaknesses are provided below.

- Investment in the program has been economically justified on the basis of expected benefits that far exceed estimated costs ($8.6 billion versus $2.4 billion over a 20-year life cycle). However, important estimating practices, such as using historical cost data from comparable programs and basing the cost estimate on a reliable schedule baseline were not employed. While these weaknesses are important because they limit the reliability of the estimates, GAO's analysis shows that they would not have altered the estimates to the point of not producing a positive return on investment.

- Earned value management has not been effectively implemented. To its credit, the program office has elected to implement program-level earned value management. In doing so, however, basic prerequisites for effectively managing earned value have not been executed. In particular, the integrated master schedule was not derived in accordance with key estimating practices, and an integrated baseline review has not been performed on any of the first increment's releases.

- A defined process for proactively avoiding problems, referred to as risk management, has been established, but risk mitigation strategies have not been effectively implemented for all significant risks, such as those associated with data conversion and organizational change management, as well the risks associated with the above-cited weaknesses.

The reasons that program management and oversight officials cited for these practices not being executed range from the complexity and challenges of managing and implementing a program of this size to limitations in the program office's scope and authority. Notwithstanding the effectiveness with which important aspects of several controls have been implemented, the above-cited weaknesses put DOD at risk of investing in a system solution that does not optimally support corporate mission needs and mission performance, and meet schedule and cost commitments.

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Abbreviations

BEA	business enterprise architecture
BTA	Business Transformation Agency
CIO	Chief Information Officer
DBSMC	Defense Business Systems Management Committee
DOD	Department of Defense
DON	Department of the Navy
EVM	earned value management
FOC	full operational capability
GCSS-MC	Global Combat Support System–Marine Corps
IOC	initial operational capability
IRB	investment review board
IT	information technology
MDA	milestone decision authority
NAVAIR	Naval Air Systems Command
NAVSEA	Naval Sea Systems Command
NAVSUP	Naval Supply Systems Command
Navy ERP	Navy Enterprise Resource Planning
NTCSS	Naval Tactical Command Support System
OMB	Office of Management and Budget
PMB	performance measurement baseline
SAP	Systems Applications and Products
SPAWAR	Space and Naval Warfare Systems Command
TC-AIMS II	Transportation Coordinators' Automated Information for Movements System

United States Government Accountability Office
Washington, DC 20548

September 8, 2008

The Honorable Daniel K. Akaka
Chairman
The Honorable John Thune
Ranking Member
Subcommittee on Readiness and Management Support
Committee on Armed Services
United States Senate

The Honorable John Ensign
United States Senate

For decades, the Department of Defense (DOD) has been challenged in modernizing its timeworn business systems.[1] In 1995, we designated DOD's business systems modernization program as high risk, and continue to do so today.[2] Our reasons include the modernization's large size, complexity, and its critical role in addressing other long-standing transformation and financial management challenges. Other reasons are that DOD has yet to institutionalize key system modernization management controls, and it has not demonstrated the ability to consistently deliver promised system capabilities and benefits on time and within budget.

Nevertheless, DOD continues to invest billions of dollars in thousands of business systems, including about a hundred that the department has labeled as business transformational programs, 12 of which account for about 50 percent of these programs' costs. The Navy Enterprise Resource Planning (Navy ERP) program is one such program. Initiated in 2003, Navy ERP is to standardize the Navy's acquisition, financial, program management, maintenance, plant and wholesale supply, and workforce management business processes across its dispersed organizational environment. As envisioned, the program consists of a series of major increments, the first of which includes three releases and is expected to cost approximately $2.4 billion over its 20-year life cycle and to be fully operational in fiscal year 2013.

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[1]Business systems are information systems, including financial and nonfinancial systems, that support DOD business operations, such as civilian personnel, finance, health, logistics, military personnel, procurement, and transportation.

[2]GAO, *High-Risk Series: An Update*, GAO-07-310 (Washington, D.C.: January 2007).

As agreed, our objective was to determine whether the Department of the Navy (DON)[3] is effectively implementing information technology (IT) management controls on Navy ERP. To accomplish this, we focused on the program's first increment by analyzing a range of program documentation and interviewing cognizant officials relative to the following management areas: architectural alignment, economic justification, earned value management (EVM), requirements management, and risk management. We conducted this performance audit from June 2007 to September 2008, 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 objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective. Additional details on our objective, scope, and methodology are in appendix I.

Results in Brief

DOD has implemented key IT management controls on its Navy ERP program to varying degrees of effectiveness. To its credit, one of the controls has been fully implemented; important aspects of other controls have not. Collectively, these management controls are to ensure that a given system investment represents the right solution to filling a mission need, meaning that the system is defined to (1) minimize overlap and duplication and maximize interoperability with related systems and (2) produce mission benefits commensurate with costs over its useful life. The controls are also to ensure that the system is acquired and deployed the right way, meaning that it is done in a way to maximize the chances of delivering defined system capabilities and benefits on time and within budget. Given that deployment of Navy ERP is more than 2 years behind schedule and is to cost about $570 million[4] more than was originally envisioned, these goals have already not been fully met, in part because DOD program management and oversight entities have not fully implemented several key IT management controls. As a result, the department has yet to adequately demonstrate that the program's first increment, as it has been defined, is the right solution, and it is likely that

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[3]The Department of the Navy is a major component of DOD, consisting of two uniformed services: the Navy and the Marine Corps.

[4]This amount is the difference between the September 2007 estimated life cycle cost of $2,445.0 million and the September 2003 estimated life cycle cost of $1,873.1 million.

the department will continue to add to the program's cost overruns and schedule delays that the program has already experienced to date. The strengths and weaknesses associated with each of the IT management controls that we evaluated are described here:

- Navy ERP compliance with DOD's federated business enterprise architecture (BEA) has not been sufficiently demonstrated. To its credit, the program office followed DOD's architecture compliance assessment guidance and used the related assessment tool. However, this guidance and tool do not adequately provide for addressing all relevant aspects of architectural compliance. Specifically, the program's compliance assessment (1) did not include all relevant architecture products, such as those that describe technical and system elements; (2) was not used to identify potential areas of duplication across programs; and (3) did not address compliance with the DON enterprise architecture. These important steps were not performed because of policy, guidance, and tool limitations, and because aspects of the corporate BEA and the DON enterprise architecture, which are both major components of DOD's federated BEA, have yet to be sufficiently defined to permit thorough compliance determinations in these areas. In addition, program oversight and approval authorities did not validate the program office's compliance assessments. As a result, the department does not have a sufficient basis for knowing if Navy ERP has been defined to minimize overlap with, and duplication of other programs' functions, and is being defined and designed to maximize interoperability among related programs.

- Investment in Navy ERP has been economically justified on the basis of expected life cycle benefits that far exceed estimated life cycle costs ($8.6 billion versus $2.4 billion over a 20-year life cycle). However, these benefit estimates have not been subject to analysis of how uncertainty in assumptions and data could impact them, as prescribed in relevant guidance. According to program officials, such uncertainty analysis is not warranted because they have taken and continue to take steps to validate the assumptions and the data, such as using the latest budget data associated with retiring legacy systems, and monitoring changes to the systems' retirement dates. While these steps are positive, they do not eliminate the need for uncertainty analysis. Accordingly, we assessed key uncertainty variables and found that while the inherent uncertainty in the estimates would reduce expected savings, the reduction would be small relative to a total benefit estimate of $8.6 billion.

With respect to the cost estimate, our analysis showed that it was not derived using all key estimating practices contained in relevant guidance. For example, the estimate was not grounded in a historical record of

comparable data from similar programs and was not based on a reliable schedule baseline, which are both necessary to having a cost estimate that can be considered credible and accurate. These practices were not employed for various reasons, including DOD's lack of historical data from similar programs and the lack of an integrated master schedule for the program's first increment that includes all three releases. Notwithstanding the fact that these limitations could materially increase the $2.4 billion cost estimate, it is nevertheless unlikely that they would increase the cost estimate to a level close to the uncertainty-adjusted benefit expectations. Therefore, we have no reason to believe that Navy ERP will not produce a positive return on investment.

- EVM, which is a means for determining and disclosing actual program performance in comparison with estimates, is not being effectively implemented in Navy ERP. To its credit, the program office has elected to implement program-level EVM.[5] In doing so, however, basic EVM activities have not been executed, which has produced, and will likely continue to produce, actual program costs and schedules that do not track close to estimates. For example, an integrated baseline review, which is to verify that the program's costs and schedule are reasonable given the program's scope of work and associated risks, has not been performed on any of the first increment's releases. According to program officials, this is because of the time it took to establish program-level EVM capabilities and because of their focus on deploying and stabilizing the first release. However, they recently stated that one has been tentatively scheduled for August 2008. By not having an integrated master schedule that has been subject to a baseline review, as well as not employing other industry standards as discussed in this report, Navy ERP will be challenged in implementing EVM effectively, and cost overruns and lengthy schedule delays beyond those already experienced by the program will likely occur. Our analysis of the latest estimate for completing just the budgeted development work for all three releases, which is about $844 million, shows that this estimate will most likely have an overrun of about $152 million.

- An important requirements management activity has been effectively implemented in Navy ERP. Specifically, the program office has ensured that system requirements for the first release are traceable, as evidenced by our analysis of 60 randomly selected system-level requirements in

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[5]Program-level means that EVM covers all aspects of the program, regardless of whether they are performed by the government or the contractor. In contrast, EVM has historically been implemented on a contract-by-contract basis, and has not included government performed work.

which we confirmed that 58 are traceable backward to operational requirements and forward to design specifications and test results. Such traceability is important because it increases the chances of delivering a system that performs as intended. Our analysis of requirements in this sample also confirmed that system requirements that had been reallocated from the first release to the other releases were traceable, thus demonstrating traceability among product releases.

- The program office has defined a process for proactively managing risks that reflects key practices governing how this IT management control should be performed. However, it has not effectively implemented this process for all identified risks. In particular, steps taken to mitigate the risks associated with converting data from existing systems to the new system and positioning user organizations for the operational changes associated with the new system were not effective. According to program officials, these mitigation strategies could not be effectively implemented because the program office does not have the authority to compel the user organizations to execute their part of the mitigation strategy. As a result, the first user organization to receive the Navy ERP experienced significant problems during recent operational testing, and these problems will take additional time and resources to correct. In addition, not all known risks have been captured in the risk inventory. For example, the risks associated with the two above discussed control weaknesses (not having adequately demonstrated the program's architectural alignment and not having implemented program-level EVM according to industry practices) are not included in the risk inventory and are thus not being disclosed and addressed. This is important because not having effectively addressed such risks has contributed to schedule delays and will likely contribute to more cost and schedule shortfalls.

Notwithstanding the effectiveness with which several program management controls have been implemented on Navy ERP, the above-cited weaknesses in implementing other management controls put DOD at risk of investing in a system solution that does not optimally support corporate mission needs and mission performance and continuing to fall short of program schedule and cost commitments. Accordingly, we are making recommendations to the Secretary of Defense aimed at addressing the cost and schedule estimating, EVM, and risk management weaknesses, thereby better ensuring that the program is managed to deliver the right solution, the right way. We are not making recommendations in this report for addressing the architecture compliance weaknesses because we recently completed other work that is more broadly focused on this management control across multiple programs.

In written comments on a draft of this report, signed by the Deputy Under Secretary of Defense (Business Transformation) and reprinted in appendix II, the department stated that it concurred with two, and partially concurred with two, of our four recommendations. Further, it stated that it has taken steps to address some of our recommendations, adding that it is committed to implementing recommendations that contribute to the program's success.

In partially concurring with two of the recommendations, DOD concurred with most aspects of both. Nevertheless, for our recommendation aimed at improving the program's cost estimates, it stated that it did not concur with one aspect—ensuring that future cost estimates reflect the risk of not having cost data for comparable programs. In doing so, DOD stated that while the program had limited comparable data on which to base the program's cost estimate, it had accounted for this limitation in the cost estimate's uncertainty analysis. We do not agree that this risk was reflected in the uncertainty analysis. We examined this analysis as part of our review and found that it did not recognize this risk. Moreover, DOD's comments did not include any evidence to the contrary.

In addition, for our recommendation aimed at improving the program's integrated master schedule, the department partially concurred with one of the five components of the recommendation—defining a critical path that incorporates all three releases of the system. In doing so, DOD stated what our report already recognized, namely that the schedule reflects a separate critical path for each release and that this is due to the size and complexity of the releases. However, DOD offers no new information in its comments. Further, our report also recognizes that to be successful, large and complex programs that involve thousands of activities need to ensure that their schedules integrate these activities. In this regard, we support the department's commitment to explore the feasibility of implementing this part of our recommendation.

While concurring with all components of our other two recommendations, the department nevertheless provided comments relative to the program's use of EVM to explain why Release 1.0 of the system was not subject to an integrated baseline review. For several reasons discussed in the agency comments section of this report, we do not agree with these additional comments. In addition, the department's comments described actions planned or under way to address our recommendations. If fully and properly implemented, DOD's described actions should go a long way in addressing the weaknesses that we identify in the report.

Background

DON's primary mission is to organize, train, maintain, and equip combat-ready naval forces capable of winning the global war on terrorism and any other armed conflict, deterring aggression by would-be foes, preserving freedom of the seas, and promoting peace and security. To support this mission, DON performs a variety of interrelated and interdependent business functions (e.g., acquisition and financial management), relying heavily on IT systems. In fiscal year 2008, DON's budget for business systems and associated infrastructure was about $2.7 billion, of which $2.2 billion was allocated to operations and maintenance of existing systems and the remaining $500 million to systems in development and modernization. Of the approximately 3,000 business systems that DOD reports in its current inventory, DON accounts for 904, or about 30 percent, of the total. Navy ERP is one such system investment.

Navy ERP: A Brief Description

In July 2003, the Assistant Secretary of the Navy for Research, Development, and Acquisition established Navy ERP to "converge" four separate pilot programs that were under way at four separate Navy commands.[6] This program is to leverage a commercial, off-the-shelf software known as an enterprise resource planning product. Such products consist of multiple, integrated functional modules that perform a variety of business-related tasks, such as acquisition and financial management. Table 1 provides a brief description and status of each of the pilots.

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[6]These commands are Naval Air, Naval Sea, Space and Naval Warfare, and Naval Supply Systems.

Table 1: Description and Status of the Navy ERP Pilots

Pilot	Description and status
SIGMA	Deployed at Naval Air Systems Command (NAVAIR)[a] to support and link such business functions as program management, contracting, financial, and human resources management. It was retired in the first quarter of fiscal year 2008.
CABRILLO	Deployed at Space and Naval Warfare Systems Command (SPAWAR)[b] to support Navy Working Capital Fund financial management. It is to be retired in fiscal year 2010.
NEMAIS	Deployed at Naval Sea Systems Command (NAVSEA)[c] to support regional maintenance, including intermediate-level maintenance[d] management and human resources. It is to be retired in fiscal year 2011.
SMART	Deployed at Naval Supply Systems Command (NAVSUP)[e] and NAVAIR to support national and local supply management, intermediate-level maintenance management and to interface with aviation depots. It was retired in fiscal year 2005.

Source: GAO analysis of DON data.

[a]NAVAIR is responsible for developing, delivering, and supporting aircraft and weapons used by sailors and marines.

[b]SPAWAR is responsible for developing, delivering, and supporting specialized command and control technologies, business information technology, and space capabilities.

[c]NAVSEA is responsible for acquiring and maintaining the Navy's ships and submarines.

[d]Intermediate-level maintenance is for repair or maintenance of items that do not have to go to the depot level for major work but cannot be maintained or repaired at the organizational level.

[e]NAVSUP is responsible for supply, fuel, and transportation, as well as other logistics programs.

According to DOD, Navy ERP is to address the Navy's long-standing problems related to financial transparency and asset visibility. Specifically, the program is intended to standardize the Navy's acquisition, financial, program management, maintenance, plant and wholesale supply, and workforce management business processes across its dispersed organizational components. When the program is fully implemented, it is to support over 86,000 users.

Navy ERP is being developed in a series of increments using the Systems Applications and Products (SAP) commercial software package, augmented as needed by customized software. SAP consists of multiple, integrated functional modules that perform a variety of business related tasks, such as finance and acquisition. The first increment, called Template 1, is currently the only funded portion of the program and consists of three releases: 1.0 Financial and Acquisition, 1.1 Wholesale and Retail Supply, and 1.2 Intermediate-Level Maintenance. Release 1.0 is the largest of the three releases in terms of the functional requirements being

addressed. Specifically, it is to provide about 56 percent of Template 1 requirements. See table 2 for a description of these releases.

Table 2: Navy ERP Template 1 Releases

Release	Functionality
1.0 Financial and Acquisition	General Fund and Navy Working Capital Fund finance applications, such as billing, budgeting, and cost planning.
	Acquisition applications, such as activity based costing, contract awards, and budget exhibits.
	Workforce management applications, such as personnel administration, and training and events management.
1.1 Wholesale and Retail Supply	Wholesale applications, such as supply and demand planning, order fulfillment, and supply forecasting.
	Retail supply applications, such as inventory management, supply and demand processing, and warehouse management.
1.2 Intermediate-Level Maintenance	Maintenance applications, such as maintenance management, quality management, and calibration management.

Source: GAO analysis of DON data.

DON estimates the life cycle cost for the program's first increment to be about $2.4 billion, including about $1 billion for acquisition, and $1.4 billion for operations and maintenance. The life cycle cost of the entire program has not yet been determined because future increments have not been defined. The program office reported that approximately $400 million was spent from fiscal year 2004 through fiscal year 2007 on the first increment. For fiscal year 2008, about $200 million is planned to be spent.

Program Oversight and Management Roles and Responsibilities

To manage the acquisition and deployment of Navy ERP, DON established a program management office within the Program Executive Office for Executive Information Systems. The program office manages the program's scope and funding and is responsible for ensuring that the program meets its objectives. To accomplish this, the program office is responsible for key program management areas, such as architectural alignment, economic justification, earned value management, requirements management, and risk management. In addition, various DOD and DON organizations share program oversight and review activities. A listing of key entities and their roles and responsibilities is in table 3.

Table 3: Organizations Responsible for Navy ERP Oversight and Management

Entity	Roles and responsibilities
Under Secretary of Defense for Acquisition, Technology, and Logistics	Serves as the milestone decision authority (MDA), which according to DOD, has overall responsibility for the program, to include approving the program to proceed through its acquisition cycle on the basis of, for example, the acquisition plan, an independently evaluated economic analysis, and the Acquisition Program Baseline.
Assistant Secretary of the Navy, Research, Development, and Acquisition	Serves as DON's oversight organization for the program, to include enforcement of Under Secretary of Defense for Acquisition, Technology, and Logistics policies and procedures.
Department of the Navy, Program Executive Office for Executive Information Systems	Oversees a portfolio of large-scale projects and programs designed to enable common business processes and provide standard capabilities, to include reviewing the acquisition plan, economic analysis, and the Acquisition Program Baseline prior to approval by the MDA.
Department of the Navy Chief Information Officer (CIO)	Supports the department's planning, programming, budgeting, and execution processes by ensuring that the program has achievable and executable goals and conforms to financial management regulations, and DON, DOD, and federal IT policies in several areas (e.g., security, architecture, and investment management); works closely with the program office during milestone review assessments.
Office of the Secretary of Defense, Office of the Director for Program Analysis and Evaluation	Verifies and validates the reliability of cost and benefit estimates found in economic analyses and provides its results to the MDA.
Naval Center for Cost Analyses	Performs independent costs estimates.
Defense Business Systems Management Committee (DBSMC)	Serves as the highest ranking governance body for business systems modernization activities and approves investments costing more than $1 million, as, for example, being compliant with the BEA.
Investment Review Board (IRB)	Reviews business system investments and has responsibility for recommending certification for all business system investments costing more than $1 million that are asserted as compliant with the BEA.
Business Transformation Agency (BTA)	Coordinates business transformation efforts across DOD and supports the IRBs and DBSMC.
Navy ERP Program Management Office	Performs day-to-day program management and, as such, is the single point of accountability for managing the program's objectives through development, deployment, and sustainment.

Source: DOD.

Overview of Navy ERP's Status

The first increment of Navy ERP is currently in the production and deployment phase of the defense acquisition system.[7] The system consists of five key program life cycle phases and three related milestone decision points. These five phases and related milestones, along with a summary of

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[7] The defense acquisition system is a framework-based approach that is intended to translate mission needs and requirements into stable, affordable, and well-managed acquisition programs.

key program activities completed during or planned for each phase, are as follows:

1. *Concept Refinement:* The purpose of this phase is to refine the initial system solution (concept) and create a strategy for acquiring the solution. This phase began in July 2003, at which time DON began to converge the four pilot programs into Navy ERP and developed its first cost estimate in September 2003. This phase of the program was combined with the next phase, thus creating a combined Milestone A/B decision point.

2. *Technology Development:* The purpose of this phase is to determine the appropriate set of technologies to be integrated into the investment solution by iteratively assessing the viability of the various technologies while simultaneously refining user requirements. During the combined Concept Refinement and Technology Development phase, the program office prepared a concept of operations and operational requirements document; performed an analysis of alternatives, business case analysis, and economic analysis; and established its first Acquisition Program Baseline. It also selected SAP as the commercial off-the-shelf ERP software. The combined phase was completed in August 2004, when the MDA approved Milestone A/B to allow the program to move to the next phase.

3. *System Development and Demonstration:* The purpose of this phase is to develop a system and demonstrate through developer testing that the system can function in its target environment. This phase was completed in September 2007, when Release 1.0 passed development testing and its deployment to NAVAIR began. This was 17 months later than the program's original schedule set in August 2004 but on time according to the revised schedule set in December 2006.

    In September 2004, the program office awarded a $176 million system integration contract to BearingPoint for full system design, development, and delivery using SAP's off-the-shelf product and related customized software. In January 2006, the program office (1) reduced the contractor's scope of work from development and integration of the first increment to only development of the first release and (2) assumed responsibility and accountability for overall system integration. According to the program office, reasons for this change included the need to change the development plan to reflect improvements in the latest SAP product released and the lack of authority by the contractor to adjudicate and reconcile differences among the various Navy user organizations (i.e., Navy commands).

In December 2006, the program office revised its Acquisition Program Baseline to reflect an increase of about $461 million in the life cycle cost estimate due, in part, to restructuring the program (e.g., changing the order of the releases, changing the role of system integrator from contractor to the program office) and resolving problems related to, among other things, converting data from legacy systems to run on Navy ERP and establishing interfaces between legacy systems and Navy ERP. In addition, the program office awarded a $151 million contract for Release 1.1 and 1.2 configuration and development to IBM in June 2007. In September 2007, prior to entering the next phase, the program revised its Acquisition Program Baseline again to reflect a $9 million decrease in the life cycle cost estimate and a 5-month increase in its program schedule. Soon after, the MDA approved Milestone C to move to the next phase.

4. *Production and Deployment:* The purpose of this phase is to achieve an operational capability that satisfies the mission needs, as verified through independent operational test and evaluation, and to implement the system at all applicable locations. This phase began in September 2007, focusing first on achieving initial operational capability (IOC) of Release 1.0 at NAVAIR by May 2008. This date is 22 months later than the baseline established for Milestone A/B in August 2004, and 4 months later than the new baseline established in September 2007. According to program documentation, these delays were due, in part, to challenges experienced at NAVAIR in converting data from legacy systems to run on the new system and implementing new business procedures associated with the system.

In light of the delays at NAVAIR in achieving IOC, the deployment schedules for the other commands were also revised. Specifically, Release 1.0 is still to be deployed at NAVSUP on October 2008, but Release 1.0 deployment at SPAWAR is now scheduled 18 months later than planned (October 2009), and deployment at NAVSEA general fund and Navy Working Capital Fund is now scheduled to be 12 months later than planned (October 2010 and 2011, respectively). Because of the Release 1.0 delays, Release 1.1 is now planned for deployment at NAVSUP 7 months later than planned (February 2010). Release 1.2 is still scheduled to be released at Regional Maintenance Centers in October 2010.

The program office is currently in the process of again re-baselining the program, and DON plans to address any cost overruns through reprogramming of fiscal year 2008 DON funds.[8] It estimates that this phase will be completed with full operational capability (FOC)[9] by August 2013 (26 months later than the baseline established in 2004, and 5 months later than the re-baseline established in September 2007).

5. *Operations and Support:* The purpose of this phase is to operationally sustain the system in the most cost-effective manner over its life cycle. In this phase, the program plans to provide centralized support to its users across all system commands. Each deployment site is expected to perform complementary support functions, such as data maintenance.

Overall, Increment 1 was originally planned to reach FOC in fiscal year 2011, and its estimated life cycle cost was about $1.87 billion.[10] The estimate was later baselined[11] in August 2004 at about $2.0 billion.[12] In December 2006 and again in September 2007, the program was re-baselined. FOC is now planned for fiscal year 2013, and the estimated life cycle cost is about $2.4 billion (31 percent increase over the original

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[8]Congressional defense committees have established reprogramming guidelines, including setting dollar thresholds that direct DOD to seek the prior approval of the committees before executing the reprogramming of appropriated funds. In accordance with these guidelines, DOD's financial management regulation provides that DOD does not need congressional committee approval when the amount to be reprogrammed falls below certain thresholds (referred to as a "below-threshold reprogramming"). As relevant here, as of fiscal year 2005, the threshold is $10 million or 20 percent of the program's appropriation, whichever is less. To fund shortfalls in Navy ERP, DON plans to reprogram amounts below this threshold from other programs.

[9]FOC means that the system has been successfully deployed in all intended locations.

[10]This 2003 estimate, which was prepared to assist in budget development and support the Milestone A/B approval, was for development, deployment, and sustainment costs in fiscal years 2003 through 2021.

[11]According to DOD's acquisition guidebook, an Acquisition Program Baseline is a program manager's estimated cost, schedule, and performance goals. Goals consist of objective values, which represent what the user desires and expects, and threshold values, which represent acceptable limits. When the program manager determines a current cost, schedule or performance threshold value will not be achieved, the MDA must be notified, and a new baseline developed, reviewed by decision makers, and, if the program is to continue, approved by the MDA.

[12]According to the August 2004 Acquisition Program Baseline, this estimate is for acquisition, operations, and support for fiscal years 2004 through 2021.

estimate).[13] Key activities for each phase are depicted in figure 1, changes in the deployment schedule are depicted in figure 2, and cost estimates are depicted in figure 3.

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[13]According to the September 2007 Acquisition Program Baseline, this estimate is for acquisition, operations, and support for fiscal years 2004 through 2023.

Figure 1: Navy ERP Time Line

Phase		
Concept refinement and technology development	Program established	
System development and demonstration	Template 1 contract awarded / Template 1 contract rescoped to Release 1.0 / Re-baselined / Releases 1.1 and 1.2 contract awarded / Re-baselined	
Production and deployment	IOC ———— FOC / IOC ———— FOC	

Fiscal year: 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

Legend:
- Activity prior to the 2004 plan
- 2004 plan
- 2007 plan

Source: GAO analysis of DON data.

Figure 2: Navy ERP Milestones for Beginning Deployment

Release		2007	2008	2009	2010	2011	2012
1.0 Financial and Acquisition	NAVAIR						
	NAVSUP						
	SPAWAR						
	NAVSEA for General Fund						
	NAVSEA for Working Capital Fund						
1.1 Wholesale and Retail Supply	NAVSUP						
1.2 Intermediate-Level Maintenance	Regional Maintenance Centers						

Fiscal year

♦ 2007 plan

◯ 2008 plan
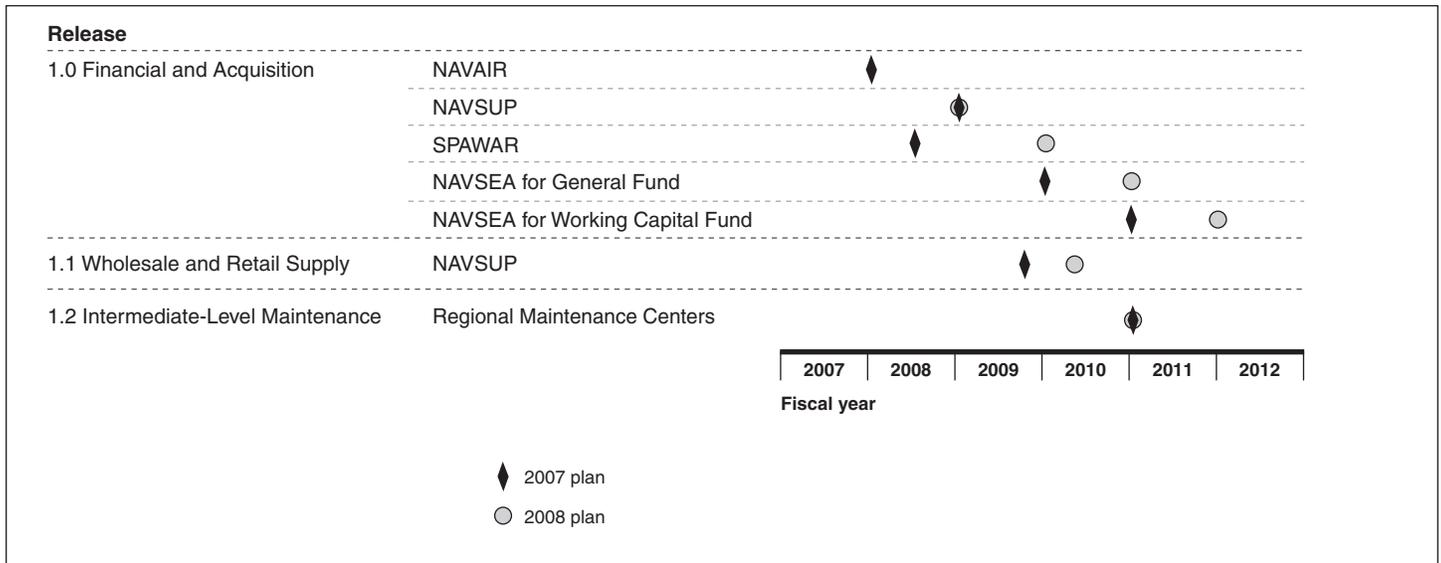
Source: GAO analysis of DON data.

Figure 3: Navy ERP Life Cycle Cost Estimates in Fiscal Years 2003, 2004, and 2007

Dollars in billions

Fiscal year	Dollars in billions
2003	$1.87
2004	$1.99
2007	$2.44

Fiscal year
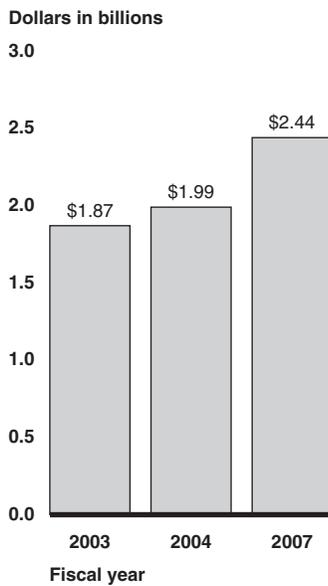
Source: GAO analysis of DON data.

Use of IT Acquisition Management Controls Maximizes Chances for Success

IT acquisition management controls are tried and proven methods, processes, techniques, and activities that organizations define and use to minimize program risks and maximize the chances of a program's success. Using these controls can result in better outcomes, including cost savings, improved service and product quality, and a better return on investment. For example, two software engineering analyses of nearly 200 systems acquisition projects indicate that teams using systems acquisition controls that reflected best practices produced cost savings of at least 11 percent over similar projects conducted by teams that did not employ the kind of rigor and discipline embedded in these practices.[14] In addition, our research shows that these controls are a significant factor in successful acquisition outcomes, including increasing the likelihood that programs and projects will be executed within cost and schedule estimates.[15]

We and others have identified and promoted the use of a number of IT acquisition management controls associated with acquiring IT systems.[16] See table 4 for a description of several of these activities.

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[14]Donald E. Harter, Mayuram S. Krishnan, and Sandra A. Slaughter, "Effects of Process Maturity on Quality, Cycle Time, and Effort in Software Product Development," *Management Science*, 46, no. 4 (2000); and Bradford K. Clark, "Quantifying the Effects of Process Improvement on Effort," *IEEE Software* (November/December 2000).

[15]GAO, *Information Technology: DOD's Acquisition Policies and Guidance Need to Incorporate Additional Best Practices and Controls*, GAO-04-722 (Washington, D.C.: July 30, 2004).

[16]GAO-04-722.

Table 4: Description of Business System IT Acquisition Management Controls

Business system acquisition practice	Description
Architectural alignment To ensure that the acquisition is consistent with the organization's enterprise architecture.	Architectural alignment is the process for analyzing and verifying that the proposed architecture of the system being acquired is consistent with the enterprise architecture for the organization acquiring the system. Such alignment is needed to ensure that acquired systems can interoperate and are not unnecessarily duplicative of one another.
Economic justification To ensure that system investments are economically justified.	Economic justification is the process for ensuring that acquisition decisions are based on reliable analyses of the proposed investment's likely costs versus benefits over its useful life, as well as an analysis of the risks associated with actually realizing the acquisition's forecasted benefits for its estimated costs. Economic justification is not a one-time event but rather is performed throughout an acquisition's life cycle in order to permit informed investment decision making.
Earned value management To ensure that actual progress against cost and schedule expectations is being measured.	EVM is a tool that integrates the technical, cost, and schedule parameters of a contract and measures progress against them. During the planning phase, an integrated program baseline is developed by time phasing budget resources for defined work. As work is performed and measured against the baseline, the corresponding budget value is "earned." Using this earned value metric, cost and schedule variances, as well as cost and time to complete estimates, can be determined and analyzed.
Requirements management To ensure that requirements are traceable, verifiable, and controlled.	Requirements management is the process for ensuring that the requirements are traceable, verifiable, and controlled. Traceability refers to the ability to follow a requirement from origin to implementation and is critical to understanding the interconnections and dependencies among the individual requirements and the impact when a requirement is changed. Requirements management begins when the solicitation's requirements are documented and ends when system responsibility is transferred to the support organization.
Risk management To ensure that risks are identified and systematically mitigated.	Risk management is the process for identifying potential acquisition problems and taking appropriate steps to avoid their becoming actual problems. Risk management occurs early and continuously in the acquisition life cycle.

Source: GAO.

Prior GAO Reviews Have Identified IT Acquisition Management Control Weaknesses on DOD Business System Investments

We have previously reported[17] that DOD has not effectively managed a number of business system investments. Among other things, our reviews of individual system investments have identified weaknesses in such things as architectural alignment and informed investment decision making, which are also the focus areas of the Fiscal Year 2005 Defense Authorization Act business system provisions.[18] Our reviews have also identified weaknesses in other system acquisition and investment management areas—such as EVM, economic justification, requirements management, and risk management.

In July 2007, we reported that the Army's approach for investing about $5 billion over the next several years in its General Fund Enterprise Business System, Global Combat Support System-Army Field/Tactical,[19] and Logistics Modernization Program did not include alignment with the Army enterprise architecture or use of a portfolio-based business system investment review process.[20] Moreover, we reported that the Army did not have reliable analyses, such as economic analyses, to support its management of these programs. We concluded that, until the Army adopts a business system investment management approach that provides for reviewing groups of systems and making enterprise decisions on how these groups will collectively interoperate to provide a desired capability, it runs the risk of investing significant resources in business systems that do not provide the desired functionality and efficiency. Accordingly, we made recommendations aimed at improving the department's efforts to achieve total asset visibility and enhancing its efforts to improve its control and accountability over business system investments. The department agreed with our recommendations.

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[17]See, for example, GAO, *DOD Business Transformation: Lack of an Integrated Strategy Puts the Army's Asset Visibility System Investments at Risk*, GAO-07-860 (Washington, D.C.: July 27, 2007); GAO, *Information Technology: DOD Needs to Ensure That Navy Marine Corps Intranet Program Is Meeting Goals and Satisfying Customers*, GAO-07-51 (Washington, D.C.: Dec. 8, 2006); GAO, *Defense Travel System: Reported Savings Questionable and Implementation Challenges Remain*, GAO-06-980 (Washington, D.C.: Sept. 26, 2006); GAO, *DOD Systems Modernization: Uncertain Joint Use and Marginal Expected Value of Military Asset Deployment System Warrant Reassessment of Planned Investment*, GAO-06-171 (Washington, D.C.: Dec. 15, 2005); and GAO, *DOD Systems Modernization: Planned Investment in the Navy Tactical Command Support System Needs to Be Reassessed*, GAO-06-215 (Washington, D.C.: Dec. 5, 2005).

[18]Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Pub. L. No. 108-375, § 332 (2004) (codified at 10 U.S.C. §§ 186 and 2222).

[19]Field/tactical refers to Army units that are deployable to locations around the world, such as Iraq or Afghanistan.

[20]GAO-07-860.

We also reported that DON had not, among other things, economically justified its ongoing and planned investment in the Naval Tactical Command Support System (NTCSS)[21] and had not invested in NTCSS within the context of a well-defined DOD or DON enterprise architecture. In addition, we reported that DON had not effectively performed key measurement, reporting, budgeting, and oversight activities and had not adequately conducted requirements management and testing activities. We concluded that, without this information, DON could not determine whether NTCSS, as defined, and as being developed, is the right solution to meet its strategic business and technological needs. Accordingly, we recommended that the department develop the analytical basis to determine if continued investment in NTCSS represents prudent use of limited resources and to strengthen management of the program, conditional upon a decision to proceed with further investment in the program. The department largely agreed with our recommendations.

In addition, we reported that the Army had not defined and developed its Transportation Coordinators' Automated Information for Movements System II (TC-AIMS II)—a joint services system with the goal of helping to manage the movement of forces and equipment within the United States and abroad—in the context of a DOD enterprise architecture.[22] In addition, we reported that the Army had not economically justified the program on the basis of reliable estimates of life cycle costs and benefits and had not effectively implemented risk management. As a result, we concluded that the Army did not know if its investment in TC-AIMS II, as planned, was warranted or represented a prudent use of limited DOD resources. Accordingly, we recommended that the department, among other things, develop the analytical basis needed to determine if continued investment in TC-AIMS II represents prudent use of limited defense resources. In response, the department agreed with our recommendations and has since reduced the program's scope by canceling future investments.

Furthermore, in 2005, we reported that DON had invested approximately $1 billion in the four previously cited ERP pilots without marked improvement in its day-to-day operations.[23] More specifically, we reported

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[21]GAO-06-215.

[22]GAO-06-171.

[23]GAO, *DOD Business Systems Modernization: Navy ERP Adherence to Best Business Practices Critical to Avoid Past Failures*, GAO-05-858 (Washington, D.C.: Sept. 29, 2005).

that the program office had not implemented an EVM system. We also identified significant challenges and risks as the project moved forward, such as developing and implementing system interfaces, converting data from legacy systems into the ERP system, meeting its estimated completion date of 2011 at an estimated cost of $800 million, and achieving alignment with DOD's BEA. To address these areas, we made recommendations that DOD improve oversight of Navy ERP, including developing quantitative metrics to evaluate the program. DOD generally agreed with our recommendations.

Implementation of Key DOD and Related IT Acquisition Management Controls on Navy ERP Varies

DOD IT-related acquisition policies and guidance, along with other relevant guidance, provide an acquisition management control framework within which to manage business system programs like Navy ERP. Effective implementation of this framework can minimize program risks and better ensure that system investments are defined in a way to optimally support mission operations and performance, as well as deliver promised system capabilities and benefits on time and within budget. To varying degrees of effectiveness, Navy ERP has been managed in accordance with aspects of this framework. However, implementation of key management controls has not been effective. Specifically,

- compliance with DOD's federated BEA has not been sufficiently demonstrated;

- investment in the program has been economically justified on the basis of expected life cycle benefits that will likely exceed estimated life cycle costs, although some estimating limitations nevertheless exist;

- earned value management has not been effectively implemented;

- an important requirements management activity has been effectively implemented; and

- a risk management process has been defined, but not effectively implemented for all risks.

The reasons that program management and oversight officials cited for why these key practices have not been sufficiently executed range from limitations in the applicable DOD guidance and tools to the complexity and challenges of managing and implementing a program of this size. Each of these reasons is described in the applicable sections of this report. By not effectively implementing all the above key IT acquisition management

functions, the program is at increased risk of (1) not being defined in a way that best meets corporate mission needs and enhances performance and (2) adding to the more than 2 years in program schedule delays and about $570 million in program cost increases experienced to date.

Navy ERP Compliance with DOD's Federated BEA Has Not Been Sufficiently Demonstrated

DOD and other guidance,[24] recognize the importance of investing in business systems within the context of an enterprise architecture.[25] Moreover, the Fiscal Year 2005 Defense Authorization Act requires that defense business systems be compliant with DOD's federated BEA.[26] Our research and experience in reviewing federal agencies show that not making investments within the context of a well-defined enterprise architecture often results in systems that are duplicative, are not well

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[24]Department of Defense Architecture Framework, Version 1.0, Volume 1 (February 2004); GAO, *Information Technology: A Framework for Assessing and Improving Enterprise Architecture Management* (Version 1.1), GAO-03-584G (Washington, D.C.: Apr. 1, 2003); Chief Information Officer Council, *A Practical Guide to Federal Enterprise Architecture*, Version 1.0 (February 2001); and Institute of Electrical and Electronics Engineers (IEEE), *Standard for Recommended Practice for Architectural Description of Software-Intensive Systems 1471-2000* (Sept. 21, 2000).

[25]A well-defined enterprise architecture provides a clear and comprehensive picture of an entity, whether it is an organization (e.g., a federal department) or a functional or mission area that cuts across more than one organization (e.g., personnel management). This picture consists of snapshots of both the enterprise's current or "as is" environment and its target or "to be" environment, as well as a capital investment road map for transitioning from the current to the target environment. These snapshots consist of integrated "views," which are one or more architecture products that describe, for example, the enterprise's business processes and rules; information needs and flows among functions, supporting systems, services, and applications; and data and technical standards and structures.

[26]DOD has adopted a federated approach for developing its business mission area enterprise architecture, which includes the corporate BEA representing the thin layer of DOD-wide corporate architectural policies, capabilities, rules, and standards; component architectures (e.g., Navy enterprise architecture); and program architectures (e.g., Navy ERP architecture).

integrated, are unnecessarily costly to interface and maintain, and do not optimally support mission outcomes.[27]

To its credit, the program office has followed DOD's BEA compliance guidance.[28] However, this guidance does not adequately provide for addressing all relevant aspects of BEA compliance. Moreover, DON's enterprise architecture, which is a major component of DOD's federated BEA, as well as key aspects of DOD's corporate BEA, have yet to be sufficiently defined to permit thorough compliance determinations. In addition, current policies and guidance do not require DON investments to comply with its enterprise architecture. This means that the department does not have a sufficient basis for knowing if Navy ERP has been defined to minimize overlap with and duplication of other programs' functionality and maximize interoperability among related programs. Each of these architecture alignment limitations is discussed here:

- The program's compliance assessments did not include all relevant architecture products. In particular, the program did not assess compliance with the BEA's technical standards profile, which outlines, for example, the standards governing how systems physically communicate with other systems and how they secure data from unauthorized access. This is particularly important because systems like Navy ERP need to share information with other systems and, for these systems to accomplish this effectively and efficiently, they need to employ common standards. A case in point is the relationship between Navy ERP and the Global Combat

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[27]See, for example, GAO, *Information Technology: FBI Is Taking Steps to Develop an Enterprise Architecture, but much Remains to Be Accomplished*, GAO-05-363 (Washington, D.C.: Sept. 9, 2005); GAO, *Homeland Security: Efforts Under Way to Develop Enterprise Architecture, but Much Work Remains*, GAO-04-777 (Washington, D.C.: Aug. 6, 2004); GAO, *Information Technology: Architecture Needed to Guide NASA's Financial Management Modernization*, GAO-04-43 (Washington, D.C.: Nov. 21, 2003); GAO, *DOD Business Systems Modernization: Important Progress Made to Develop Business Enterprise Architecture, but Much Work Remains*, GAO-03-1018 (Washington, D.C.: Sept. 19, 2003); GAO, *Information Technology: DLA Should Strengthen Business Systems Modernization Architecture and Investment Activities*, GAO-01-631 (Washington, D.C.: June 29, 2001); and GAO, *Information Technology: INS Needs to Better Manage the Development of Its Enterprise Architecture*, GAO/AIMD-00-212 (Washington, D.C.: Aug. 1, 2000).

[28]DOD, *Business Enterprise Architecture Compliance Guidance* (Apr. 10, 2006).

Support System—Marine Corps (GCSS-MC) program.[29] Specifically, Navy ERP has identified 25 technical standards that are not in the BEA technical standards profile, and GCSS-MC has identified 13 technical standards that are not in the profile. Among these non-BEA standards are program-unique information sharing protocols, which could limit information sharing between Navy ERP and GCSS-MC, and with other systems.

In addition, the program office did not assess compliance with the BEA products that describe system-level characteristics. This is important because doing so would create a body of information about programs that could be used to identify common system components and services that could potentially be shared by the programs, thus avoiding wasteful duplication. For example, our analysis of Navy ERP program documentation shows that it contains system functions related to receiving goods, taking physical inventories, and returning goods, which are also system functions cited by the GCSS-MC program. However, because compliance with the BEA system products was not assessed, the extent to which these functions are potentially duplicative was not considered.

Furthermore, the program office did not assess compliance with BEA system products that describe data exchanges among systems. As we previously reported, establishing and using standard system interfaces is a critical enabler to sharing data.[30] For example, Navy ERP program documentation indicates that it is to exchange inventory order and status data with other systems. System interfaces are important for understanding how information is to be exchanged between systems. However, since the program was not assessed for compliance with these products, it does not have the basis for understanding how its approach to exchanging information differs from that of other systems that it is to interface with. Compliance against each of these BEA products was not assessed because DOD's compliance guidance does not provide for doing

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[29]Initiated in 2003, GCSS-MC is to modernize the Marine Corps logistics systems and thereby provide the decision makers with timely and complete logistics information to support the warfighter. Moreover, according to program officials, both GCSS-MC and Navy ERP are under the leadership of Navy's Program Executive Office for Enterprise Information Systems, which is responsible for developing, acquiring, and deploying seamless enterprise-wide information technology systems.

[30]GAO, *DOD Business Systems Modernization: Progress in Establishing Corporate Management Controls Needs to be Replicated Within Military Departments*, GAO-08-705 (Washington, D.C.: May 15, 2008).

so and, according to BTA officials, because some BEA system products are not sufficiently defined. According to these officials, BTA plans to continue to define these products as the BEA evolves.

- The compliance assessment was not used to identify potential areas of duplication across programs, which DOD has stated is an explicit goal of its federated BEA and associated investment review and decision-making processes. More specifically, even though the compliance guidance provides for assessing programs' compliance with the BEA product that defines DOD operational activities, and Navy ERP was assessed for compliance with this product, the results were not used to identify programs that support the same operational activities and related business processes. Given that the federated BEA is intended to identify and avoid not only duplications within DOD components, but also between components, it is important that such commonality be addressed. For example, BEA compliance assessments for Navy ERP and GCSS-MC, as well as two Air Force programs (Defense Enterprise Accounting and Management System—Air Force and the Air Force Expeditionary Combat Support System) show that each program supports at least six of the same BEA operational activities (e.g., conducting physical inventory, delivering property and services) and three of these four programs support at least 18 additional operational activities (e.g., performing budgeting, managing receipt and acceptance). However, since the potential overlap among these and other programs was not assessed, these programs may be investing in duplicative functionality. Reasons for this were that the compliance guidance does not provide for such analyses to be conducted and programs have not been granted access rights to use this functionality in the compliance tool.

- The program's compliance assessment did not address compliance against DON's enterprise architecture, which is one of the biggest members of the federated BEA. This is particularly important given that DOD's approach to fully satisfying the architecture requirements of the Fiscal Year 2005 Defense Authorization Act is to develop and use a federated architecture in which component architectures are to provide the additional details needed to supplement the thin layer of corporate policies, rules, and

standards included in the corporate BEA.[31] As we recently reported,[32] DON's enterprise architecture is not mature because, among other things, it is missing a sufficient description of its current and future environments in terms of business and information/data. However, certain aspects of an architecture nevertheless exist and, according to DON CIO officials, these aspects will be leveraged in its efforts to develop a complete enterprise architecture. For example, the FORCEnet architecture is intended to document Navy's technical infrastructure. Therefore, opportunities exist for DON to assess its programs in relation to these architecture products, and to understand where its programs are exposed to risks because products do not exist, are not mature, or at odds with other Navy programs. According to DOD officials, compliance with the DON architecture was not assessed because DOD compliance policy is limited to compliance with the corporate BEA, and a number of aspects of the DON enterprise architecture have yet to be sufficiently developed.

- The program's compliance assessment was not validated by DON or DOD investment oversight and decision-making authorities. More specifically, neither the DOD IRBs nor the DBSMC, nor the BTA in supporting both of these investment oversight and decision-making authorities, reviewed the program's assessments. According to BTA officials, under DOD's tiered approach to investment accountability, these entities are not responsible for validating programs' compliance assessments. Rather, this is a component responsibility, and thus they rely on the military departments and defense agencies to validate the assessments.

  However, DON Office of the CIO, which is responsible for precertifying investments as compliant before they are reviewed by the IRB, did not validate any of the program's compliance assessments. According to Office of the CIO officials, they rely on Functional Area Managers to validate a program's compliance assessments. However, no DON policy or guidance exists that describes how the Functional Area Managers should conduct such validations. CIO officials stated that this is because these authorities do not have the resources that they need to validate the assessments, and

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[31]As we recently reported, while the corporate BEA includes corporate policies, capabilities, rules, and standards, it is still evolving and will continue to add additional details. See GAO-08-705.

[32]GAO, *DOD Business Systems Modernization: Military Departments Need to Strengthen Management of Enterprise Architecture Programs*, GAO-08-519 (Washington, D.C.: May 12, 2008).

because a number of aspects of the DON architecture are not yet sufficiently developed.

Validation of program assessments is further complicated by the absence of information captured in the assessment tool about what program documentation or other source materials were used by the program office in making its compliance determinations. Specifically, the tool is only configured, and thus was only used, to capture the results of a program's comparison of program architecture products to BEA products. Thus, it was not used to capture the system products used in making these determinations.

The limitations in existing BEA compliance-related policy and guidance, the supporting compliance assessment tool, and the federated BEA, put programs like Navy ERP at increased risk of being defined and implemented in a way that does not sufficiently ensure interoperability and avoid duplication and overlap. We recently completed a review examining multiple programs' compliance with the federated BEA, including Navy ERP, for the Senate Armed Services Committee, Subcommittee on Readiness and Management Support. We addressed the architectural compliance guidance, tool, and validation limitations as part of this review.[33]

Investment in Navy ERP Has Been Economically Justified, but Important Estimating Practices Were Not Implemented

The investment in Navy ERP has been economically justified on the basis of expected life cycle benefits that far exceed estimated life cycle costs. According to the program's benefit/cost analysis, Navy ERP will produce about $8.6 billion in estimated benefits for an estimated cost of about $2.4 billion over its 20-year life cycle. While these benefit estimates were not subject to any analysis of how uncertainty in assumptions and data could impact the estimates, as called for by relevant guidance, our examination of key uncertainty variables, such as the timing of legacy systems' retirement, showed that the savings impact would be relatively minor. However, the reliability of the cost estimate is limited because it was derived using several, but not all, key estimating practices. For example, the estimate was not grounded in a historical record of comparable data from similar programs and was not based on a reliable schedule baseline,

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[33]GAO, *DOD Business Systems Modernization: Key Navy Programs' Compliance with DOD's Federated Business Enterprise Architecture Needs to Be Adequately Demonstrated*, GAO-08-972 (Washington, D.C.: Aug. 7, 2008).

which are both necessary to having a cost estimate that can be considered credible and accurate. These practices were not employed for various reasons, including DOD's lack of historical data from similar programs and the lack of an integrated master schedule for the program that includes all releases.

Notwithstanding the fact that these limitations could materially increase the $2.4 billion cost estimate, it is nevertheless unlikely that these factors would increase the estimate to a level approaching the program's benefit expectations. Therefore, we have no reason to believe that Navy ERP will not produce a positive return on investment.

Benefit Estimates Are Sufficiently Reliable Despite Absence of Uncertainty Analysis

Forecasting expected benefits over the life of a program is a key aspect of economically justifying an investment. The Office of Management and Budget (OMB) guidance[34] advocates economically justifying investments on the basis of expected benefits, costs, and risks. Since estimates of benefits can be uncertain because of the imprecision in both the underlying data and modeling assumptions used, the guidance also provides for analyzing and reporting the effects of this uncertainty. By doing this, informed investment decision making can occur through the life of the program, and a baseline can be established against which to compare the accrual of actual benefits from deployed system capabilities.

The most recent economic analysis, dated August 2007, includes monetized benefit estimates for fiscal years 2004–2023, in three key areas—about $2.7 billion in legacy system cost savings, $3.3 billion in cost savings from inventory reductions, and $2.7 billion in cost savings from labor productivity improvements. Collectively, these benefits total about $8.6 billion.[35]

The program office calculated expected benefits in terms of cost savings, which is consistent with established practices and guidance. For example, the program is to result in the retirement of 138 legacy systems (including the 4 pilot systems) between fiscal years 2005 and 2015, and the yearly maintenance costs for a single system are expected to be as high as about

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[34]Office of Management and Budget, Circular No. A-94: *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs* (Oct. 29, 1992).

[35]The benefits estimates for the areas are rounded; therefore, they add to more than $8.6 billion.

$39 million.[36] According to relevant guidance, cost saving estimates should also be analyzed in terms of how uncertainty in assumptions and data could impact them. However, the program office did not perform such uncertainty analysis. According to program officials, uncertainty analysis is not warranted because they have taken and continue to take steps to validate the assumptions and the data, such as using the latest budget data associated with the legacy systems, and monitoring changes to the systems' retirement dates. While these steps are positive, they do not eliminate the need for uncertainty analysis. Accordingly, we assessed key uncertainty variables, such as the timing of the legacy systems' retirement, and found that the retirement dates of some of these systems have changed since the estimate was prepared, due to, among other things, schedule delays in the program. While the inherent uncertainty in these dates would reduce expected savings (e.g., only $11 million based on the 134 legacy systems that we examined),[37] the reduction would be small relative to a total benefit estimate of $8.6 billion.

The Cost Estimate Was Not Reliably Derived

A reliable cost estimate is a key variable in calculating return on investment, and it provides the basis for informed investment decision making, realistic budget formulation and program resourcing, meaningful progress measurement, proactive course correction, and accountability for results. According to OMB,[38] programs must maintain current and well-documented cost estimates, and these estimates must encompass the full life cycle of the program. OMB states that generating reliable cost estimates is a critical function necessary to support OMB's capital programming process. Without reliable estimates, programs are at increased risk of experiencing cost overruns, missed deadlines, and performance shortfalls.

Our research has identified a number of practices that are the basis of effective program cost estimating. We have issued guidance that

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[36]For example, the Uniform Accounting Data Process System-Inventory Control Points has yearly maintenance costs of $39.3 million.

[37]These reductions in expected savings represent the costs of maintaining the legacy systems during the period in which the systems' retirement dates have been delayed.

[38]OMB, Circular No. A-11, *Preparation, Submission, and Execution of the Budget* (Washington, D.C.: Executive Office of the President, June 2006); Circular No. A-130 Revised, *Management of Federal Information Resources* (Washington, D.C.: Executive Office of the President, Nov. 28, 2000); and *Capital Programming Guide: Supplement to Circular A-11, Part 7, Preparation, Submission, and Execution of the Budget* (Washington, D.C.: Executive Office of the President, June 2006).

associates these practices with four characteristics of a reliable cost estimate.[39] Specifically, these four characteristics are as follows:

- *Comprehensive:* The cost estimates should include both government and contractor costs over the program's full life cycle, from the inception of the program through design, development, deployment, and operation and maintenance to retirement. They should also provide an appropriate level of detail to ensure that cost elements are neither omitted nor double counted and include documentation of all cost-influencing ground rules and assumptions.

- *Well-documented:* The cost estimates should have clearly defined purposes and be supported by documented descriptions of key program or system characteristics (e.g., relationships with other systems, performance parameters). Additionally, they should capture in writing such things as the source data used and their significance, the calculations performed and their results, and the rationale for choosing a particular estimating method or reference. Moreover, this information should be captured in such a way that the data used to derive the estimate can be traced back to, and verified against, their sources. The final cost estimate should be reviewed and accepted by management on the basis of confidence in the estimating process and the estimate produced by the process.

- *Accurate:* The cost estimates should provide for results that are unbiased and should not be overly conservative or optimistic (i.e., they should represent most likely costs). In addition, the estimates should be updated regularly to reflect material changes in the program, and steps should be taken to minimize mathematical mistakes and their significance. Among other things, the estimate should be grounded in a historical record of cost estimating and actual experiences on comparable programs.

- *Credible:* The cost estimates should discuss any limitations in the analysis performed due to uncertainty or biases surrounding data or assumptions. Further, the estimates' derivation should provide for varying any major assumptions and recalculating outcomes based on sensitivity analyses, and their associated risks and inherent uncertainty should be disclosed. Also, the estimates should be verified based on cross-checks using other estimating methods and by comparing the results with independent cost estimates.

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[39]GAO, *Cost Assessment Guide: Best Practices for Estimating and Managing Program Costs*, Exposure Draft, GAO-07-1134SP (Washington, D.C.: July 2, 2007).

The $2.4 billion life cycle cost estimate for Navy ERP reflects many of the practices associated with a reliable cost estimate, including all practices associated with being comprehensive and well-documented, and several related to being accurate and credible (see table 5). However, several important practices related to accuracy and credibility were not performed. To be reliable, a cost estimate should be comprehensive, well-documented, accurate, and credible.

Table 5: Summary of Cost Estimating Characteristics That the Cost Estimate Satisfies

Characteristic of reliable estimates	Satisfied?[a]
Comprehensive	Yes
Well-documented	Yes
Accurate	Partially
Credible	Partially

Source: GAO analysis of DON data.

[a]"Yes" means that the program office provided documentation demonstrating satisfaction of the criterion. "Partially" means that the program office provided documentation demonstrating satisfaction of part of the criterion. "No" means that the program office has yet to provide documentation demonstrating satisfaction of the criterion.

The cost estimate is comprehensive because it includes both the government and contractor costs specific to development, acquisition (nondevelopment), implementation, and operations and support over the program's 20-year life cycle. Moreover, the estimate clearly describes how the various subelements are aggregated to produce amounts for each cost category, thereby ensuring that all pertinent costs are included, and no costs are double counted. Finally, cost-influencing ground rules and assumptions, such as the program's schedule, labor rates, and inflation rates are documented.

The cost estimate is also well-documented in that the purpose of the cost estimate is clearly defined, and the technical baseline includes, among other things, the hardware components and planned performance parameters. Furthermore, the calculations and results used to derive the estimate are documented, including descriptions of the methodologies used and evidence of traceability back to source data (e.g., vendor quotes, salary tables). Also, the cost estimate was reviewed by the Naval Center for Cost Analysis and the Office of the Secretary of Defense, Director for

Program Analysis and Evaluation, which adds a level of confidence in the estimating process and the estimate produced.

However, the estimate lacks accuracy because not all important practices related to this characteristic were performed. Specifically, while the estimate is grounded in documented assumptions (e.g., hardware refreshment every 5 years) and periodically updated to reflect changes to the program, it is not adequately grounded in historical experience with comparable programs. While the program office did leverage historical cost data from the Navy ERP pilot programs, program officials told us that the level of cost accounting on these programs did not provide sufficient data. As stated in our guide, estimates should be based on historical records of cost and schedule estimates from comparable programs, and such historical data should be maintained and used for evaluation purposes and future estimates on comparable programs. The importance of doing so is evident by the fact that Navy ERP's cost estimate has increased by about $570 million since fiscal year 2003, which program officials attributed to, among other things, site implementation costs (e.g., training and converting legacy system data) not included in the original cost estimate, schedule delays, and the lack of historical data from similar ERP programs.

This lack of cost data for large-scale ERP programs is, in part, due to DOD not having a standardized cost element structure for these programs that can be used for capturing actual cost data, which is a prerequisite to capturing and maintaining the kind of historical data that can inform cost estimates on similar programs. This means that programs like Navy ERP will not be able to ground their cost estimates in actual costs from comparable programs. According to officials with the Defense Cost and Resource Center,[40] such cost element structures are needed, along with a requirement for programs to report on their costs, but approval and resources have yet to be gained for either these structures or the reporting of their costs. We recently completed work that addressed standardization

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[40]The Defense Cost and Resource Center is responsible for collecting current and historical major defense acquisition program cost and software resource data in a joint service environment and making those data available for use by authorized government analysts when estimating the cost of ongoing and future government programs.

of DOD's ERP cost element structure and maintenance of a database for historical ERP cost data for use on ERP programs.[41]

Compounding the estimate's limited accuracy are limitations in its credibility. Specifically, while the estimate satisfies some of the key practices for a credible cost estimate (e.g., confirming key cost drivers, performing sensitivity analyses,[42] and having an independent cost estimate prepared by the Naval Center for Cost Analysis that was within 11 percent of the program's estimate), the program lacks a reliable schedule baseline, which is a key component of a reliable cost estimate because it serves as the basis for future work to be performed. Other factors that limit confidence in the cost estimate's accuracy are (1) past increases in the program's cost estimate (as discussed earlier) and (2) trends in EVM data (as discussed later). Taken together, the program's cost estimate is not sufficiently credible and accurate and thus not reliable.

While important cost estimating practices were not implemented, it is nevertheless unlikely that these limitations would materially increase the $2.4 billion cost estimate to a level approaching the program's $8.6 billion benefit expectations.

Earned Value Management Has Not Been Effectively Implemented

Measuring and reporting progress against cost and schedule commitments (i.e., baselines) is a vital element of effective program management. EVM provides a proven means for measuring such progress and thereby identifying potential cost overruns and schedule delays early, when their impact can be minimized.

To its credit, the program has elected to implement program-level EVM, which is a best practice that has rarely been implemented in the federal government. In doing so, however, basic EVM activities have not been executed. In particular, an integrated baseline review, which is to verify that the program's cost and schedule are reasonable given the program's scope of work and associated risks, has not been performed. Moreover, other accepted industry standards have not been sufficiently implemented,

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[41]GAO, *DOD Business Systems Modernization: Key Marine Corps System Acquisition Needs to Be Better Justified, Defined, and Managed*, GAO-08-822 (Washington, D.C.: July 28, 2008).

[42]Sensitivity analysis reveals how the cost estimate is affected by a change in a single assumption or cost driver while holding all other variables constant.

and surveillance of EVM implementation by an entity independent of the program office has not occurred. Not performing these important practices has contributed to the cost overruns and lengthy schedule delays already experienced on Release 1.0, and they will likely result in more. In fact, our analysis of the latest estimate to complete just the budgeted development work for all three releases, which is about $844 million, shows that this estimate will most likely be exceeded by about $152 million.

The Program Has Elected to Implement Program-Level EVM

As we previously reported,[43] EVM offers many benefits when done properly. In particular, it allows performance to be measured, and it serves as an early warning system for deviations from plans. It, therefore, enables a program office to mitigate the risks of cost and schedule overruns. OMB policy recognizes the use of EVM as an important part of program management and decision making.[44]

Implementing EVM at the program level rather than just the contract level is considered a best practice, and OMB recently began requiring it to measure how well a program's approved cost, schedule, and performance goals are being met. According to OMB, integrating government and contractor cost, schedule, and performance status should result in better program execution through more effective management. In addition, integrated EVM data can be used to better justify budget requests.

To minimize the risk associated with its decision to transition responsibility for Navy ERP system integration from the contractor to the government and to improve cost and schedule performance, the program office elected in October 2006 to perform EVM at the program level. We support the use of program-level EVM. However, if not implemented effectively, this program-level approach will be of little value.

An Integrated Baseline Review Has Not Been Performed

A fundamental aspect of effective EVM is the development of a performance measurement baseline (PMB), which represents the cumulative value of planned work and serves as the baseline against which

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[43]GAO, *Missile Defense: Additional Knowledge Needed in Developing System for Intercepting Long-Range Missiles*, GAO-03-600 (Washington, D.C.: Aug. 21, 2003).

[44]OMB, *Preparation, Submission, and Execution of the Budget*, Circular A-11 (Washington, D.C.: Executive Office of the President, June 2006), part 7, Planning, Budgeting, Acquisition, and Management of Capital Assets, sec. 300. http://www.whitehouse.gov/omb/circulars/index.html.

variances are calculated. According to relevant best practice guidance, a PMB consists of

- a complete work breakdown structure,

- a complete integrated master schedule, and

- accurate budgets for all planned work.[45]

To validate the PMB, an integrated baseline review is performed to obtain stakeholder agreement on the baseline. According to DOD guidance and best practices, such a review should be held within 6 months of a contract award and conducted on an as needed basis throughout the life of a program to ensure that the baseline reflects (1) all tasks in the statement of work, (2) adequate resources (staff and materials) to complete the tasks, and (3) integration of the tasks into a well-defined schedule. Further, the contract performance reports that are to be used to monitor performance against the PMB should be validated during the integrated baseline review.[46]

The program office has satisfied some of the prerequisites for having a reliable PMB, such as developing a work breakdown structure and specifying the contract performance reports that are to be used to monitor performance. However, it has not conducted an integrated baseline review. Specifically, a review was not conducted for Release 1.0, even though the contract was finalized about 30 months ago (January 2006). Also, while the review for Release 1.1 was recently scheduled for August 2008, this is 8 months later than when such a review should be held, according to DOD guidance and best practices. This means that the reasonableness of the program's scope and schedule relative to the program risks has not been assured, and has likely been, and will likely continue to be a primary contributor to future cost increases and schedule delays.

According to program officials, a review was not performed on the first release because development of this release was largely complete by the

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[45]GAO-07-1134SP.

[46]Defense Contract Management Agency, *Department of Defense Earned Value Management Implementation Guide* (Washington, D.C.: October 2006); and GAO-07-1134SP.

time the program office established the underlying capabilities needed to perform program-level EVM. In addition, program officials stated that an integrated baseline review has yet to be performed on the other two releases because their priority has been on deploying and stabilizing the first release. In our view, not assuring the validity of the PMB precludes effective implementation of EVM. Until a review is conducted, DOD will not have reasonable assurance that the program's scope and schedule are achievable, and thus, additional cost and schedule overruns are likely.

Industry EVM Standards Have Not Been Fully Implemented and Independently Surveilled

In 1996, DOD adopted industry EVM guidance[47] that identifies 32 essential practices organized into five categories: (1) organization; (2) planning, scheduling and budgeting; (3) accounting; (4) analysis and management reports; and (5) revisions and data maintenance. DOD requires that all programs' implementation of EVM undergo a compliance audit against the 32 industry practices. In addition, DOD policy and guidance[48] state that independent surveillance of EVM should occur over the life of the program to guarantee the validity of the performance data and ensure that EVM is being used effectively to manage cost, schedule, and technical performance.

On Navy ERP, compliance with the 32 accepted industry practices has not been verified, and surveillance of EVM by an independent entity has not occurred. Therefore, the program does not have the required basis for ensuring that EVM is being effectively implemented on Navy ERP. According to program officials, surveillance was performed by NAVAIR for Release 1.0. However, NAVAIR officials said that they did not perform such surveillance because they did not receive the Release 1.0 cost performance data needed to do so. Program officials also stated that DON's Center for Earned Value Management[49] has conducted an initial assessment of their EVM management system, and that they intend to have the Center perform surveillance. However, they did not have a plan for

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[47]American National Standards Institute (ANSI)/Electronic Industries Alliance (EIA) Standard, *EVM Systems Standard*, ANSI/EIA-748-A-1998 (R2002), approved May 19, 1998; revised January 2002.

[48]Defense Contract Management Agency, *Department of Defense Earned Value Management Implementation Guide* (Washington, D.C.: October 2006). See also DOD Memorandum: *Revision to DOD Earned Value Management Policy* (Washington, D.C.: Mar. 7, 2005).

[49]DON established the Center for Earned Value Management in April 2007 to, among other things, work with program offices to improve the accuracy of EVM data and to provide independent assistance to program managers when requested.

accomplishing this. Until compliance with the standards is verified and continuous surveillance occurs, and deviations are addressed, the program will likely continue to experience cost overruns and schedule delays.

Estimated Schedule Baseline Was Not Derived in Accordance with All Key Schedule Estimating Practices

The success of any program depends in part on having a reliable schedule of when the program's work activities will occur, how long they will take, and how they are related to one another. As such, the schedule not only provides a road map for the systematic execution of a program but also provides the means by which to estimate costs, gauge progress, identify and address potential problems, and promote accountability. Our research has identified nine practices associated with effective schedule estimating.[50] These practices are (1) capturing key activities, (2) sequencing key activities, (3) establishing the duration of key activities, (4) assigning resources to key activities, (5) integrating key activities horizontally and vertically, (6) establishing the critical path for key activities, (7) identifying "float time"[51] between key activities, (8) distributing reserves to high-risk activities, and (9) performing a schedule risk analysis.

The program's estimated schedule was developed using some of these practices, but several key practices were not fully employed that are fundamental to having a schedule that provides a sufficiently reliable basis for estimating costs, measuring progress and forecasting slippages. On the positive side, the schedule for the first two releases captures key activities and their durations and is integrated horizontally and vertically, meaning that multiple teams executing different aspects of the program can effectively work to the same master schedule. Moreover, for these two releases, the program has established float time between key activities and distributed schedule reserve to high-risk activities. However, the program has not adequately sequenced and assigned resources to key program activities. Moreover, the estimated schedule for the first increment is not grounded in an integrated master schedule of all the releases, and thus the schedule for this increment does not reflect the program's critical path of work that must be performed to achieve the target completion date. Also, it does not reflect the results of a schedule-risk analysis across all three releases with schedule reserve allocated to high-risk activities because such risks were not examined. See table 6 for the results of our analyses relative to each of the nine practices.

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[50]GAO-07-1134SP.

[51]Float time is the amount of time an activity can slip before affecting the critical path.

Table 6: Satisfaction of Schedule Estimating Key Practices

Practice	Explanation	Satisfied?[a]	GAO analysis
Capturing key activities	The schedule should reflect all key activities (e.g., steps, events, outcomes) as defined in the program's work breakdown structure, to include activities to be performed by both the government and its contractors.	Yes	The program's estimated schedules for the first two releases reflect both government and contractor activities, such as development and testing of the software components, as well as key milestones for measuring progress.
Sequencing key activities	The schedule should be planned so that it can meet critical program dates. To meet this objective, key activities need to be logically sequenced in the order that they are to be carried out. In particular, activities that must be finished prior to the start of other activities (i.e., predecessor activities), as well as activities that cannot begin until other activities are completed (i.e., successor activities) should be identified. By doing so, interdependencies among activities that collectively lead to the accomplishment of events or milestones can be established and used as a basis for guiding work and measuring progress.	Partially	The schedules for the first two releases include the logical sequencing of most, but not all, activities. For example, 234 of 2,445 activities in the Release 1.1 schedule were not sequenced properly. By not identifying the correct interdependencies and properly sequencing key activities, the schedule may not facilitate the meaningful tracking of progress.
Establishing the duration of key activities	The schedule should realistically reflect how long each activity will take to execute. In determining the duration of each activity, the same rationale, historical data, and assumptions used for cost estimating should be used for schedule estimating. Further, these durations should be as short as possible, and they should have specific start and end dates. Excessively long periods needed to execute an activity should prompt further decomposition of the activity so that shorter execution durations will result.	Yes	The schedules for the first two releases establish realistic durations of key activities. For example, the schedule for Release 1.1 is based on historical data from Release 1.0, which provides a level of confidence that the durations are reasonable.
Assigning resources to key activities	The schedule should reflect what resources (i.e., labor, material, and overhead) are needed to do the work, whether all required resources will be available when they are needed, and whether any funding or time constraints exist.	Partially	The schedules for the first two releases include the allocation of resources, such as personnel, to activities, but it does not reflect whether all resources will be available when they are needed because the identified resources are shared across the three releases. Restated, personnel are assigned to activities across multiple releases, each of which is managed according to a separate schedule. Therefore, if one of the schedules were to be delayed, the other schedules that required the same resources would likely also be delayed.

Practice	Explanation	Satisfied?[a]	GAO analysis
Integrating key activities horizontally and vertically	The schedule should be horizontally integrated, meaning that it should link the products and outcomes associated with already sequenced activities. These links are commonly referred to as "handoffs" and serve to verify that activities are arranged in the right order to achieve aggregated products or outcomes. The schedule should also be vertically integrated, meaning that traceability exists among varying levels of activities and supporting tasks and subtasks. Such mapping or alignment among levels enables different groups to work to the same master schedule.	Yes	The schedules for the first two releases are both horizontally and vertically integrated, meaning that the activities across the multiple teams are arranged in the right order to achieve aggregated products or outcomes. In addition, traceability exists among varying levels of activities, which allows multiple teams (i.e., development, testing) to work to the same master schedule.
Establishing the critical path for key activities	Using scheduling software, the critical path—the longest duration path through the sequenced list of key activities—should be identified. The establishment of a program's critical path is necessary for examining the effects of any activity slipping along this path. Potential problems that might occur along or near the critical path should also be identified and reflected in the scheduling of the time for high-risk activities (see next practice).	Partially	While the program has established the critical path for the first two releases separately, it has not done so for the entire first increment. This is because the program maintains separate schedules for each release, and in doing so, cannot identify the longest duration of tasks through the entire first increment. Without doing so, the effects of any slippage along the critical path on future releases cannot be determined.
Identifying "float time" between key activities	The schedule should identify float time—the time that a predecessor activity can slip before the delay affects successor activities—so that schedule flexibility can be determined. As a general rule, activities along the critical path typically have the least amount of float time.	Yes	The schedules for the first two releases identify float time between key activities.
Distributing reserves to high-risk activities	The baseline schedule should include a buffer or a reserve of extra time. Schedule reserve for contingencies should be calculated by performing a schedule risk analysis (see next practice). As a general rule, the reserve should be applied to high-risk activities, which are typically found along the critical path.	Partially	The schedule allocates reserve for high-risk activities on the critical path for Release 1.0. However, because the program has not established a critical path for the first increment, it cannot allocate reserve for the high-risk activities on the entire program's critical path.
Schedule risk analysis should be performed	A schedule risk analysis should be performed using statistical techniques to predict the level of confidence in meeting a program's completion date. This analysis focuses not only on critical path activities but also on activities near the critical path, since they can potentially affect program status.	Partially	A schedule risk analysis on the entire program was not performed. A schedule risk analysis has been done on Release 1.0, and the program office plans to do one for Release 1.1. However, without analyzing the risks associated with the program's entire schedule, the program cannot determine the level of confidence in meeting the program's completion date.

Source: GAO analysis of DON data.

[a]"Yes" means that the program provided documentation demonstrating satisfaction of the practice. "Partially" means that the program provided documentation demonstrating satisfaction of part of the practice. "No" means that the program has yet to provide documentation demonstrating satisfaction of the practice.

According to program documentation, they have plans to address the logical sequencing of activities (to ensure that it reflects how work is to be performed), but program officials stated that they do not plan to combine all three releases into a single integrated master schedule for the entire first increment of the program because doing so would produce an overly complex and nonexecutable schedule involving as many as 15,000 activities. However, our research of and experience in evaluating major programs' use of EVM and integrated master schedules show that while large, complex programs necessitate schedules involving thousands of activities, successful programs ensure that their schedules integrate these activities. In our view, not adequately performing these practices does not allow the program to effectively assign resources, identify the critical path, and perform a schedule risk analysis that would allow it to understand, disclose, and compensate for its schedule risks. This means that the program is not well-positioned to understand progress and forecast its impact. To illustrate, the program recently experienced delays in deploying its first release at NAVAIR, which according to a recent operational test and evaluation report[52] has significantly affected the schedule's critical path. These schedule impacts are because resources supporting the deployment at NAVAIR began to shift to the next scheduled deployment site and thus are no longer available to resolve critical issues at NAVAIR. Since the schedule baseline is not integrated across all releases, the impact of this delay on other releases, and thus the program as a whole, cannot be readily determined.

Trends in EVM Data Show Pattern of Cost Overruns and Schedule Slippages

Program data show a pattern of actual cost overruns and schedule delays between January 2007 and May 2008. Moreover, our analysis of the data supports a most likely program cost growth of about $152 million to complete all three releases.

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[52]Department of the Navy, Commander, Operational Test and Evaluation Force, *Navy Enterprise Resource Planning System Initial Operational Test and Evaluation, OT-C1 Final Report to the Chief of Naval Operations* (Norfolk, VA: June 13, 2008).

Differences from the PMB are measured in both cost and schedule variances.[53] Positive variances indicate that activities are costing less or are completed ahead of schedule. Negative variances indicate that activities are costing more or are falling behind schedule. These cost and schedule variances can then be used in forecasting the cost and time needed to complete the program.

Based on program-provided data for the first increment over a 17-month period ending May 2008, the program has experienced negative cost variances. Specifically, while these cost variances have fluctuated during this period, they have consistently been negative. (See fig. 4.) Moreover, our analysis of the cost to complete just the budgeted development work (also known as the PMB) for all three releases, which is about $844 million,[54] will be exceeded by between about $102 million and $316 million, with a most likely overrun of about $152 million.[55] In contrast, the program office reports that the overrun at completion will be $55 million but has yet to provide us with documentation supporting this calculation. Moreover, our calculation does not reflect the recent problems discovered during the operational test and evaluation at NAVAIR and thus the overrun is likely to be higher.

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[53]Cost variances compare the earned value of the completed work with the actual cost of the work performed. For example, if a contractor completed $5 million worth of work, and the work actually cost $6.7 million, there would be a negative $1.7 million cost variance. Schedule variances are also measured in dollars, but they compare the earned value of the work actually completed as of a point in time to the value of work that was expected to be completed. For example, if a contractor completed $5 million worth of work at the end of the month but was budgeted to complete $10 million worth of work, there would be a negative $5 million schedule variance.

[54]This figure is the total estimated budget for the program. It represents the cumulative value of the budgeted cost of work scheduled over the life of the program.

[55]To make these assessments, we applied earned value analysis techniques to data from the program's contract performance reports. These techniques compare budget versus actual costs versus project status in dollar amounts. For our analysis, we used standard earned value formulas to calculate cost and schedule variance and forecast the range of cost overrun at completion.

Figure 4: Cumulative Cost Variance for Navy ERP over a 17-Month Period

Dollars in millions

Fiscal year

During this same 17-month period, the program has experienced negative schedule variances and, since January 2008, they have almost doubled each month. Further, as of May 2008, the program had not completed about $24 million in scheduled work. (See fig. 5.) An inability to meet schedule performance is a frequent indication of future cost increases, as more spending is often necessary to resolve schedule delays.

Figure 5: Cumulative Schedule Variance of the Navy ERP Program over a 17-Month Period

Dollars in millions
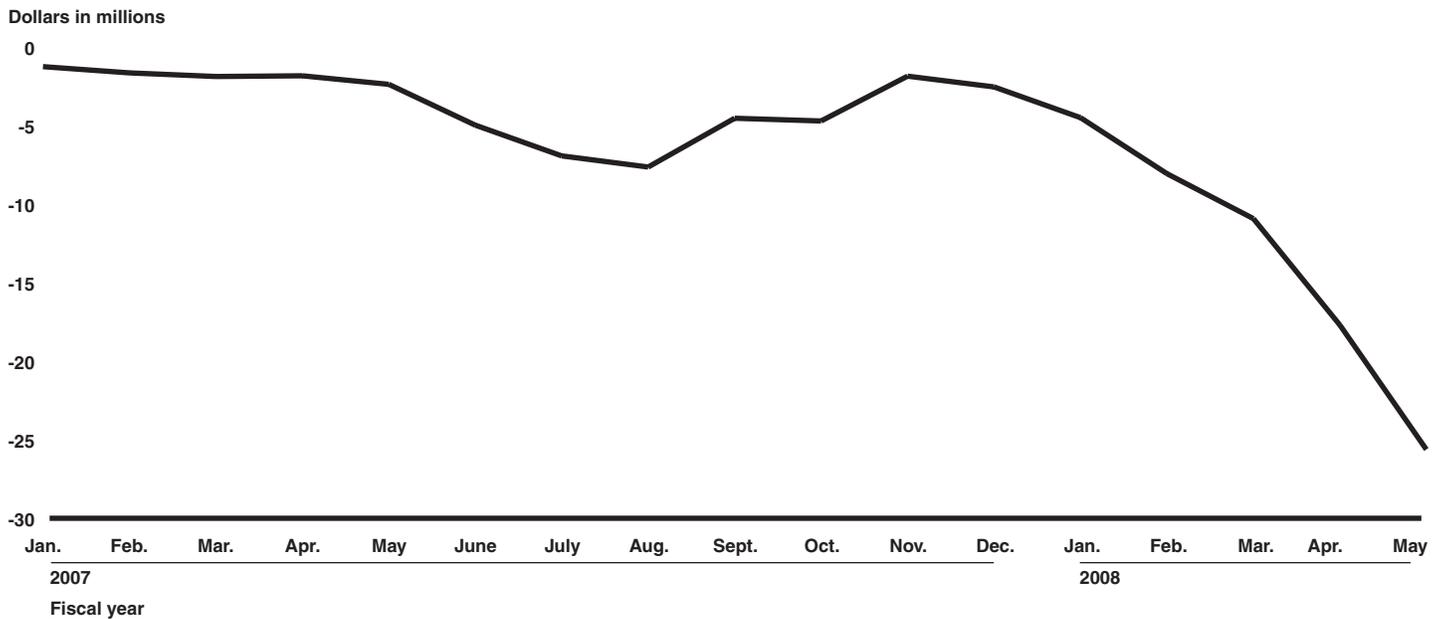
Source: GAO analysis based on Navy ERP data.

Because the program office has not performed important reliability checks, such as EVM validation and integrated baseline reviews, as discussed above, we cannot be certain that the PMB is reliable (i.e., reflects all the work to be done and has identified all the risks). As a result, the overrun that we are forecasting could be higher.

By not executing basic EVM practices, the program has and will likely continue to experience cost and schedule shortfalls. Until the program office implements these important EVM practices, it will likely not be able to track actual program costs and schedules close to estimates.

Important Requirements Management Activity Has Been Effectively Implemented

Well-defined and managed requirements are recognized by DOD guidance as essential, and they can be viewed as a cornerstone of effective system acquisition. One aspect of effective requirements management is requirements traceability.[56] By tracing requirements both backward from system requirements to higher level business or operational requirements and forward to system design specifications and test plans, the chances of the deployed product satisfying requirements is increased, and the ability to understand the impact of any requirement changes and thus make informed decisions about such changes, is enhanced.

The program office is effectively implementing requirements traceability for its 1,733 Release 1.0 system requirements. To verify this traceability, we randomly selected and analyzed 60 of the 1,733 system requirements and confirmed that 58 of the 60 were traceable both backward to higher level requirements and forward to design specifications and test results. The remaining 2 had been allocated to the other releases, and thus we also confirmed the program's ability to maintain traceability between product releases. In doing so, the program utilized a tool called DOORS, which if implemented properly, allows each requirement to be linked from its most conceptual definition to its most detailed definition, as well as to design specifications and test cases. In effect, the tool maintains the linkages among requirement documents, design documents, and test cases even if requirements change.

If DON continues to effectively implement requirements traceability, it will increase the chances that system requirements will be met by the deployed system.

A Risk Management Process Has Been Defined, but All Risks Have Not Been Effectively Mitigated

Proactively managing program risks is a key acquisition management control and, if defined and implemented properly, it can increase the chances of programs delivering promised capabilities and benefits on time and within budget. To the program office's credit, it has defined a risk management process that meets relevant guidance. However, it has not effectively implemented the process for all identified risks. As a result, these risks have not been proactively mitigated and either have

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[56]DOD, *Defense Acquisition Guidebook*, Version 1.0 (Oct. 17, 2004). Software Engineering Institute, Software Acquisition Capability Maturity Model® version 1.03, CMU/SEI-2002-TR-010 (Pittsburgh, PA: March 2002).

contributed to cost and schedule shortfalls, or could potentially contribute to such shortfalls.

DOD acquisition management guidance, as well as other relevant guidance advocates identifying facts and circumstances that can increase the probability of an acquisition's failing to meet cost, schedule, and performance commitments and then taking steps to reduce the probability of their occurrence and impact.[57] In brief, effective risk management consists of: (1) establishing a written plan for managing risks; (2) designating responsibility for risk management activities; (3) encouraging program-wide participation in the identification and mitigation of risks; (4) defining and implementing a process that provides for the identification, analysis, and mitigation of risks; and (5) examining the status of identified risks in program milestone reviews.

The program office has developed a written plan for managing risks and established a process that together provide for the above-cited risk management practices. Moreover, it has largely followed its plan and process as per the following examples:

- The program manager has been assigned overall responsibility for managing risks and serves as the chair of the risk management board.[58] Also, a functional team lead (i.e., subject matter expert) is assigned responsibility for analyzing and mitigating each identified risk.

- Program-wide participation in the identification, analysis, and mitigation of risks is encouraged. Specifically, a manager for each release is responsible for providing risk management guidance to the staff, which includes staff identification and analysis of risks. Also, according to the program office's risk management plan, all program personnel can submit a risk for approval. In addition, stakeholders participate in risk management activities during acquisition milestone reviews.

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[57]Department of Defense, *Risk Management Guide for DOD Acquisition*, 6th Edition, Version 1.0., http://www.acq.osd.mil/sse/ed/docs/2006-RM-Guide-4Aug06-final-version.pdf (accessed March 13, 2008) and Software Engineering Institute, *CMMI for Acquisition, Version 1.2*, CMU/SEI-2007-TR-017 (Pittsburgh, PA: November 2007).

[58]The risk management board oversees risk management activities by assigning risk owners, approving and directing resources to facilitate risk handling strategies, and reviewing risk handling status.

- The program office has identified and categorized individual risks. As of June 2008, the risk database contained 15 active risks—3 high, 8 medium, and 4 low.[59]

- Program risks are considered during program milestone reviews. For example, during the program's critical design review, which is a key event of the system development and demonstration phase, key risks regarding implementing new business processes and legacy system changes were discussed. Furthermore, the program manager receives a monthly risk report that describes the status of program risks.

However, the program office has not consistently followed other aspects of its process. In particular, it has not effectively implemented steps for mitigating the risks associated with (1) converting data from NAVAIR's legacy systems to run on Navy ERP and (2) positioning NAVAIR for adopting the new business processes embedded in Navy ERP. As we have previously reported, it is important for organizations that are to operate and use commercial off-the-shelf software products, such as Navy ERP, to proactively manage and position themselves for the organizational impact of introducing functionality embedded in the commercial products. If they do not, the organization's performance will suffer.[60]

To the program office's credit, it identified numerous risks associated with data conversion and organizational change management and developed and implemented strategies that were intended to mitigate these risks. However, it closed these risks even though they were never effectively mitigated, as evidenced by the results of recently completed DON operational test and evaluation. According to the June 2008 operational test and evaluation report for NAVAIR, significant problems relating to both legacy system data conversion and adoption of new business processes were experienced. The report states that these problems have contributed to increases in the costs to operate the system, including

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[59]Risk levels of high, medium or low are assigned using quantitative measurements of the probability of the risk occurring and the potential impact to the program's cost, schedule, and performance. Based on that assessment, a risk level is assigned to represent the risk's significance.

[60]See, for example, GAO, *Office of Personnel Management: Retirement Systems Modernization Program Faces Numerous Challenges*, GAO-05-237 (Washington, D.C.: Feb. 28, 2005); and GAO, *Information Technology: Customs Automated Commercial Environment Program Progressing, but Need for Management Improvements Continues*, GAO-05-267 (Washington, D.C.: Mar. 14, 2005).

unexpected manual effort. It further states that these problems have rendered the deployed version not operationally effective and that deployment of the system to other sites should not occur until the change management process has been analyzed and improved. It also attributed the realization of the problems to the program office and NAVAIR not having adequately engaged and communicated early with each other to coordinate and resolve differences in organizational perspectives and priorities and provide intensive pre-deployment preparation and training. Program officials acknowledged these shortcomings and attributed them to their limited authority over the commands. In this regard, they have previously surfaced these risks with department oversight and approval authorities, but actions were not taken by these authorities that ensured that the risks were being effectively mitigated.

Beyond not effectively mitigating these risks, the program office has not ensured that all risks are captured in the risk inventory. For example, the inventory does not include the risks described in this report that are associated with not having adequately demonstrated the program's alignment to the federated BEA and not having implemented program-level EVM in a manner that reflects industry practices. This means that these risks are not being disclosed or mitigated.

By not effectively addressing all risks associated with the program, these risks can and have become problems that contribute to cost and schedule shortfalls. Until all significant risks are proactively addressed, to include ensuring that all associated mitigation steps are implemented and that they accomplished their intended purpose, the program will likely experience further problems at subsequent deployment sites.

Conclusions

DOD's success in delivering large-scale business systems, such as Navy ERP, is in large part determined by the extent to which it employs the kind of rigorous and disciplined IT management controls that are reflected in department policies and related guidance. While implementing these controls does not guarantee a successful program, it does minimize a program's exposure to risk and thus the likelihood that it will fall short of expectations. In the case of Navy ERP, living up to expectations is important because the program is large, complex, and critical to addressing the department's long-standing problems related to financial transparency and asset visibility.

The effectiveness to which key IT management controls have been implemented in Navy ERP varies, with one control and several aspects of

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others being effectively implemented, and others less so. Moreover, those controls that have not been effectively implemented have, in part, contributed to the sizable cost and schedule shortfalls experienced to date on the program. Unless this changes, more shortfalls can be expected.

While the program office is primarily responsible for ensuring that effective IT management controls are implemented, other oversight and stakeholder organizations share responsibility. For example, even though the program has not demonstrated its alignment with the federated BEA, it nevertheless followed established DOD architecture compliance guidance and used the related compliance assessment tool in assessing and asserting its compliance. The root cause for not demonstrating compliance thus is not traceable to the program office but rather is due to, among other things, the limitations of the compliance guidance and tool, and the program's oversight entities not validating the compliance assessment and assertion. Also, the reason that the program's cost estimate was not informed by the cost experiences of other programs of the same size and scope is because DOD does not have a standard ERP cost element structure and has not maintained a historical database of costs for like programs to use. In contrast, effective implementation of other management controls, such as implementing EVM, requirements traceability, and risk management is the responsibility of the program office.

All told, addressing the management control weaknesses requires the combined efforts of the various organizations that share responsibility for managing and overseeing the program. By doing so, the department can better assure itself that Navy ERP will optimally support its performance goals and will deliver promised capabilities and benefits on time and within budget.

Because we recently completed work that more broadly addresses the above cited architectural alignment and comparable program cost data limitations, we are not making recommendations in this report for addressing them.

Recommendations for Executive Action

To strengthen Navy ERP management control and better provide for the program's success, we are making the following recommendations:

- To improve the reliability of Navy ERP benefit estimates and cost estimates, we recommend that the Secretary of Defense direct the Secretary of the Navy, through the appropriate chain of command, to ensure that future Navy ERP estimates include uncertainty analyses of estimated benefits, reflect the risks associated with not having cost data

for comparable ERP programs, and are otherwise derived in full accordance with the other key estimating practices, and economic analysis practices discussed in this report.

- To enhance Navy ERP's use of EVM, we recommend that the Secretary of Defense direct the Secretary of the Navy, through the appropriate chain of command, to ensure that (1) an integrated baseline review on the last two releases of the first increment is conducted, (2) compliance against the 32 accepted industry EVM practices is verified, and (3) a plan to have an independent organization perform surveillance of the program's EVM system is developed and implemented.

- To increase the quality of the program's integrated master schedule, we recommend that the Secretary of Defense direct the Secretary of the Navy, through the appropriate chain of command, to ensure that the schedule (1) includes the logical sequencing of all activities, (2) reflects whether all required resources will be available when needed, (3) defines a critical path that integrates all three releases, (4) allocates reserve for the high-risk activities on the entire program's critical path, and (5) incorporates the results of a schedule risk analysis for all three releases and recalculates program cost and schedule variances to more accurately determine a most likely cost and schedule overrun.

- To improve Navy ERP's management of program risks, we recommend that the Secretary of Defense direct the Secretary of the Navy, through the appropriate chain of command, to ensure that (1) the plans for mitigating the risks associated with converting data from legacy systems to Navy ERP and positioning the commands for adopting the new business processes embedded in the Navy ERP are re-evaluated in light of the recent experience with NAVAIR and adjusted accordingly, (2) the status and results of these and other mitigation plans' implementation are periodically reported to program oversight and approval authorities, (3) these authorities ensure that those entities responsible for implementing these strategies are held accountable for doing so, and (4) each of the risks discussed in this report are included in the program's inventory of active risks and managed accordingly.

Agency Comments and Our Evaluation

In written comments on a draft of this report, signed by the Deputy Under Secretary of Defense (Business Transformation) and reprinted in appendix II, DOD stated that it concurred with two of our four recommendations and partially concurred with the remaining two. Further, it stated that it has taken steps to address some of our recommendations, adding that it is committed to implementing recommendations that contribute to the

program's success. The department's comments relative to both of the recommendations that it partially concurred with, as well as additional comments, are discussed below.

For our recommendation associated with improving the program's benefit and cost estimates, DOD concurred with two of the recommendation's three parts, but it did not concur with one part—ensuring that future cost estimates reflect the risk of not having cost data for comparable programs. While acknowledging that the program had limited cost data from comparable programs on which to base its cost estimate, DOD stated that an uncertainty analysis had been applied to the estimate to account for the risk associated with not having such data. The department further stated that actual experience on the program will continue to be used to refine the program's cost estimating methodology. While we support DOD's stated commitment to using actual program cost experience in deriving future estimates, we do not agree that the latest estimate accounted for the risk of not having cost data from comparable programs. We examined the uncertainty analysis as part of our review, and found that it did not recognize this risk. Moreover, DOD's comments offered no new evidence to the contrary.

For our recommendation associated with improving the program's schedule estimating, DOD concurred with four of the recommendation's five parts, and partially concurred with one part—ensuring that the schedule defines a critical path that integrates all releases. In taking this position, the department stated that a critical path has been established for each release rather than across all three releases, and it attributes this to the size and complexity of the program. We do not take issue with either of these statements, as they are already recognized in our report. However, DOD offers no new information in its comments. Further, our report also recognizes that to be successful, large and complex programs that involve thousands of activities need to ensure that their schedules integrate these activities. In this regard, we support the department's commitment to explore the feasibility of implementing this part of our recommendation.

In addition, while stating that it concurred with all parts of our recommendation associated with improving the program's use of EVM, DOD nevertheless provided additional comments as justification for having not conducted an integrated baseline review on Release 1.0. Specifically, it stated that when it rebaselined this release in December 2006, the release's development activities were essentially complete and the release was in the latter stages of testing. Further, it stated that the risks associated with the Release 1.0 schedule were assessed 3 months after this rebaselining, and these risks were successfully mitigated. To

support this statement, it said that Release 1.0 achieved its "Go-Live" as scheduled at NAVAIR. We do not agree with these comments for several reasons. First, at the time of the rebaselining, about 9 months of scheduled Release 1.0 development remained, and thus the release was far from complete. Moreover, the significance of the amount of work that remained, and still remains today on Release 1.0 is acknowledged in DOD's own comment that the scheduled integrated baseline review for Release 1.1 will also include remaining Release 1.0 work. Second, the Release 1.0 contract was awarded in January 2006, and DOD's own guidance requires that an integrated baseline review be conducted within 6 months of a contract's award. Third, although DOD states that the program achieved "Go-Live" as scheduled on October 1, 2007, the program achieved initial operational capability 7 months later than established in the December 2006 baseline.

In addition to these comments, the department also described actions under way or planned to address our recommendations. We support the actions described, as they are consistent with the intent of our recommendations. If fully and properly implemented, these actions will go a long way in addressing the management control weaknesses that our recommendations are aimed at correcting.

We are sending copies of this report to interested congressional committees; the Director, Office of Management and Budget; the Congressional Budget Office; the Secretary of Defense; and the Department of Defense Office of the Inspector General. We also will make copies available to others upon request. In addition, the report will be available at no charge on the GAO Web site at http://www.gao.gov.

If you or your staff have any questions about this report, please contact me at (202) 512-3439 or hiter@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 major contributions to this report are listed in appendix III.

Randolph C. Hite
Director, Information Technology Architecture
    and Systems Issues

Appendix I: Objective, Scope, and Methodology

Our objective was to determine whether the Department of the Navy is effectively implementing information technology management controls on the Navy Enterprise Resource Planning (Navy ERP) program. To accomplish this, we focused on the first increment of Navy ERP and the following management areas (1) architectural alignment, (2) economic justification, (3) earned value management (EVM), (4) requirements management, and (5) risk management.

- To determine whether Navy ERP was aligned with the Department of Defense's (DOD) federated business enterprise architecture (BEA), we reviewed the program's BEA compliance assessments and system architecture products, as well as Versions 4.0, 4.1, and 5.0 of the BEA, and compared them with the BEA compliance requirements described in the Fiscal Year 2005 Defense Authorization Act[1] and DOD's BEA compliance guidance, and we evaluated the extent to which the compliance assessments addressed all relevant BEA products. We also determined the extent to which the program-level architecture documentation supported the BEA compliance assessments. We obtained documentation, such as the BEA compliance assessments from the Navy ERP and Global Combat Support System—Marine Corps programs, as well as the Air Force's Defense Enterprise Accounting and Management System and Air Force Expeditionary Combat Support System programs. We then compared these assessments to identify potential redundancies or opportunities for reuse and determined if the compliance assessments examined duplication across programs, and if the tool that supports these assessments is being used to identify such duplication. In doing so, we interviewed program officials and officials from the Department of the Navy, Office of the Chief Information Officer and reviewed recent GAO reports to determine the extent to which the programs were assessed for compliance against the Department of the Navy enterprise architecture. We also interviewed program officials and officials from the Business Transformation Agency and the Department of the Navy, including the logistics Functional Area Manager, and obtained guidance documentation from these officials to determine the extent to which the compliance assessments were subject to oversight or validation.

- To determine whether the program had economically justified its investment in Navy ERP, we reviewed the latest economic analysis to determine the basis for the cost and benefit estimates. This included

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[1]Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005, Pub. L. No. 108-375, § 332 (2004) (codified at 10 U.S.C. §§ 186 and 2222).

evaluating the analysis against Office of Management and Budget guidance
and GAO's Cost Assessment Guide.[2] In doing so, we interviewed cognizant
program officials, including the program manager and cost analysis team,
regarding their respective roles, responsibilities, and actual efforts in
developing and/or reviewing the economic analysis. We also interviewed
officials at the Office of Program Analysis and Evaluation and Naval
Center for Cost Analysis as to their respective roles, responsibilities, and
actual efforts in developing and/or reviewing the economic analysis. We
did not verify the validity of the source data used to calculate estimated
benefits, such as those data used to determine the yearly costs associated
with legacy systems planned for retirement.

- To determine the extent to which the program had effectively
implemented EVM, we reviewed relevant documentation, such as contract
performance reports, acquisition program baselines, performance
measurement baseline, and schedule estimates and compared them with
DOD policies and guidance.[3] To identify trends that could affect the
program baseline in the future, we assessed cost and schedule
performance and, in doing so, we applied earned value analysis
techniques[4] to data from contract performance reports. We compared the
cost of work completed with the budgeted costs for scheduled work over
a 17-month period, from January 2007 to May 2008, to show trends in cost
and schedule performance. We also used data from the reports to estimate
the likely costs at completion of the program through established earned
value formulas. This resulted in three different values, with the middle
value being the most likely. We checked EVM data to see if there were any
mathematical errors or inconsistencies that would lead to the data being
unreliable. We interviewed cognizant officials from the Naval Air Systems
Command and program officials to determine whether the program had
conducted an integrated baseline review, whether the EVM system had

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[2]Office of Management and Budget, Circular No. A-94: *Guidelines and Discount Rates for
Benefit-Cost Analysis of Federal Program* (Oct. 29, 1992), GAO-07-1134SP.

[3]Defense Contract Management Agency, *Department of Defense Earned Value
Management Implementation Guide* (Washington, D.C.: Apr. 7, 2005). See also DOD
Memorandum: *Revision to DOD Earned Value Management Policy* (Washington, D.C.:
Mar. 7, 2005).

[4]The earned value concept is applied as a means of placing a dollar value on project status.
The techniques we used compared the program's budget to actual costs and project status
in dollar amounts. We used standard earned value formulas to calculate cost and schedule
variance and forecast the range of cost overrun at program completion.

been validated against industry guidelines,[5] and to better understand the anomalies in the EVM data and determine what outside surveillance was being done to ensure that the industry standards are being met. We also reviewed the program's schedule estimates and compared them with relevant best practices[6] to determine the extent to which they reflect key estimating practices that are fundamental to having a reliable schedule. In doing so, we interviewed cognizant program officials to discuss their use of best practices in creating the program's current schedule.

- To determine the extent to which the program has effectively implemented requirements management, we reviewed relevant program documentation, such as the program management plan and baseline list of requirements. To determine the extent to which the program has maintained traceability backward to high-level business operation requirements and system requirements, and forward to system design specifications, and test plans, we randomly selected 60 program requirements and traced them both backward and forward. This sample was designed with a 5 percent tolerable error rate at the 95 percent level of confidence so that, if we found 0 problems in our sample, we could conclude statistically that the error rate was less than 5 percent. In addition, we interviewed program officials involved in the requirements management process to discuss their roles and responsibilities for managing requirements.

- To determine the extent to which the program implemented risk management, we reviewed relevant risk management documentation, such as the program's risk management plan and risk database reports demonstrating the status of the program's major risks and compared the program office's activities with DOD acquisition management guidance and related industry practices.[7] We also reviewed the program's mitigation process with respect to key risks to determine the extent to which these risks were effectively managed. In doing so, we interviewed cognizant program officials, such as the program manager and risk manager, to discuss their roles and responsibilities and obtain clarification on the

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[5]American National Standards Institute (ANSI) /Electronic Industries Alliance (EIA) EVM Systems Standard, ANSI/EIA-748-A-1998 (R2002), approved May 19, 1998; revised January 2002.

[6]GAO-07-1134SP.

[7]Department of Defense, *Risk Management Guide for DOD Acquisition*, 6th Edition, Version 1.0., http://www.acq.osd.mil/sse/ed/docs/2006-RM-Guide-4Aug06-final-version.pdf (accessed March 13, 2008) and Software Engineering Institute, CMMI for Acquisition, Version 1.2, CMU/SEI-2007-TR-017 (Pittsburgh, PA: November 2007).

program's approach to managing risks associated with acquiring and implementing Navy ERP.

We conducted this performance audit at DOD offices in the Washington, D.C., metropolitan area and Annapolis, Md., from June 2007 to September 2008, 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 objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective.

Appendix II: Comments from the Department of Defense

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

ACQUISITION
TECHNOLOGY
AND LOGISTICS

AUG 1 9 2008

Mr. Randolph C. Hite
Director, Information Technology Architecture and Systems Issues
U.S. Government Accountability Office
441 G Street, N.W.
Washington, DC 20548

Dear Mr. Hite:

This is the Department of Defense (DoD) response to the GAO draft report GAO-08-896, "DEFENSE BUSINESS SYSTEMS MODERNIZATION: Important Management Controls Being Implemented on Major Navy Program, But Improvements Needed in Key Areas," dated July 18, 2008 (GAO Code 310659). Detailed comments on the report recommendations are enclosed.

The Department concurred with two recommendations and partially concurred with the remaining two. The Department has already taken steps to address some of GAO's recommendations and the Navy Enterprise Resource Planning (ERP) program office is committed to implementing recommendations that will contribute to the program's success.

We appreciate the GAO's input on the Department's progress with its business transformation efforts and continue to value our partnership.

Sincerely,

Paul A. Brinkley
Deputy Under Secretary of Defense
(Business Transformation)

Enclosure:
As stated

GAO DRAFT REPORT DATED JULY 18, 2008
GAO-08-896 (GAO CODE 310659)

"DOD BUSINESS SYSTEMS MODERNIZATION: IMPORTANT
MANAGEMENT CONTROLS BEING IMPLEMENTED ON MAJOR
NAVY PROGRAM, BUT IMPROVEMENTS NEEDED IN KEY AREAS"

DEPARTMENT OF DEFENSE COMMENTS
TO THE GAO RECOMMENDATIONS

RECOMMENDATION 1: The GAO recommends that the Secretary of Defense direct
the Secretary of the Navy, through the appropriate chain of command, to ensure that
future Navy Enterprise Resource Planning (ERP) estimates include uncertainty analyses
of estimated benefits, reflect the risk associated with not having cost data for comparable
ERP programs, and are otherwise derived in full accordance with the other key estimating
practices, and economic analysis practices discussed in this report. (Page 52/GAO Draft
Report)

DOD RESPONSE: Partially Concur. Future Navy ERP estimates will include
uncertainty analyses of estimated benefits and be derived in full accordance with key
estimating and economic analysis practices. In future estimates, uncertainty surrounding
the assumptions driving the benefit estimate will have probability distributions applied.
The point estimate reported will be generated using the expected values of the probability
distributions.

The Department does not concur with the second element of Recommendation 1, that
future Navy ERP estimates reflect the risk associated with not having cost data for
comparable ERP programs. At Milestone A/B, the program estimate was based on
commercial best practices and standards used to implement System Application Program
(SAP) functionality as well as engineering inputs and expertise developed during the
Navy's pilot ERP programs. This approach was considered the best approach given the
limited comparable enterprise program system implementation data currently available in
DoD. Furthermore, the industry standards and the functional scope definition had
uncertainty analysis applied to account for the risk associated with not having comparable
DoD programmatic data. As the program began execution, the methodology was and
continues to be refined as actual experience is gained by the Navy ERP program.

RECOMMENDATION 2: The GAO recommends that the Secretary of Defense direct
the Secretary of the Navy, through the appropriate chain of command, to ensure that: (1)
an integrated baseline review on the last two releases of the first increment is conducted;
(2) compliance against the 32 accepted industry earned value management (EVM)
practices is verified: and (3) a plan to have an independent organization perform

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surveillance of the program's EVM system is developed and implemented. (Page
52/GAO Draft Report)

DOD RESPONSE: Concur. The Department appreciates the importance of Earned
Value Management (EVM) as an effective management tool that promotes efficient
management of programs such as Navy ERP. Navy ERP has been implementing
"Program-Level" EVM since 2006. During that time, the Navy ERP Program Office has
received detailed guidance and advice from various government and industry groups since
Program-Level EVM is rare and requires tailoring to achieve compliance with best
practices.

A key part of this implementation is the Integrated Baseline Review (IBR), which has
been scheduled for Navy ERP Release 1.1 in August 2008. Although this IBR will focus
on Release 1.1, it will also include the remaining Release 1.0 deployments. The IBR will
focus on the health of the baseline, assessing schedule and associated resourcing. Navy
ERP will also conduct IBR on future releases.

An IBR was not conducted on Release 1.0 because once the rebaselining was approved in
December 2006, development was essentially complete and the release was in the latter
stages of testing. However, a Schedule Risk Assessment (SRA) of Release 1.0 was
conducted in March 2007. The main finding was that the Integrated Master Schedule
(IMS) was high risk for achieving Go-Live due to the lack of integration of the Navy ERP
schedule with the schedule of Naval Air System Command (NAVAIR), the customer.
Navy ERP took corrective measures to mitigate this risk by developing a cut-over
schedule that integrated with NAVAIR's schedule. Navy ERP has made it a requirement
to incorporate customer schedules in all future releases. The corrective measures
successfully mitigated the risk associated with 1.0 as indicated by the Program achieving
Go-Live as scheduled.

Navy ERP follows the direction of the Assistant Secretary of the Navy for Research,
Development and Acquisition (ASN(RDA)) to work with the Navy Center for Earned
Value Management (CEVM) to validate that management processes meet the intent of the
32 guidelines described in the American National Standards Institute/Electronic
Industries Alliance (ANSI/EIA) standard ANSI/EIA-748. CEVM will also perform
ongoing surveillance of Navy ERP processes and EVM data, addressing the last element
of GAO's recommendation. Additionally, as of August 2008, Navy ERP is complying
with the Under Secretary of Defense for Acquisition, Technology, and Logistics (AT&L)
memo issued July 11, 2007 on the implementation of the Central Repository System.
This memo requires that all Acquisition Category I programs submit monthly cost and
schedule performance reports via the Defense Cost and Resource Center (DCARC)
Earned Value Repository.

RECOMMENDATION 3: The GAO recommends that the Secretary of Defense direct
the Secretary of the Navy, through the appropriate chain of command, to ensure that the
schedule: (1) includes the logical sequencing of all activities; (2) reflects whether all

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required resources will be available when needed; (3) defines a critical path that
integrates all three releases; (4) allocates reserve for the high-risk activities on the entire
program's critical path; and (5) incorporates the results of a schedule risk analysis for all
three releases, and recalculates program cost and schedule variances to more accurately
determine a most likely cost and schedule overrun. (Page 52/GAO Draft Report)

DOD RESPONSE: Partially Concur. The Department's EVM policy recognizes that the
preparation of an Integrated Master Schedule (IMS) is a best practice. The Department
concurs with the following elements of the recommendation and the Navy ERP Program
Office will ensure that the schedule:

- Includes the logical sequencing of all activities: Navy ERP has implemented a
  logically sequenced schedule for Release 1.1 of all activities based on experience
  gained from Navy ERP Release 1.0. Improvements have been made and the
  schedule is continuously monitored through weekly schedule metrics.
- Reflects whether all required resources will be available when needed: The Navy
  ERP IMS has a resource-loaded, time-phased schedule for each release that
  identifies resource allocation and is aligned with the Program's approved staffing
  plan.
- Allocates reserve for the high-risk activities on the entire program's critical path:
  Navy ERP has actively begun refining the risk identification process to
  incorporate risk and potential impact to the program schedule utilizing schedule
  inputs. As this process matures, the result will be used to assist in identify
  adequate resources required in managing integrated program activities across all
  three releases.
- Incorporates the results of a schedule risk analysis (SRA) for all releases: The
  Results of the SRA for Release 1.1 will be compared to the results of the SRA for
  Release 1.0 and incorporated into the variance analysis for cost and schedule to
  avoid any potential overruns. Navy ERP is implementing an estimate at
  completion (EAC) process for quarterly updates beginning in Fiscal Year 2009.

The Department partially concurs with the third element of the recommendation, that the
schedule defines a critical path that integrates all three releases. Navy ERP utilizes a
critical path for each release. This approach recognizes the size and complexity of the
Navy's implementation releases and still allows the Navy to remain focused on the true
dependencies the individual releases have with one another. The Program Office will
review this recommendation with Navy leadership to determine feasibility for Navy ERP.

RECOMMENDATION 4: The GAO recommends that the Secretary of Defense direct
the Secretary of the Navy, through the appropriate chain of command, to ensure that: (1)
the plans for mitigating the risks associated with converting data from legacy systems to
Navy ERP and positioning the commands for adopting the new business processes
embedded in the Navy ERP are re-evaluated in light of the recent experience with Naval
Air Systems Command (NAVAIR) and adjust accordingly; (2) the status and results of
these and other mitigation plans' implementation are periodically reported to program

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oversight and approval authorities; (3) these authorities ensure that those entities responsible for implementing these strategies are held accountable for doing so; and (4) each of the risks discussed in this report are included in the program's inventory of active risks, and managed accordingly. (Page 53/GAO Draft Report)

DOD RESPONSE: Concur. Navy ERP incorporated lessons learned from NAVAIR into the Navy ERP Program Command Implementation Guidance. The guidance, a copy of which is attached for reference, incorporates key lessons learned from prior deployments and provides a detailed overview of the implementation process and key information required in structuring a Command's implementation team and activities needed for success. The Navy ERP Program Command Implementation Guidance also identifies critical success factors based on extensive commercial and Navy ERP implementation experience and provides a time-phased checklist to help focus a Command's resources on the right actions, at the right time. It has been reviewed by the Navy System Command Commanders and is being used by the Navy Supply System Command (NAVSUP) in preparation for the next deployment of Navy ERP Release 1.0.

The Readiness Assessment checklist in the Navy ERP Program Command Implementation Guidance helps to identify risks, and through the Navy ERP Risk Program process, elevate the risk appropriately to the right level of management to facilitate mitigation planning. In addition to those risks identified by the program, Navy ERP will add the risks identified by GAO to its risk inventory. Risks and mitigation plans are formally captured by the Navy ERP Risk Management Board in its Risk Radar tracking tool.

Furthermore, in light of the experience learned with deployment to NAVAIR, Navy ERP has completed a full review and reevaluation of all active risks and corresponding mitigation plans. This review included two areas noted by GAO in the report: (1) conversion of data from legacy systems to Navy ERP and (2) transformation change management to position Commands to adopt Navy ERP.

Since Navy's ERP's deployment of Release 1.0 to NAVAIR, the enterprise governance structure that reviews program risks has evolved. Governance now includes the Navy Component Acquisition Executive's review process, the Navy ERP Senior Integration Board, and Enterprise Risk Assessment Methodology (ERAM) assessments. The Navy will work through these governance bodies and with other appropriate oversight and approval authorities to determine additional reporting mechanisms for risks with associated mitigation plans, to ensure commitment and accountability across the Navy Enterprise. Direction received from these authorities with respect to risk and risk management will be incorporated into the Navy ERP Risk Management Program. Through the Navy and Office of the Secretary of Defense (OSD) governance bodies, including the Milestone Decision Authority (MDA), Deputy Under Secretary of Defense (Business Transformation), as well as Navy Enterprise Senior Integration Board (NESIB), the Navy ERP Program Manager is held accountable for overall program performance, including implementing risk mitigation strategies. This aligns to Department of Defense

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Directive 5000.1, paragraph 3.5, which states that the Program Manager is accountable
for credible cost, schedule, and performance reporting to the MDA.

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Appendix III: GAO Contact and Staff Acknowledgments

GAO Contact

Randolph C. Hite, (202) 512-3439, or hiter@gao.gov

Staff Acknowledgments

In addition to the individual named above, key contributors to this report were Neelaxi Lakhmani, Assistant Director; Monica Anatalio; Harold Brumm; Neil Doherty; Cheryl Dottermusch; Nancy Glover; Mustafa Hassan; Michael Holland; Ethan Iczkovitz; Anh Le; Josh Leiling; Emily Longcore; Lee McCracken; Madhav Panwar; Karen Richey; Melissa Schermerhorn; Karl Seifert; Sushmita Srikanth; Jonathan Ticehurst; and Adam Vodraska.

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