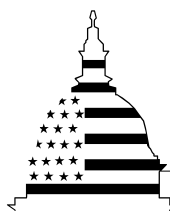


September 2003

# DOD BUSINESS SYSTEMS MODERNIZATION

Important Progress  
Made to Develop  
Business Enterprise  
Architecture, but  
Much Work Remains



G A O

Accountability ★ Integrity ★ Reliability



Highlights of [GAO-03-1018](#), a report to congressional committees

## Why GAO Did This Study

The National Defense Authorization Act for Fiscal Year 2003 directed the Department of Defense (DOD) to develop an enterprise architecture and a transition plan that meets certain requirements. The act also directed DOD to have a process for controlling its system investments. As required by the act, GAO assessed DOD's actions to comply with the act's requirements and recently issued a report to congressional defense committees. This report provides further details of GAO's assessment results regarding (1) the extent to which DOD's actions complied with the requirements of the act and (2) DOD's plans for further development and implementation of its architecture.

## What GAO Recommends

To further assist DOD in its efforts to effectively develop and implement an enterprise architecture and to guide and constrain its business system investments, GAO is making recommendations to the Secretary of Defense aimed at improving DOD's plans for developing the next version of the architecture and implementing the institutional means for selecting and controlling both planned and ongoing business system investments. DOD concurred with 9 of our 10 recommendations, partially concurred with the remaining one, and described completed, ongoing, or planned actions to address them.

[www.gao.gov/cgi-bin/getrpt?GAO-03-1018](http://www.gao.gov/cgi-bin/getrpt?GAO-03-1018)

To view the full product, including the scope and methodology, click on the link above. For more information, contact Gregory Kutz, (202) 512-9095 ([kutzg@gao.gov](mailto:kutzg@gao.gov)) or Randolph Hite, (202) 512-3439 ([hiter@gao.gov](mailto:hiter@gao.gov)).

# DOD BUSINESS SYSTEMS MODERNIZATION

## Important Progress Made to Develop Business Enterprise Architecture, but Much Work Remains

### What GAO Found

DOD has expended tremendous effort and resources and made important progress in complying with the act's requirements aimed at developing and effectively implementing a well-defined business enterprise architecture. Further, DOD's initial version of its architecture provides a foundation from which to build and ultimately produce a well-defined architecture. For example, the "As Is" environment includes an inventory of about 2,300 existing systems and their characteristics that support DOD's current business operations; and the "To Be" environment addresses, to at least some degree, how DOD intends to operate in the future, what information will be needed to support these future operations, and what technology standards should govern the design of future systems. Further, DOD has established some of the architecture management capabilities advocated by best practices and federal guidance, such as having a program office, designating a chief architect, and using an architecture development methodology and automated tool.

At the same time, DOD's initial architecture does not yet adequately address the act's requirements and other relevant architectural requirements governing the scope and content. For example, critical federal requirements governing the "To Be" architecture, such as federal accounting requirements for recording revenue, are not included in the initial architecture. Other items not included are

- descriptions of the current business operations in terms of entities and people who perform the functions, processes, and activities and the locations where these are performed;
- descriptions of the systems to be developed or acquired to support future business operations; and
- time frames for phasing out existing systems.

Furthermore, DOD has not yet implemented an effective investment management process for selecting and controlling ongoing and planned business system investments. Until it does, DOD remains at risk of spending billions of dollars on duplicative, stove-piped, nonintegrated systems that do not optimize mission performance and accountability and, therefore, do not support the department's business transformation goals.

Overall, our findings indicate that DOD has taken positive first steps, but much remains to be accomplished before DOD will have the kind of blueprint and associated investment controls to successfully modernize its business operations and supporting systems. According to program officials and the initial version of the transition plan, DOD intends to extend and evolve the architecture to include the missing scope and detail; however, it has not yet defined specific plans outlining how this will be accomplished.

---

# Contents

---

## Letter

|   |    |
|---|----|
| Results in Brief  | 1  |
| Background  | 3  |
| DOD Has Taken Positive First Steps in Complying with Enterprise Architecture Legislative Requirements, but Much Remains to be Accomplished  | 6  |
| DOD's Plans for Evolving and Extending Its Enterprise Architecture and for Improving Business System Investment Decision Making Are Unclear | 16 |
| Conclusions   | 50 |
| Recommendations   | 52 |
| Agency Comments and Our Evaluation  | 53 |
|   | 55 |

---

## Appendixes

|  |    |
|--|----|
| <b>Appendix I: SEC. 1004. [of Public Law 107-314] Development and Implementation of Financial Management Enterprise Architecture</b> | 58 |
| <b>Appendix II: Scope and Methodology</b>  | 60 |
| <b>Appendix III: Status of Prior Recommendations on DOD's Business Enterprise Architecture</b>                                       | 64 |
| <b>Appendix IV: Comments from the Department of Defense</b>  | 68 |
| <b>Appendix V: GAO Contacts and Staff Acknowledgments</b>  | 73 |
| GAO Contacts   | 73 |
| Acknowledgments  | 73 |

---

## Tables

|   |    |
|---|----|
| Table 1: Interrelationship Between Domains and Business Process Areas   | 9  |
| Table 2: Summary of GAO's Enterprise Architecture (EA) Maturity Framework Stages                                      | 18 |
| Table 3: Assessment of DOD's Enterprise Architecture Efforts Against GAO's Enterprise Architecture Maturity Framework | 20 |
| Table 4: Summary of GAO Analysis of JFMIP Requirements  | 25 |
| Table 5: Detailed Analysis of the Extent to Which DOD's "As Is" Architecture Satisfies Key Elements                   | 33 |
| Table 6: Detailed Analysis of the Extent to Which DOD's "To Be" Architecture Satisfies Key Elements                   | 38 |

---

|  |    |
|--|----|
| Table 7: Detailed Analysis of the Extent to Which DOD's Transition Plan Satisfies Key Architectural Elements | 45 |
|--|----|

---

**Figures**

|  |    |
|--|----|
| Figure 1: Interdependent C4ISR Views   | 12 |
| Figure 2: Summary of Extent to Which Version 1.0 of DOD's Enterprise Architecture Satisfies Key Elements Governing Architectural Content | 30 |

This is a work of the U.S. government and is not subject to copyright protection in the United States. It may be reproduced and distributed in its entirety without further permission from GAO. However, because this work may contain copyrighted images or other material, permission from the copyright holder may be necessary if you wish to reproduce this material separately.



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

September 19, 2003

## Congressional Committees

Our research of successful public and private sector organizations shows that attempting a large-scale systems modernization program without having a well-defined modernization blueprint—commonly called an enterprise architecture—and effective investment management controls, results in systems that are duplicative, are not well-integrated, are unnecessarily costly to maintain and interface, and do not effectively optimize mission performance. Accordingly, in May 2001<sup>1</sup> we recommended that the Department of Defense (DOD) develop an enterprise architecture to guide and constrain its almost \$20 billion annual investment in business systems and establish the investment controls needed to implement this architecture. In July 2001, DOD initiated a program to, among other things, address our recommendations, and began developing a DOD-wide business enterprise architecture (BEA) in April 2002. This effort is an essential part of the Secretary of Defense's broad initiative to "transform the way the department works and what it works on."

The National Defense Authorization Act for Fiscal Year 2003<sup>2</sup> required DOD to develop by May 1, 2003, a financial management enterprise architecture<sup>3</sup> and a transition plan for implementing the architecture that meet certain requirements. The act also requires DOD to control expenditures for financial system improvements while the architecture and transition plan are being developed and after they are completed. The act states that the enterprise architecture shall describe an information infrastructure that, at a minimum, would enable DOD to achieve certain capabilities, such as complying with all federal accounting, financial management, and

---

<sup>1</sup> U.S. General Accounting Office, *Information Technology: Architecture Needed to Guide Modernization of DOD's Financial Operations*, [GAO-01-525](#) (Washington, D.C.: May 17, 2001).

<sup>2</sup> Bob Stump National Defense Authorization Act for Fiscal Year 2003, Pub. L. No. 107-314, § 1004, 116 Stat. 2458, 2629, Dec. 2, 2002.

<sup>3</sup> In May 2003, the DOD Comptroller changed the architecture name from the Financial Management Enterprise Architecture to the BEA to reflect the transformation of departmentwide business operations and supporting systems, including accounting and finance, budget formulation, acquisition, inventory management, logistics, personnel, and property management systems.

---

reporting requirements. The act also requires development of a transition plan for implementing the enterprise architecture that includes, among other things, a schedule for phasing out existing systems that will not become part of the “To Be” environment. Finally, before the architecture and transition plan are approved, the act requires DOD to review proposed obligations of funds in amounts exceeding \$1 million for financial system improvements to determine if they meet specific conditions called for in the act. Once the architecture and transition plan are approved, the act requires DOD to ensure that obligations exceeding \$1 million for financial system investments are consistent with the architecture and the transition plan.

The act also directs us to submit to congressional defense committees, within 60 days of DOD’s approval of its enterprise architecture and its transition plan, an assessment of DOD’s actions taken to comply with these requirements. (See app. I for a copy of section 1004 of the act.) We recently issued a report to satisfy this requirement.<sup>4</sup> This report provides specific details on our assessment results regarding (1) the extent to which DOD’s actions complied with the requirements of the act and (2) DOD’s plans for further development and implementation of its enterprise architecture. It also makes recommendations to the Secretary of Defense for improving DOD’s architecture development, maintenance, and implementation efforts, including restricting investments in systems until the architecture is sufficiently defined and effective controls are in place for ensuring new investments are aligned with it.

We performed our work from March 2003 through June 2003 in accordance with U.S. generally accepted government auditing standards. Details on our scope and methodology are included in appendix II. We requested comments on a draft of this report from the Secretary of Defense or his designee. Written comments from the Under Secretary of Defense (Comptroller) are addressed in the “Agency Comments and Our Evaluation” section of this report and are reprinted in appendix IV.

---

<sup>4</sup> U.S. General Accounting Office, *Business Systems Modernization: Summary of GAO’s Assessment of Department of Defense’s Initial Business Enterprise Architecture*, [GAO-03-877R](#) (Washington, D.C.: July 7, 2003).

---

---

## Results in Brief

As we reported in February 2003,<sup>5</sup> DOD undertook a challenging and ambitious task—to develop within 1 year a departmentwide architecture for modernizing its current financial and business operations and systems. Thus far, DOD has expended tremendous effort and resources and made important progress in complying with the legislative requirements aimed at developing and effectively implementing a well-defined enterprise architecture. Concerning progress, the department has established some of the architecture management capabilities advocated by best practices and federal guidance,<sup>6</sup> such as having a program office, designating a chief architect, and using an architecture development methodology and automated tool. Further, DOD's initial version of its BEA provides a foundation from which to build and ultimately produce a well-defined business enterprise architecture. For example, the “As Is” descriptions include an inventory of about 2,300 systems in operation or under development, and their characteristics, that support DOD's current business operations. The “To Be” descriptions address, to at least some degree, how DOD intends to operate in the future, what information will be needed to support these future operations, and what technology standards should govern the design of future systems.

At the same time, the initial version does not yet adequately address the act's requirements and other relevant architectural requirements.<sup>7</sup> For example,

- While DOD has incorporated many relevant external requirements from 152 federal sources in developing its “To Be” architecture products,

---

<sup>5</sup> U.S. General Accounting Office, *DOD Business Systems Modernization: Improvements to Enterprise Architecture Development and Implementation Efforts Needed*, [GAO-03-458](#) (Washington, D.C.: Feb. 28, 2003).

<sup>6</sup> U.S. General Accounting Office, *Information Technology: A Framework for Assessing and Improving Enterprise Architecture Management (Version 1.1)*, [GAO-03-584G](#) (Washington, D.C.: April 2003).

<sup>7</sup> See for example, Office of Management and Budget, *Federal Enterprise Architecture Business Reference Model*, Version 1.0 (2002); Chief Information Officer Council, *A Practical Guide to Federal Enterprise Architecture*, Version 1.0 (February 2001); Office of Management and Budget Circular A-130, *Management of Federal Information Resources* (Nov. 28, 2000); M.A. Cook, *Building Enterprise Information Architectures: Reengineering Information Systems* (Upper Saddle River, N.J., Prentice Hall: 1996); and National Institute of Standards and Technology, *Information Management Directions: The Integration Challenge*, Special Publication 500-167 (September 1989).

---

critical federal requirements governing the “To Be” architecture, such as federal accounting requirements for recording revenue, are not included. As a result, the architecture’s descriptions of certain business processes, such as those associated with revenue accounting and reporting, which include over \$70 billion earned annually by working capital fund activities, are not complete.

- The “As Is” environment provides little descriptive content and does not satisfy 90 percent of the architectural elements required by relevant guidance, such as descriptions of the current business operations in terms of the entities/people who perform the functions, processes, and activities, and the locations where the functions, processes, and activities are performed. As a result, DOD does not have a sufficiently described picture of its current environment to permit development of a meaningful and useful transition plan.
- The “To Be” architecture does not provide sufficient descriptive content related to future business operations and supporting technology to permit effective acquisition and implementation of system solutions and associated operational change. For example, it does not include descriptions of the actual systems to be developed or acquired to support future business operations and the physical infrastructure (e.g., hardware and software) that will be needed to support the business systems. As a result, the “To Be” environment lacks the details needed to provide DOD with a common vision and frame of reference for defining a transition plan to guide and constrain capital investments, and thus to effectively leverage technology to orchestrate logical, systematic change and optimize enterprisewide mission performance.
- The transition plan does not possess the attributes needed to provide a temporal roadmap for moving from the “As Is” to the “To Be” environment and is basically a plan to develop a transition plan. For example, such information as time frames for phasing out existing systems within DOD’s current inventory of about 2,300 systems, and resource requirements for implementing the “To Be” architecture, are not part of the transition plan. As a result, DOD does not yet have a meaningful and reliable basis for managing the disposition of its existing inventory of about 2,300 systems or for sequencing the introduction of modernized business operations and supporting systems.



---

Moreover, DOD has not yet defined and implemented an effective approach to select and control business systems investments<sup>8</sup> for obligations exceeding \$1 million while the architecture is being developed and after it is completed. Since enactment of the act, as of June 6, 2003, DOD had approved one business system improvement for \$10 million that met this \$1 million threshold and was currently reviewing four others. Our analysis of DOD's fiscal years 2003 and 2004 information technology (IT) budget requests shows that over 200 business systems in each year's budget, totaling about \$4 billion per year, could involve obligations of funds that meet the \$1 million threshold. This indicates that the majority of the billions of dollars that DOD invests in business system improvements annually have not been subject to the scrutiny of the DOD Comptroller now called for in the act. Overall, our findings indicate that DOD has taken positive first steps, but much remains to be accomplished before DOD will have the kind of blueprint and associated investment controls needed to successfully modernize its financial management operations and supporting business systems.

DOD's position is that, to varying degrees, the initial version of its architecture fully satisfies the act's requirements, but it also recognizes that the architecture needs to be expanded and extended to provide a sufficient basis for guiding and constraining investment decisions. DOD's position is also that it has taken steps to implement the act's requirements regarding approving system investments, but that it needs to do more to effectively select and control business system investments. DOD attributes the current state of its architecture and investment management processes to the limited time it has had to define and implement each, in part because it was overly optimistic in estimating what it could deliver by May 1, 2003. Until DOD develops and provides for effective implementation of a well-defined enterprise architecture, its ability to modernize its business and systems environments in a way that minimizes risk and maximizes return on investment will be severely hindered.

According to program officials and the initial version of the transition plan, DOD intends to extend and evolve the architecture to include the missing scope and detail. However, it has not defined specific plans outlining how

---

<sup>8</sup> Business systems include financial and nonfinancial systems, such as civilian personnel, finance, health, logistics, military personnel, procurement, and transportation, with the common element being the generation or use of financial data to support DOD's business operations.

---

this will be accomplished. Rather, DOD's current plan is to develop a strategy for producing the next version of its architecture, and managing ongoing and planned investments. Among other things, this strategy is to provide for

- determining the resources needed to further develop the architecture;
- developing a methodology for integrating the architecture with other internal and external architectures;
- establishing an approach for maintaining its existing systems inventory; and
- evaluating the architecture for completeness, accuracy, and integration of end-to-end business processes and system functions.

In addition, DOD program documentation provides for initiating pilot projects in the near term that are to demonstrate and implement a portion of the architecture and be usable across the department. However, DOD officials stated that the pilot projects are intended to validate departmentwide business processes and not to implement production systems. Because of these differing views of what the pilot projects are intended to achieve, the purpose and scope of these projects remain unclear, and specific projects have yet to be selected.

To assist DOD, we are making recommendations to the Secretary of Defense aimed at improving its plans for developing the next version of the architecture and implementing the institutional means for selecting and controlling both planned and ongoing system investments. DOD concurred with 9 of our 10 recommendations, partially concurred with the remaining one, and described actions recently completed, ongoing, or planned to implement them.

---

## Background

DOD is one of the largest and most complex organizations in the world. In fiscal year 2002, DOD reported that its operations involve about \$700 billion in assets, nearly \$1.5 trillion in liabilities, approximately 3.3 million military and civilian personnel, and disbursements of over \$346 billion. Moreover, execution of these operations spans a wide range of defense organizations, including the military services and their respective major commands and functional activities, numerous large defense agencies and field activities, and various combatant and joint operational commands

---

that are responsible for military operations for specific geographic regions or theaters of operations. To execute these military operations, the department performs an assortment of interrelated and interdependent business functions, including logistics management, procurement, healthcare management, and financial management.

The department's pervasive problems in performing these business functions are well chronicled by the DOD Inspector General, the military service audit agencies, and us. Of the 25 areas in the federal government that we have designated as high risk, 6 are DOD program areas (i.e., systems modernization management, financial management, contract management, inventory management, support infrastructure management, and weapon systems acquisition), and DOD shares responsibility for 3 of the governmentwide high-risk areas (i.e., strategic human capital management, protecting information systems and critical infrastructures, and federal real property).<sup>9</sup> DOD's problems in each of these areas hinder the efficiency of operations, and leave the department vulnerable to fraud, waste, and abuse.

To support its business functions, DOD reports that it currently relies on about 2,300 systems, including accounting, acquisition, logistics, and personnel. As we have previously reported,<sup>10</sup> this environment was not designed to be, but rather has evolved into, an overly complex, and error-prone IT environment, including (1) little standardization across DOD, (2) multiple systems performing the same tasks, (3) the same data stored in multiple systems, and (4) manual data entry into multiple systems. For fiscal year 2003, DOD requested approximately \$26 billion in IT funding to support a wide range of military operations as well as DOD business system operations. Approximately \$18 billion—nearly \$5.2 billion for business systems and \$12.8 billion primarily for business systems infrastructure—relates to the operation, maintenance, and modernization

---

<sup>9</sup> U.S. General Accounting Office, *High Risk Series: An Update*, [GAO-03-119](#) (Washington, D.C.: January 2003); U.S. General Accounting Office, *High Risk Series: Strategic Human Capital Management*, [GAO-03-120](#) (Washington, D.C.: January 2003); U.S. General Accounting Office, *High Risk Series: Protecting Information Systems Supporting the Federal Government and the Nation's Critical Infrastructures*, [GAO-03-121](#) (Washington, D.C.: January 2003); and U.S. General Accounting Office, *High Risk Series: Federal Real Property*, [GAO-03-122](#) (Washington, D.C.: January 2003).

<sup>10</sup> U.S. General Accounting Office, *DOD Financial Management: Important Steps Underway But Reform Will Require a Long-term Commitment*, [GAO-02-784T](#) (Washington, D.C.: June 4, 2002).

---

of DOD's business systems. The remaining \$8 billion relates primarily to command and control systems, including the infrastructure to support these systems.

One of the seven key elements we have reported<sup>11</sup> as necessary to successfully execute the department's business systems modernization program is establishing and implementing an enterprise architecture. Subsequently, in its fiscal year 2002 *Performance and Accountability Report*, DOD acknowledged that deficiencies in its systems and business processes hindered the department's ability to collect and report financial and performance information that is accurate, reliable, and timely. The report noted that to address its systemic problems and assist in the transformation of the department's business operations, the department had undertaken the development and implementation of a business enterprise architecture, or modernization blueprint. Table 1 shows the scope of DOD's business operations, including business domains owners, and related business process areas and supporting functions.

---

<sup>11</sup> U.S. General Accounting Office, *Department of Defense: Status of Financial Management Weaknesses and Progress Toward Reform*, [GAO-03-931T](#) (Washington D.C.: June 25, 2003).

**Table 1: Interrelationship Between Domains and Business Process Areas**

| Domain   | Domain owner   | Business process areas                               | Business process functions  |
|--|--|--|---|
| Acquisition/Procurement                                  | Under Secretary of Defense (Acquisition, Technology and Logistics)   | Procurement and Acquisition                          | Identifying a need and procuring and acquiring goods and services to satisfy the need (includes managing contracts and purchase card programs).   |
| Finance, Accounting Operations, and Financial Management | Under Secretary of Defense (Comptroller/Chief Financial Officer)   | Accounting   | Identifying, measuring, recording, and communicating economic information about an organization (includes developing and maintaining DOD standard accounting structure, policies, and cost accounting). |
|  |  | Collection, Accounts Receivable, and Cash Management | Recording, tracking, managing, monitoring, liquidating, and collecting amounts due to DOD (includes reconciling fund balance with Treasury).  |
|  |  | Payables and Disbursing                              | Receiving payment requests, determining payment due dates, and issuing payment.   |
|  |  | Financial and Management Reporting                   | Providing accurate, reliable, and timely financial and management information.  |
| Human Resource Management                                | Under Secretary of Defense (Personnel and Readiness)   | Human Resource Management                            | Facilitating entry to the organization, developing and managing careers, managing benefits and pay, executing policies and procedures, and managing employee information.                               |
| Logistics  | Under Secretary of Defense (Acquisition, Technology and Logistics)   | Logistics  | Planning, controlling, and carrying out the efficient and effective movement and maintenance of forces (includes inventory and personal property management).   |
| Strategic Planning and Budgeting                         | Under Secretary of Defense (Comptroller/Chief Financial Officer)   | Strategic Planning and Budgeting                     | Strategic planning, developing the programs and the budget, and executing the budget.   |
| Installations and Environment                            | Under Secretary of Defense (Acquisition, Technology and Logistics)   | Real Property and Environmental Liabilities          | Managing all real property and environmental controls.  |
| Technical Infrastructure                                 | Assistant Secretary of Defense (Networks and Information Integration)/Chief Information Officer <sup>a</sup> | All of the above                                     | Providing foundation for enterprise data management, reporting, enterprise and technical services, and standards and policy (includes information assurance).   |

Source: GAO analysis of DOD data.

<sup>a</sup>Formerly known as Assistant Secretary of Defense (Command, Control, Communications and Intelligence)/Chief Information Officer.

---

---

## Enterprise Architecture Is Critical to DOD's Ability to Improve Its Business Functions

Effective use of enterprise architectures is a trademark of successful public and private organizations. For a decade, we have promoted the use of architectures, recognizing them as a crucial means to a challenging goal: agency operational structures that are optimally defined, in both business and technological environments. The Congress, the Office of Management and Budget (OMB), and the federal Chief Information Officer (CIO) Council also have recognized the importance of an architecture-centric approach to modernization. For example, the Clinger-Cohen Act of 1996<sup>12</sup> mandates that an agency's CIO develop, maintain, and facilitate the implementation of an architecture within the agency and that the agency's decisions to invest in IT satisfy specified criteria and take into account the agency's business processes. Further, OMB has issued guidance<sup>13</sup> that, among other things, requires system investments to be consistent with these architectures.

### What Is an Enterprise Architecture?

An enterprise architecture provides a clear and comprehensive picture of an entity, whether it is an organization (e.g., federal department or agency) or a functional or mission area that cuts across more than one organization (e.g., financial management). This picture consists of snapshots of both the enterprise's current or "As Is" operational and technological environment and its target or "To Be" environment, as well as a capital investment roadmap for transitioning from the current to the target environment. These snapshots further consist of "views," which are basically one or more architecture products that provide conceptual or logical representations of the enterprise.

The concept of enterprise architectures dates back to the mid-1980s. At that time, John Zachman, widely recognized as a leader in the field of enterprise architecture, identified the need to use a logical construction blueprint (i.e., an architecture) for defining and controlling the integration of systems and their components.<sup>14</sup> Accordingly, Zachman developed a structure or "framework" for defining and capturing an architecture. In his work, Zachman drew parallels to the field of classical architecture and later

---

<sup>12</sup> The Clinger-Cohen Act of 1996, Pub. L. No. 104-106, Div. E, Title LI, sections 5122 and 5125, 110 Stat. 679, 683-85, Feb. 10, 1996 (codified, as amended, at 40 U.S.C. sections 11312 and 11315(b)(2)).

<sup>13</sup> OMB Circular No. A-130, *Management of Federal Information Resources* (Nov. 28, 2000).

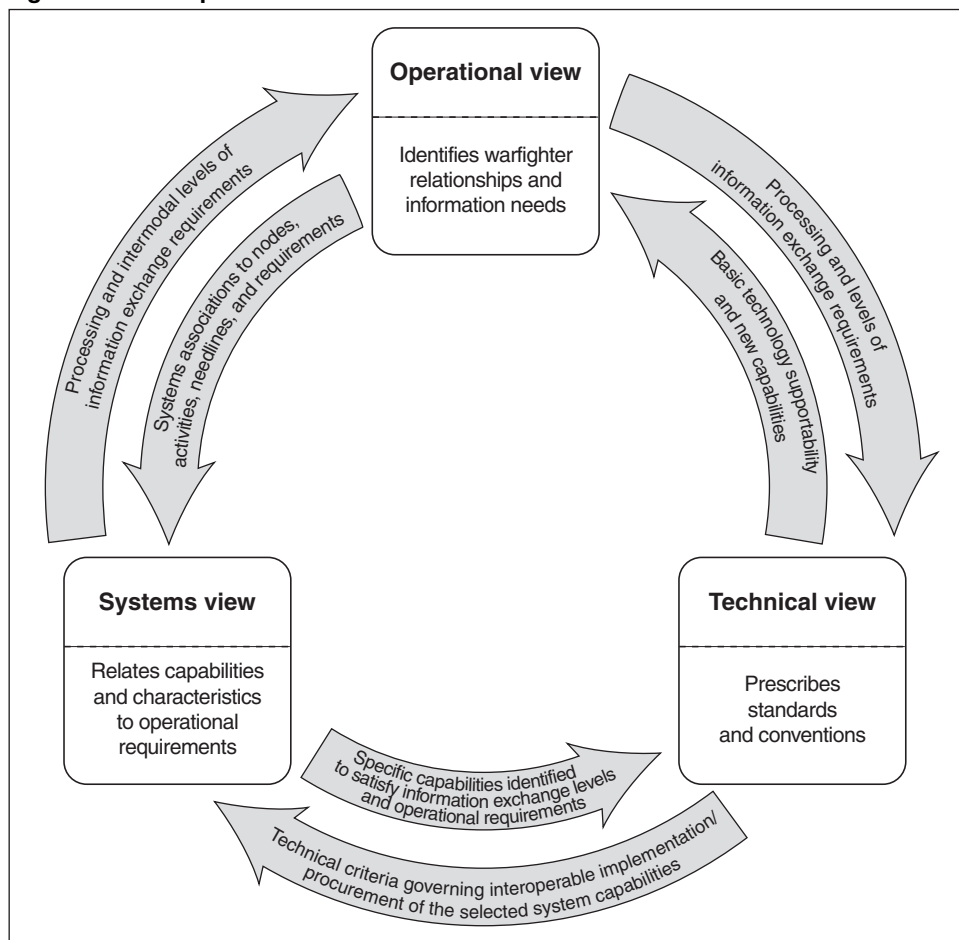
<sup>14</sup> J.A. Zachman, "A Framework for Information Systems Architecture," *IBM Systems Journal* 26, no. 3 (1987).

---

to the aircraft manufacturing industry, in which different work products (e.g., architect plans, contractor plans, shop plans, and bills of lading) represent different views of the planned building or aircraft. Similarly, Zachman's framework identified the kinds of work products needed for people to understand and thus build a given system or entity. This framework provides for six windows from which to view the enterprise, which Zachman terms "perspectives" on how a given entity operates: those of (1) the strategic planner, (2) the system user, (3) the system designer, (4) the system developer, (5) the subcontractor, and (6) the system itself. Zachman also proposed six abstractions or models associated with each of these perspectives: these models cover (1) how the entity operates, (2) what the entity uses to operate, (3) where the entity operates, (4) who operates the entity, (5) when entity operations occur, and (6) why the entity operates. Zachman's framework provides a way to identify and describe an entity's existing and planned component parts and the parts' relationships before one begins the costly and time-consuming efforts associated with developing or transforming the entity.

Since Zachman introduced his framework, a number of other frameworks have been proposed. In February 1998, DOD directed its components to use its *Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) Architecture Framework*, Version 2.0. The C4ISR architecture framework defines the type and content of architectural artifacts, as well as the relationships among artifacts, that are needed to produce a useful enterprise architecture. Briefly, the framework decomposes an enterprise architecture into three primary views (windows into how the enterprise operates): the operational, systems, and technical views. According to DOD, the three interdependent views are needed to ensure that IT systems are developed and implemented in an interoperable and cost-effective manner. (See fig. 1 for an illustration of the three views.)

**Figure 1: Interdependent C4ISR Views**



Source: C4ISR Architecture Framework, Version 2.

More recently, OMB established the Federal Enterprise Architecture Program Management Office to develop a federated enterprise architecture according to a collection of five “reference models”:

- The *Business Reference Model* is intended to describe the business operations of the federal government independent of the agencies that perform them, including defining the services provided to state and local governments.



- 
- The *Performance Reference Model* is to provide a common set of general performance outputs and measures for agencies to use to achieve business goals and objectives.
  - The *Data and Information Reference Model* is to describe, at an aggregate level, the type of data and information that support program and business line operations, and the relationships among these types.
  - The *Service Component Reference Model* is to identify and classify IT service (i.e., application) components that support federal agencies and promote the reuse of components across agencies.
  - The *Technical Reference Model* is to describe how technology is supporting the delivery of service components, including relevant standards for implementing the technology.

These post-Zachman frameworks differ in their nomenclatures and modeling approach. However, the frameworks consistently provide for defining an enterprise's operations in both (1) logical terms, such as interrelated business processes and business rules, information needs and flows, and work locations and users, and (2) technical terms, such as hardware, software, data, communications, and security attributes and performance standards. The frameworks also provide for defining these perspectives both for the enterprise's "As Is" and "To Be" environments, as well as a transition plan for moving from the "As Is" to the "To Be" environment.

The importance of developing, implementing, and maintaining an enterprise architecture is a basic tenet of both organizational transformation and IT management. Managed properly, an enterprise architecture can clarify and help optimize the interdependencies and relationships among an organization's business operations and the underlying IT infrastructure and applications that support these operations. Employed in concert with other important management controls, such as portfolio-based capital planning and investment control practices, architectures can greatly increase the chances that organizations' operational and IT environments will be configured so as to optimize mission performance. Our experience with federal agencies has shown that investing in IT without defining these investments in the

---

context of an architecture often results in systems that are duplicative, not well integrated, and unnecessarily costly to maintain and interface.<sup>15</sup>

Subsection 1004(b) of the act (see app. I) also defines elements required of DOD's enterprise architecture that are consistent with the above mentioned enterprise architecture guidance and requirements. Specifically, DOD's financial management enterprise architecture (its BEA) must define an information infrastructure that would enable DOD to meet certain requirements and it must include policies, procedures, data standards, and system interface requirements applicable uniformly throughout DOD.

---

## Prior Reviews of DOD's Enterprise Architecture Efforts Have Identified Challenges and Weaknesses

For the last 2 years, GAO has addressed the need for and reviewed DOD's efforts to develop an enterprise architecture for modernizing its business operations and systems and made recommendations to assist DOD in successfully developing the architecture and using it to gain control over its ongoing business system investments.

In particular, we reported in May 2001<sup>16</sup> that the department had neither an enterprise architecture for its financial and financial-related business operations, nor the management structure, processes, and controls in place to effectively develop and implement one. We also reported that the department planned to spend billions of dollars on new and modified business systems that would function independently from one another and outside the context of an enterprise architecture. We concluded that if the department continued down this path, it would only perpetuate its existing business operations and systems environment, which we described as duplicative, not interoperable, unnecessarily costly to maintain and interface, and not optimizing mission performance and accountability. We made eight recommendations to the Secretary of Defense aimed at providing the means for effectively developing and implementing an

---

<sup>15</sup> See, for example, U.S. General Accounting Office, *DOD Business Systems Modernization: Improvements to Enterprise Architecture Development and Implementation Efforts Needed*, GAO-03-458 (Washington, D.C.: February 2003); U.S. General Accounting Office, *Information Technology: DLA Should Strengthen Business Systems Modernization Architecture and Investment Activities*, [GAO-01-631](#) (Washington, D.C.: June 2001); and U.S. General Accounting Office, *Information Technology: INS Needs to Better Manage the Development of Its Enterprise Architecture*, AIMD-00-212 (Washington, D.C.: August 2000).

<sup>16</sup> [GAO-01-525](#).

---

enterprise architecture. Of the eight recommendations, DOD has fully implemented one, partially implemented five, and has not yet implemented two.

In February 2003,<sup>17</sup> we reported that while DOD is following some enterprise architecture and IT investment management processes and controls, it is not following others, in part, because it was focused on meeting an ambitious schedule. More specifically, with respect to developing the architecture, we reported that DOD had yet to (1) establish a governance structure and process controls needed to ensure ownership of and accountability for the architecture across the department, (2) clearly communicate to intended stakeholders its purpose, scope, and approach to developing the architecture, and (3) define and implement an independent quality assurance process.

We also reported in our February 2003 report that, while DOD had taken some initial steps aimed at improving its management of ongoing business system investments, DOD had yet to (1) establish an investment governance structure and process to align ongoing investments with its architectural goals and direction, (2) establish and apply common investment criteria to its ongoing IT system projects, and (3) conduct a comprehensive review of its ongoing IT investments to ensure they are consistent with architecture development efforts. We reiterated our earlier recommendations and made six new recommendations to the Secretary of Defense to assist DOD in successfully developing an enterprise architecture and using it to gain control over its ongoing business system investments. Of the six recommendations we made, DOD has partially implemented two but has not yet implemented the remaining four.

In March 2003,<sup>18</sup> we reported on DOD's draft version of the BEA, dated February 7, 2003, and concluded that it did not include a number of items recommended by relevant architectural guidance and that DOD's plans would not fully satisfy the act's requirements. For example, the draft architecture did not include a "To Be" security view, which defines the security requirements, including relevant standards to be applied in implementing security policies, procedures, and controls. We did not make

---

<sup>17</sup> [GAO-03-458](#).

<sup>18</sup> U.S. General Accounting Office, *Information Technology: Observations on Department of Defense's Draft Enterprise Architecture*, [GAO-03-571R](#) (Washington, D.C.: Mar. 28, 2003).

---

recommendations because this draft was a work in process that was changing daily. However, DOD officials agreed with our preliminary assessment of the architecture and stated that subsequent versions of the architecture would provide these missing details.

See appendix III for details on the status of all our recommendations, including our assessment of DOD's actions.

---

## **DOD Has Taken Positive First Steps in Complying with Enterprise Architecture Legislative Requirements, but Much Remains to be Accomplished**

DOD has made important progress in complying with the legislative requirements to develop and effectively implement a well-defined enterprise architecture. The department has (1) elected an incremental approach to developing its architecture, (2) adopted some of the architecture management capabilities advocated by best practices and federal guidance,<sup>19</sup> such as designating a chief architect, and (3) developed initial versions of architecture products that provide a foundation upon which to build. Nevertheless, DOD's initial architecture lacks sufficient scope and content to fully satisfy legislative requirements, satisfy relevant architecture guidance, and make informed decisions about systems investments. Moreover, DOD has yet to implement an effective investment management process to select and control ongoing and planned business system investments.

---

## **DOD Is Following an Incremental Approach to Developing Its Architecture**

Our research and experience show that for major program investments, such as the development of an enterprise architecture, successful organizations approach product development in an incremental fashion, meaning that they initially develop a foundational product that is expanded and extended through a series of follow-on products that add more capability and value. In doing so, these organizations can effectively mitigate the enormous risk associated with trying to deliver a large and complex product that requires the execution of many activities over an extended period of time as a single monolithic product. In effect, this incremental approach permits a large undertaking to be broken into a series of smaller projects, or incremental versions, that can be better controlled to provide reasonable assurance that expectations are met.

---

<sup>19</sup> [GAO-03-584G](#).

---

For its enterprise architecture development program, we have recognized and told DOD that given its plans, capabilities, and status, it would not be able to produce and approve a complete version of its architecture by May 1, 2003. Accordingly, we advised DOD to adopt an incremental approach to developing and implementing its architecture and to represent its architecture product to stakeholders as an initial version and to define its plans for evolving and extending this initial version to satisfy the act and create a well-defined blueprint. Recognizing these obstacles, DOD has adopted an incremental approach. Specifically, DOD has designated its architecture as version 1.0 and has committed to building on this in producing subsequent versions. According to DOD, the next significant delivery of the BEA is currently planned for May 2004.

---

**DOD Has Recently Adopted Some, but Not All Key Elements of Architecture Management Best Practices**

Effective process controls for managing architecture development, maintenance, and implementation are recognized hallmarks of successful public and private organizations. According to guidance published by the federal CIO Council,<sup>20</sup> effective architecture management consists of a number of practices, conditions, and structures. In April 2003, we published version 1.1 of our enterprise architecture management maturity framework, which arranges the core elements of the CIO Council's guidance into five hierarchical stages.<sup>21</sup> The framework provides an explicit benchmark for gauging the effectiveness of architecture management and provides a roadmap for making improvements. Table 2 summarizes the framework's five stages of maturity.

---

<sup>20</sup> Chief Information Officer Council, *A Practical Guide to Federal Enterprise Architecture*, Version 1.0 (February 2001).

<sup>21</sup> GAO-03-584G.

**Table 2: Summary of GAO’s Enterprise Architecture (EA) Maturity Framework Stages**

| Stage  | Description  |
|--|--|
| <b>Stage 1: Creating EA awareness</b>  | Organization does not have plans to develop and use an architecture, or it has plans that do not demonstrate an awareness of the value of having and using an architecture. While stage 1 agencies may have initiated some EA activity, these agencies’ efforts are ad hoc and unstructured, lack institutional leadership and direction, and do not provide the management foundation necessary for successful EA development.  |
| <b>Stage 2: Building the EA management foundation</b>                                    | Organization recognizes that the EA is a corporate asset by vesting accountability for it in an executive body that represents the entire enterprise. At this stage, an organization assigns EA management roles and responsibilities and establishes plans for developing EA products and for measuring program progress and product quality; it also commits the resources necessary for developing an architecture—people, processes, and tools.  |
| <b>Stage 3: Developing the EA</b><br>(includes all elements in stage 2)                  | Organization focuses on developing architecture products according to the selected framework, methodology, tool, and established management plans. Roles and responsibilities assigned in the previous stage are in place, and resources are being applied to develop actual EA products. The scope of the architecture has been defined to encompass the entire enterprise, whether organization-based or function-based.   |
| <b>Stage 4: Completing the EA</b><br>(includes all elements in stage 3)                  | Organization has completed its EA products, meaning that the products have been approved by the EA steering committee or an investment review board, and by the CIO. Further, an independent agent has assessed the quality (i.e., completeness and accuracy) of the EA products. Additionally, evolution of the approved products is governed by a written EA maintenance policy approved by the head of the organization.  |
| <b>Stage 5: Leveraging the EA to manage change</b><br>(includes all elements in stage 4) | Organization has secured senior leadership approval of the EA products and a written institutional policy stating that IT investments must comply with the architecture, unless granted an explicit compliance waiver. Further, decision makers are using the architecture to identify and address ongoing and proposed IT investments that are conflicting, overlapping, not strategically linked, or redundant. Also, the organization tracks and measures EA benefits or return on investment, and adjustments are continuously made to both the EA management process and the EA products. |

Source: GAO.

The state of DOD’s implementation of key enterprise architecture management practices, conditions, and structures currently places it at stage 1 of our maturity framework. Specifically, it has satisfied about 80 percent of the core elements associated with building the enterprise architecture management foundation—stage 2 of our framework—but only about 41 percent (9 of the 22) of the core elements associated with stages 3, 4, and 5. According to our framework, effective architecture management is generally not achieved until an enterprise has a completed and approved architecture that is being effectively maintained and is being used to leverage organizational change and support investment decision making; having these characteristics is equivalent to having satisfied all stage 3 core elements and many stage 4 and 5 elements.

---

With respect to stage 2 core elements, DOD has, for example, established a program office, assigned a chief architect, and selected a framework (C4ISR) and an automated tool (e.g., the System Architect by Popkin Software). However, the department has not satisfied two of the stage 2 core elements that are critical to effective enterprise architecture management. For example, a committee or group representing the enterprise has not yet been established to guide, direct, and approve the architecture. Instead, the current version of its architecture has been guided and directed by the Business Modernization and Systems Integration (BMSI) program office. Although the Secretary of Defense has established Financial Management Modernization Executive and Steering Committees for the enterprise architecture, which are made up of senior leaders from across the department, to provide program guidance, these committees are not accountable for approving the architecture. Instead, the responsibility of each committee is limited to providing guidance to the BMSI program office and advising the DOD Comptroller. However, DOD officials told us that the Executive Committee has approved the architecture; yet there were no minutes of the Executive Committee documenting this decision. Without an accountable corporate entity to lead the architectural effort, there is increased risk that the architecture will not represent a corporate decision-making tool and will not be viewed and endorsed as a departmentwide asset.

Further, DOD does not have a written and approved policy for architecture development, which is a stage 3 core element. Without such a policy that, for example, identifies the major players in the development process and provides for architecture guidance, direction, and approval, DOD has been, and will continue to be, challenged in achieving departmentwide architecture commitment and support.

The department also has yet to implement numerous stage 4 and 5 core elements. For example, DOD has not (1) documented and approved a policy for architecture maintenance, (2) fully implemented an independent verification and validation function that covers architecture products and architecture management processes, and (3) made the architecture an integral component of its IT investment management process.

According to program officials, the department set overly optimistic expectations and time frames for its enterprise architecture program, which resulted in the need to establish architecture management process controls concurrent with developing architecture products. Until the department implements the core elements of our enterprise architecture

management maturity framework, it is unlikely that it will be able to either produce and maintain a well-defined architecture or effectively implement what is produced.

Table 3 provides the results of our assessment of DOD's satisfaction of each of the core elements of our maturity framework.

**Table 3: Assessment of DOD's Enterprise Architecture Efforts Against GAO's Enterprise Architecture Maturity Framework**

| Stage   | Core element  | Satisfied? | Comments   |
|---|---|------------|--|
| <b>Stage 1: EA Awareness</b>                          | Agency is aware of EA.  | Yes        | In July 2001, the Secretary of Defense issued a memorandum directing the development and implementation of a departmentwide enterprise architecture.   |
| <b>Stage 2: Building the EA Management Foundation</b> | Adequate resources exist (funding, people, tools, and technology).  | Yes        | According to DOD, it has adequate program funding. It requested approximately \$196.3 million for the program and received about \$186.8 million. Further, it reports that it has skilled staff (government employees and contractors) for its architecture program. In addition, DOD is using automated tools and technology, such as System Architect by Popkin Software and the Dynamic Object-Oriented Requirements System by Telelogic.   |
|   | Committee or group representing the enterprise is responsible for directing, overseeing, and approving the EA.  | No         | DOD has not assigned responsibility for directing, overseeing, and approving the EA to a committee or group comprised of representatives from across the department.   |
|   | Program office responsible for EA development and maintenance exists.   | Yes        | DOD has established a program office that is responsible for EA development and maintenance.   |
|   | Chief architect exists.   | Yes        | DOD has assigned a chief architect.  |
|   | EA is being developed using a framework, methodology, and automated tool.   | Yes        | The EA is being developed using DOD's C4ISR architecture framework and the Federal Enterprise Architecture Program Management Office Reference Models. Further, DOD has a methodology that adapts its development contractor's architecture methodology to the C4ISR framework. In addition, DOD is using automated tools, such as System Architect by Popkin Software, to build the EA, and Dynamic Object-Oriented Requirements System by Telelogic, as the repository for requirements information. |
|   | EA plans call for describing both the "As Is" and the "To Be" environments of the enterprise, as well as a sequencing plan for transitioning from the "As Is" to the "To Be." | Yes        | EA plans call for describing the "As Is" and the "To Be" environments, and a sequencing plan.  |



(Continued From Previous Page)

| Stage   | Core element   | Satisfied? | Comments   |
|---|--|------------|--|
|   | EA plans call for describing both the “As Is” and the “To Be” environments in terms of business, performance, information/data, application/service, and technology.                   | Yes        | EA plans call for describing both the “As Is” and the “To Be” environments in terms of business, performance, information/data, application/service, and technology.   |
|   | EA plans call for business, performance, information/data, application/service, and technology descriptions to address security.   | No         | According to DOD, EA plans will not address security for the “As Is” environment, but will address security for the “To Be” environment.   |
|   | EA plans call for developing metrics for measuring EA progress, quality, compliance, and return on investment.   | Yes        | EA plans call for developing EA metrics for measuring progress, quality, compliance, and return on investment.   |
| <b>Stage 3: Developing EA Products</b> (includes all elements from stage 2) | Written/approved organization policy exists for EA development.  | No         | DOD has a policy for developing the Global Information Grid (GIG), <sup>a</sup> which requires that all other departmental architectures be in alignment with the GIG. While this policy outlines the roles and responsibilities for development, maintenance, and implementation of the GIG, it does not do so for other architectures, such as the BEA. Such policy should describe, for example, the scope of the BEA and the processes for BEA oversight, control, and validation. The policy should also identify the major players in the development process, including the chief architect, steering committee, and CIO. The GIG policy does not provide this information for the BEA. |
|   | EA products are under configuration management.  | Yes        | Configuration of EA products is being managed by an automated tool.  |
|   | EA products describe or will describe both the “As Is” and the “To Be” environments of the enterprise, as well as a sequencing plan for transitioning from the “As Is” to the “To Be.” | Yes        | According to plans, EA products will describe the “As Is” and the “To Be” environments, as well as a sequencing plan.  |
|   | Both the “As Is” and the “To Be” environments are described or will be described in terms of business, performance, information/data, application/service, and technology.             | Yes        | According to plans, the “As Is” and the “To Be” environments will be described in terms of business, performance, information/data, application/service, and technology.   |
|   | Business, performance, information/data, application/service, and technology descriptions address or will address security.  | No         | According to DOD, descriptions will not address security for the “As Is” environment, but will address security for the “To Be” environment.   |
|   | Progress against EA plans is measured and reported.  | Yes        | DOD is measuring and reporting progress against EA plans. For example, the verification and validation contractor reports on the quality of EA products, and the development contractor reports weekly on its progress (cost, schedule, performance).  |

(Continued From Previous Page)

| Stage   | Core element  | Satisfied? | Comments   |
|---|---|------------|--|
| <b>Stage 4: Completing EA Products</b><br>(includes all elements from stage 3)                | Written/approved organization policy exists for EA maintenance.   | No         | There is no written/approved policy for EA maintenance.  |
|   | EA products and management processes undergo independent verification and validation.   | No         | EA products undergo verification and validation; however, as we previously reported, <sup>b</sup> this function is not independent of the program office. Further, management processes are not verified and validated.  |
|   | EA products describe both the “As Is” and the “To Be” environments of the enterprise, as well as a sequencing plan for transitioning from the “As Is” to the “To Be.” | No         | Version 1.0 of the EA describes the “As Is” and the “To Be” environments of the enterprise, as well as a sequencing plan; however, as discussed later in this report, this version is missing needed scope and detail.   |
|   | Both the “As Is” and the “To Be” environments are described in terms of business, performance, information/data, application/service, and technology.                 | No         | Version 1.0 of the EA describes the “As Is” and the “To Be” environments of the enterprise, as well as a sequencing plan; however, as discussed later in this report, this version is missing needed scope and detail.   |
|   | Business, performance, information/data, application/service, and technology descriptions address security.   | No         | Version 1.0 of the EA describes the “As Is” and the “To Be” environments of the enterprise, as well as a sequencing plan; however, as discussed later in the report, this version is missing needed scope and detail. Further, according to DOD, security will not be addressed for the “As Is” environment. |
|   | Organization CIO has approved current version of EA.  | Yes        | The CIO is a member of the executive committee. According to a DOD program official, the executive committee has approved the EA.  |
|   | Committee or group representing the enterprise or the investment review board has approved current version of EA.   | Yes        | According to a DOD program official, the executive committee has approved the EA.  |
| <b>Stage 5: Leveraging the EA for Managing Change</b><br>(includes all elements from stage 4) | Quality of EA products is measured and reported.  | Yes        | The verification and validation contractor reviews and reports on the quality of EA products.  |
|   | Written/approved organization policy exists for IT investment compliance with EA.   | No         | There is no written/approved policy requiring IT investment compliance with the EA.  |
|   | Process exists to formally manage EA change.  | No         | There is no defined process for managing changes to the EA.  |
|   | EA is integral component of IT investment management process.   | No         | The EA is not being used to make investment selection and control decisions, and thus is not part of the investment management process.  |
|   | EA products are periodically updated.   | Yes        | According to DOD, it plans to periodically update the EA; the next significant version is to be issued in May 2004. An initial version (1.0) was issued in May 2003.   |

(Continued From Previous Page)

| Stage | Core element  | Satisfied? | Comments   |
|-------|---|------------|--|
|       | IT investments comply with EA.                        | No         | The EA is not being used to select and control investments, and thus investments do not comply with the architecture.  |
|       | Organization head has approved current version of EA. | Yes        | According to a program official, the Secretary of Defense orally delegated approval authority to the DOD Comptroller, who approved version 1.0 of the EA.  |
|       | Return on EA investment is measured and reported.     | No         | Metrics and processes for measuring EA benefits have not been developed, thus precluding return on investment measurement. DOD is not capturing the full cost of its EA investment—no cost information for fiscal year 2001 exists and actual government salary expenses are unknown. As of May 28, 2003, the department had contractually obligated about \$116 million and disbursed about \$48.5 million. |
|       | Compliance with EA is measured and reported.          | No         | Metrics for measuring EA compliance have not been developed, thus precluding measuring and reporting on compliance.  |

Source: GAO analysis of DOD data.

<sup>a</sup>DOD defines the GIG as the globally interconnected, end-to-end set of information, capabilities, associated processes, and personnel for collecting, processing, storing, disseminating, and managing information on demand to warfighters, policy makers, and support personnel.

<sup>b</sup>GAO-03-458.

## Initial Version of Architecture Provides a Foundation Upon Which to Build

DOD has expended tremendous effort and resources and made important progress in complying with the legislative requirements aimed at developing and implementing a well-defined enterprise architecture. Further, DOD's initial version of its BEA provides a foundation from which to build and ultimately produce a well-defined business enterprise architecture. However, the initial architecture does not adequately address the act's requirements and other relevant architectural requirements.<sup>22</sup> Specifically, the initial version of the architecture does not adequately describe the accounting and financial management requirements, and the

<sup>22</sup> See for example, Office of Management and Budget, *Federal Enterprise Architecture Business Reference Model*, Version 1.0 (2002); Chief Information Officer Council, *A Practical Guide to Federal Enterprise Architecture*, Version 1.0 (February 2001); Office of Management and Budget Circular A-130, *Management of Federal Information Resources* (Nov. 28, 2000); M.A. Cook, *Building Enterprise Information Architectures: Reengineering Information Systems* (Upper Saddle River, N.J., Prentice Hall: 1996); and National Institute of Standards and Technology, *Information Management Directions: The Integration Challenge*, Special Publication 500-167 (September 1989).

---

“As Is” and “To Be” environments and the transition plan are not sufficiently complete to provide a basis for guiding and constraining investment decisions.

Architecture Does Not Adequately Address Federal Requirements and Accounting Standards

DOD elicited and incorporated about 4,000 external requirements in its “To Be” architecture from 152 federal sources. Our review of 1,767 of the external requirements—specifically those that were elicited from the Joint Financial Management Improvement Program (JFMIP)<sup>23</sup>—identified 340 JFMIP requirements (about 19 percent) that were not adequately addressed in version 1.0 of the “To Be” architecture. Specifically, DOD (1) omitted some JFMIP requirements that are significant, (2) included some that are invalid, and (3) included some that are not appropriate to its business operations.

Mission requirements are one of the key bases for determining the scope and content for enterprise architectures. One source of requirements is the legal, regulatory, and other external constraints that define the environment within which an enterprise, such as DOD, must operate. If a given architecture is not developed to adequately recognize these constraints, and these missing constraints are significant, the architecture will not provide a sufficient frame of reference for informed decision making. The act specifies that the architecture should enable DOD to comply with all federal accounting, financial management, and reporting requirements. JFMIP requirements arise from various public laws, regulations, bulletins, circulars, federal accounting standards, and leading practices and are applicable government wide. Agencies must use these requirements, in addition to agency-unique mission requirements, in planning and implementing their financial management improvement projects.

DOD’s “To Be” architecture omitted significant JFMIP requirements. For example, DOD’s architecture did not include any relevant revenue requirements. These requirements are significant to DOD because they affect the accounting of and reporting for DOD’s revenue, which include at least \$70 billion earned annually by DOD working capital fund activities. Department and contractor officials agreed that these system requirements

---

<sup>23</sup> JFMIP is a joint undertaking of the Department of the Treasury, GAO, the Office of Management and Budget, and the Office of Personnel Management, working with each other, other agencies, and the private sector to improve financial management in the federal government. JFMIP issues a series of requirements in support of agency operations.

were either excluded or not adequately addressed and stated that a subsequent version of the architecture would include or modify the requirements. Table 4 summarizes the JFMIP requirements that we reviewed and the numbers of missing or incomplete requirements we identified.

**Table 4: Summary of GAO Analysis of JFMIP Requirements**

| JFMIP requirements          | Number of JFMIP requirements | Number of missing or incomplete requirements | Percent of missing or incomplete requirements |
|-----------------------------|------------------------------|--|---|
| Revenue                     | 220                          | 220  | 100   |
| Acquisition                 | 112                          | 10   | 9   |
| Core Financial              | 430                          | 4  | 1   |
| Human Resources and Payroll | 203                          | 37   | 18  |
| Managerial Cost Accounting  | 67                           | 30   | 45  |
| Inventory                   | 141                          | 7  | 5   |
| Travel                      | 166                          | 12   | 7   |
| Property Management         | 78                           | 0  | 0   |
| Benefit                     | 350                          | 20   | 6   |
| <b>Total</b>                | <b>1,767</b>                 | <b>340</b>                                   | <b>19</b>                                     |

Source: GAO analysis of DOD data.

---

As another example, the “To Be” architecture did not include requirements governing accounting for and reporting of national defense plant, property, and equipment (PP&E)<sup>24</sup> that became valid shortly before the architecture was approved. These requirements significantly affect the accounting of and reporting requirements for a reported 600,000 aircraft, ships, combat vehicles, missiles and other weapons systems, and related equipment. The architecture did not incorporate requirements for these accounting standards<sup>25</sup> even though (1) the Federal Accounting Standards Advisory Board and the three sponsoring agencies<sup>26</sup> responsible for federal accounting standards approved them in October 2002 and (2) DOD already recognized these new PP&E requirements in its fiscal year 2002 *Performance and Accountability Report* and has begun to implement them. According to DOD and contractor officials, they used outdated requirements because the new standard was not in effect when they were identifying and linking national defense PP&E requirements to activities, processes, and entities depicted by the architecture. As a result, DOD must now revise its architecture to reflect these requirements, activities, and processes to ensure compliance with the new accounting standard.

Lastly, the architecture includes options for doing business at the federal level that were not appropriate to DOD’s business operations (i.e., do not reflect external requirements constraining DOD’s operations). For example, Statement of Federal Financial Accounting Standards (SFFAS) No. 3, *Accounting for Inventory and Related Property*, requires operating materials and supplies to be primarily accounted for using the consumption method and allows the purchases method to be used as an exception only under certain conditions.<sup>27</sup> Because DOD’s operating supplies and materials are considered significant, DOD reports the value of its almost

---

<sup>24</sup> National Defense PP&E assets include weapons systems and support PP&E owned by DOD or its component entities for use in the performance of military missions.

<sup>25</sup> SFFAS No. 23, *Eliminating the Category National Defense Property, Plant, and Equipment*, May 2003.

<sup>26</sup> The three sponsoring agencies are the Department of the Treasury, the Office of Management and Budget, and the General Accounting Office.

<sup>27</sup> The consumption method of accounting requires operating materials and supplies to be capitalized when purchased and reported as an operating expense when they are consumed. Under the purchases method, operating materials and supplies are reported as an operating expense when they are purchased if their amounts are insignificant, they are in the hands of the end user for use in normal operations, or it is not cost effective to apply the consumption method.

---

\$91 billion of operating materials and supplies using the consumption method of accounting. Developing the architecture to allow DOD to use the purchases method to account for its inventory and related property may result in inappropriate use of this method and, therefore, inconsistent practices and supporting system solutions among DOD components.

According to DOD and contractor officials, both the omission and limited definition of relevant federal requirements is partly due to not having a fully functioning quality assurance process to verify and validate the requirements when the requirements were elicited. In March 2003, following our previous recommendation to strengthen quality assurance activities, DOD increased its quality assurance activities. These officials stated that, as part of their current quality assurance process, they are identifying additional requirements and deleting existing requirements that are duplicative or deemed not mandatory. As a result, version 1.0 of the BEA does not adequately reflect and recognize critical external requirements, and thus is not yet sufficiently complete for making informed decisions about system investments.

Initial Version of DOD  
Architecture Is Not Sufficiently  
Complete to Satisfy Act and  
Guide and Constrain  
Modernization Investments

As previously discussed, the various frameworks used to develop an enterprise architecture consistently (1) describe the architectures for both the enterprise's "As Is" and "To Be" environments in logical (e.g., business, performance, application, information) as well as technical (e.g., hardware, software, data) terms, and (2) define a capital investment sequencing plan to transition from the "As Is" to the "To Be" environment. However, the frameworks do not prescribe the degree to which the component parts should be described to be considered correct, complete, understandable, and usable—essential attributes of any architecture. This is because the depth and detail of the descriptive content depend on the architecture's intended purpose.

In the case of DOD, the act specifies that its enterprise architecture should enable the department to (1) comply with all federal accounting, financial management, and reporting requirements, (2) routinely produce timely, accurate, and reliable financial information for management purposes, (3) integrate budget, accounting, and program information and systems, and (4) provide for the systematic measurement of performance. Moreover, DOD's stated intention is to use the architecture as the basis for departmentwide business transformation and systems modernization.

---

Collectively, these purposes necessitate that the architecture provide considerable depth and detail, as well as logical and rational structuring and internal linkages. More specifically, they mean that the architecture should contain sufficient scope and detail to permit, for example, (1) elimination of duplicative business operations and systems, (2) standardization and integration of business operations and interoperability of supporting systems, (3) maximum use of enterprisewide services, and (4) alignment with related shared solutions, like OMB's e-gov initiatives. Moreover, this scope and detail<sup>28</sup> should be accomplished in a way that (1) provides flexibility in adapting to changes in the enterprise's internal and external environments, (2) facilitates its usefulness and comprehension by varying perspectives/users/stakeholders, and (3) provides for properly sequencing investments to recognize, for example, the investments' respective dependencies and relative business value.

Version 1.0 of DOD's enterprise architecture does not contain sufficient scope and detail to either satisfy the act's requirements or effectively guide and constrain departmentwide business transformation and systems modernization. This is based on our decomposition of version 1.0 into various parts and components and comparison of it against relevant benchmarks. More specifically, we first divided the architecture into the three primary component parts specified in the act and recognized in best practices and federal guidance: the "As Is" architecture, the "To Be" architecture, and the transition plan. We then divided the "As Is" and the "To Be" architectures into five architectural components similar to those in OMB's architecture reference models: the business, information/data, services/applications, technical, and performance components; we added security as a sixth component because of its recognized importance and relevance to the other five. We then compared version 1.0 to relevant

---

<sup>28</sup> Subsection 1004(b)(2) of the act also specifies that DOD's enterprise architecture shall "include policies, procedures, data standards, and system interface requirements that are to apply uniformly throughout the Department."



---

criteria<sup>29</sup> governing the content of key architectural elements for the transition plan and these six components of the “As Is” and “To Be” architectures. Based on this comparison, we determined whether version 1.0 of the architecture generally satisfied, did not satisfy,<sup>30</sup> or partially satisfied<sup>31</sup> each architectural element.

Overall, DOD’s “As Is” architecture did not satisfy 26 of 29 key elements, and partially satisfied the remaining 3; its “To Be” architecture did not satisfy 4 of 30 key elements, and partially satisfied the remaining 26; and its transition plan partially satisfied 2 of the 3 elements, but did not satisfy the remaining 1 (see fig. 2). This means that version 1.0 of DOD’s enterprise architecture does not satisfy the requirements of the act and is not sufficiently complete to provide an adequate basis for guiding and constraining investments in modernized systems. Program officials agreed that this version of the architecture is not complete, but stated that it fully satisfies the act, because it addresses, to at least some degree, each of the act’s requirements. They added that they have accomplished as much in completing the architecture as was possible in the time available, and that the department was overly optimistic in estimating what it could produce by May 1, 2003. We agree that DOD set unrealistic expectations of the scope and level of architectural definition it could provide by this time, but do not agree, as discussed in detail in the previous section and the sections that follow, that it satisfies the act’s requirements. We also believe that the state of DOD’s architecture is also due to weaknesses in its architecture development management controls that are discussed in the previous section, and that our prior recommendations were aimed at correcting.

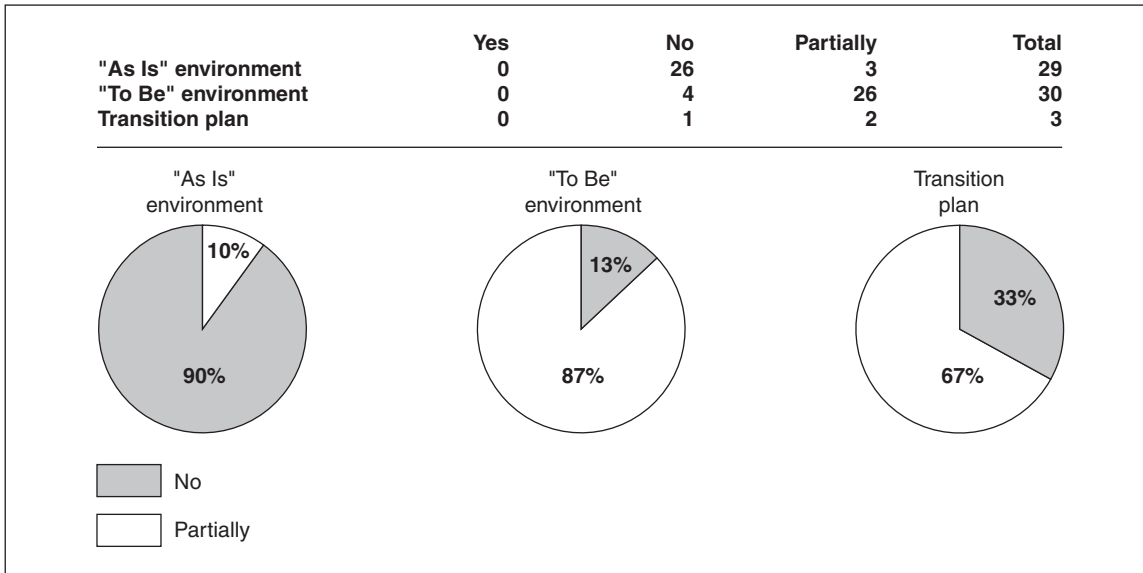
---

<sup>29</sup> See for example, Office of Management and Budget, *Federal Enterprise Architecture Business Reference Model*, Version 1.0 (2002); Chief Information Officer Council, *A Practical Guide to Federal Enterprise Architecture*, Version 1.0 (February 2001); Office of Management and Budget, *Management of Federal Information Resources*, Circular No. A-130 (Nov. 28, 2000); Cook, M.A., *Building Enterprise Information Architectures: Reengineering Information Systems* (Prentice Hall Inc.: 1996); and National Institute of Standards and Technology, *Information Management Directions: The Integration Challenge*, Special Publication 500-167 (September 1989).

<sup>30</sup> The architecture does not satisfy any aspects of this key architectural element.

<sup>31</sup> The architecture partially satisfies some aspects of this key architectural element but does not satisfy at least one significant aspect.

**Figure 2: Summary of Extent to Which Version 1.0 of DOD’s Enterprise Architecture Satisfies Key Elements Governing Architectural Content**



Source: GAO analysis of DOD data.

In addition, the structure of the “To Be” architecture contains internal linkage, consistency, and navigation limitations that constrain its ease of use and understandability. For example, explicit linkages among (1) services/applications, (2) organizations using the services/applications, and (3) technical standards governing the services/applications were missing, as were linkages between certain business and information/data artifacts. This is important because dependencies exist among these architectural components and a well-defined architecture makes such dependencies explicit to ensure that systems are implemented in a nonduplicative and integrated fashion. We also found instances of internal inconsistencies. For example, one artifact (a table) indicated that DOD had not selected any standards for certain security services, while another artifact identified selected standards for these services. In another instance, four artifacts listed identified requirement sources for security, such as the Computer Security Act of 1987<sup>32</sup> and OMB Circular A-130; however, the artifacts’ respective lists varied and no single list included all the requirement sources. In another instance, some terms contained within

<sup>32</sup> The Computer Security Act of 1987, Pub. L. No. 100-235, 101 Stat. 1724, Jan. 8, 1988.

---

the architecture (e.g., availability, integrity checks, confidentiality, and authentication) were not consistently defined, and the architecture did not explain the basis for these inconsistencies. For example, one artifact defined authentication as the “standard practices followed to authenticate the identity of system users,” while another artifact defined it as a “security measure designed to establish the validity of a transmission, message, or originator, or a means of verifying an individual’s authorization to receive specific categories of information.”

Such inconsistencies in the architecture can in turn lead to misinterpretations, and thus incompatibilities, in how systems are implemented. Additionally, the architecture did not include user instructions or guidance, making it difficult to navigate and use. For example, (1) certain artifacts (e.g., diagrams) could not be read on-line because there was no “zoom” capability enabling enlargement, and (2) specific content, such as the applicability of security standards to specific security services, took three persons several days to locate. The complete results of our analysis of each of version 1.0’s parts and related components are discussed in detail below.

*“As Is” Architecture:* This architecture is intended to capture the current state of enterprise operations in sufficient scope and detail to permit meaningful analysis of gaps between such things as current and future processes, data, standards, and systems. It thus should describe, for those areas of the enterprise that are likely to change, the current set of business processes and performance measures that are in place and operating and, among other things, the information/data, services/applications, and technology that are in place to support these processes and measures. According to relevant guidance,<sup>33</sup> the “As Is” architecture should contain, for example, a description of (1) the actual business operations currently being performed to support the organization’s mission, including the entities/people that perform the functions, processes, and activities, and the locations where the functions, processes, and activities are being

---

<sup>33</sup> See for example, Office of Management and Budget, *Federal Enterprise Architecture Business Reference Model*, Version 1.0 (2002); Chief Information Officer Council, *A Practical Guide to Federal Enterprise Architecture*, Version 1.0 (February 2001); Office of Management and Budget, *Management of Federal Information Resources*, Circular No. A-130 (Nov. 28, 2000); Cook, M.A., *Building Enterprise Information Architectures: Reengineering Information Systems* (Prentice Hall Inc.: 1996); and National Institute of Standards and Technology, *Information Management Directions: The Integration Challenge*, Special Publication 500-167 (September 1989).

---

performed, (2) the information/data used by the functions, processes, and activities, (3) the systems that support the functions, processes, and activities, including system interfaces, (4) the types of technology (e.g., hardware and software) and associated technical standards that comprise the physical systems environment, (5) the security standards and tools used to secure and protect systems and data, and (6) the metrics for evaluating the effectiveness of mission operations and supporting system performance in achieving mission goals and objectives. Without this information, an enterprise would be extremely challenged in identifying the proper sequence of changes needed to move from its current operating environment to its future, target environment. As stated by one leading industry authority on enterprise architecture,<sup>34</sup> an organization will be unable to effectively plan and manage its modernization efforts, and will waste IT dollars, if it does not have a clear picture of its “As Is” environment.

Version 1.0 of DOD’s “As Is” architecture provides little of this descriptive content. On the positive side, it includes an inventory of about 2,300 existing systems that support DOD’s current business operations, including certain characteristics about each (e.g., system owner, purpose and business process it supports, and vendor). However, the majority of systems do not have descriptions of system interfaces, and the inventory has not been validated and continues to change significantly. For example, DOD’s current “As Is” systems inventory of about 2,300 systems has increased approximately 35 percent when compared to its “As Is” inventory of about 1,700 business systems in October 2002. In addition, DOD’s architecture does not describe (1) the current business operations in terms of the entities/people who perform the functions, processes, and activities, and the locations where the functions, processes, and activities are performed, (2) the data/information being used by the functions, processes, and activities, (3) the types of technology and associated technical standards being employed, (4) the security standards and tools being used, and (5) the performance metrics being used. Instead, it merely provides a listing of the names of the current business processes. As a result, DOD does not have a sufficiently described picture of its current environment to permit development of a meaningful and useful transition plan. See table 5 for the detailed results of our analysis of DOD’s “As Is” architecture.

---

<sup>34</sup> Troux Technologies, Inc. [http://www.eacommunity.com/sponsor/troux\\_061903.htm](http://www.eacommunity.com/sponsor/troux_061903.htm).

**Table 5: Detailed Analysis of the Extent to Which DOD’s “As Is” Architecture Satisfies Key Elements**

| Key architectural element  | Element satisfied? |    |           | Explanation of partially satisfied  |
|--|--------------------|----|-----------|---|
|  | Yes                | No | Partially |   |
| Business   |                    |    |           |   |
| A description of the strategic goals, which defines what an organization wants to achieve.   |                    | X  |           |   |
| A business strategy, which defines how the strategic goals and objectives will be achieved.  |                    | X  |           |   |
| An inventory of key policies, procedures, and standards governing how business operations are executed and managed.  |                    | X  |           |   |
| A description of key business processes and how they support the agency’s mission, including the organizational units responsible for performing the business processes and the locations where the business processes are being performed.  |                    |    | X         | The architecture contains (1) a list of the names of the business processes and (2) a high-level (1-page) graphical depiction of these processes. It does not contain detailed descriptions of existing business operations that include, for example, information flows among activities, organizational units and locations that perform the business processes, and the technological characteristics of the systems that perform these processes. |
| An analysis of deficiencies in the “As Is” business environment that are to be addressed, as well as obstacles to addressing these deficiencies, plans for addressing them, and a business case for addressing them. An example is an analysis of the quality of existing data to determine their completeness and accuracy. |                    |    | X         | The architecture contains an analysis of process area deficiencies. However, this analysis does not include the business case(s) for addressing the deficiencies.   |
| A description of organizational accountability for execution of current business policies, procedures, and standards.  |                    | X  |           |   |
| Information/Data   |                    |    |           |   |
| A description of the data management policies, processes, procedures, and tools (e.g., CRUD Matrix <sup>a</sup> ) for analyzing, designing, building, and maintaining existing databases.  |                    | X  |           |   |
| A description of the business and operational rules <sup>b</sup> for data standardization to ensure data consistency, integrity, and accuracy, such as business and security rules that govern access, maintenance, and use of data.   |                    | X  |           |   |
| A data dictionary, which is a repository of standard data definitions for applications.  |                    | X  |           |   |

(Continued From Previous Page)

| Key architectural element   | Element satisfied? |    |           | Explanation of partially satisfied   |
|---|--------------------|----|-----------|--|
|   | Yes                | No | Partially |  |
| A conceptual data model that describes the fundamental things/objects (e.g., invoices, financial statements, inventory) that make up the business and how they are used, but without regard for how they will be physically stored. It represents the consolidated structure of business objects to be used by business applications.   |                    | X  |           |  |
| A logical database model that provides the data structures that support information flows, and that provides the basis for developing the schemas for designing, building, and maintaining the existing physical databases.   |                    | X  |           |  |
| A metadata <sup>c</sup> model that specifies the rules and standards for access to information.   |                    | X  |           |  |
| A description of information flows and relationships between organizational units, business operations, and applications.   |                    | X  |           |  |
| <b>Services/Applications</b>  |                    |    |           |  |
| A stable listing of business application systems and system components and their interfaces.  |                    |    | X         | There is a list of systems, but the respective interfaces have not been described. Further, this list continues to change. |
| A description of the common technical approach, policies, and procedures for developing/acquiring business application systems throughout their life cycle, including requirements management, design, implementation, testing, deployment, operations, and maintenance. The common technical approach should also describe the process for integrating legacy systems with the systems to be developed/acquired. |                    | X  |           |  |
| <b>Technical</b>  |                    |    |           |  |
| Descriptions of the enterprise infrastructure services <sup>d</sup> to include specific details regarding the functionality and capabilities that these services provide to enable systems applications.  |                    | X  |           |  |
| Identification of the technical standards <sup>e</sup> implemented for each enterprise service.   |                    | X  |           |  |
| A description of the physical IT infrastructure needed to support the current and any newly developed and/or acquired systems outside the scope of the architecture, including the relationships among hardware, software, and communications devices.  |                    | X  |           |  |

(Continued From Previous Page)

| Key architectural element   | Element satisfied? |    |           | Explanation of partially satisfied |
|---|--------------------|----|-----------|------------------------------------|
|   | Yes                | No | Partially |                                    |
| Common policies and procedures for developing/acquiring infrastructure systems throughout their life cycle, including requirements management, design, implementation, testing, deployment, operations, and maintenance.                            |                    | X  |           |                                    |
| <b>Security</b>   |                    |    |           |                                    |
| A description of the policies, procedures, goals, strategies, and requirements relevant to information assurance and security.  |                    | X  |           |                                    |
| A listing of security and information assurance related terms.  |                    | X  |           |                                    |
| A listing of accountable organizations and their respective responsibilities for implementing enterprise security services.   |                    | X  |           |                                    |
| A description of operational security rules that are derived from security policies.  |                    | X  |           |                                    |
| A description of enterprise security infrastructure services (e.g., identification and authentication) needed to protect the department's assets, and the means for implementing such a service (e.g., firewalls and intrusion detection software). |                    | X  |           |                                    |
| A description of the security standards <sup>f</sup> implemented for each enterprise service to secure assets. These standards should be derived from security requirements.  |                    | X  |           |                                    |
| A description of the protection mechanisms implemented to secure the department's assets, such as firewalls and intrusion detection software, including a description of the relationships among these protection mechanisms.                       |                    | X  |           |                                    |
| <b>Performance</b>  |                    |    |           |                                    |
| A description of the performance management process, including how the organization measures, tracks, evaluates, and predicts business performance with respect to business functions, baseline data, and service levels.                           |                    | X  |           |                                    |
| A description of customer-focused, measurable goals and outcomes for business products and services.  |                    | X  |           |                                    |
| A description of measurable goals and outcomes for managing technology to enable the achievement of business goals and outcomes.  |                    | X  |           |                                    |

Source: GAO analysis of DOD data.

<sup>a</sup>A CRUD (create, read, update, and/or delete) matrix shows the specific business functions and applications that create, read, update, and/or delete specific data elements, which enables the organization to develop applications.

---

<sup>b</sup>Business and operational rules define specific constraints for the data, such as security needs (e.g., confidentiality and access of data), and actions that should or should not occur such as updating or deleting data.

<sup>c</sup>Metadata are “data about data” that enable automation and consistent management and use of information, such as rules and standards.

<sup>d</sup>Examples of enterprise services include application services, such as web services, and collaboration services, such as instant messaging or voice conferencing.

<sup>e</sup>Technical standards are strict rules and protocols governing how a given enterprise service is to be implemented.

<sup>f</sup>Security standards cover such services as identification and authentication, audit trail creation, access controls, virus prevention, and intrusion prevention and detection.

*“To Be” Architecture:* This architecture is intended to capture the vision of future business operations and supporting technology. It should describe the desired capabilities and structures at a specified point(s) in the future. The “To Be” architecture should show, for example, future business processes, information needs, and supporting infrastructure, and it should be fiscally and technologically achievable. According to relevant guidance,<sup>35</sup> the “To Be” architecture should contain, among other things, a description of (1) the future business operations that will be performed to support the organization’s mission, including the entities/people that will perform the functions, processes, and activities, and the locations where the functions, processes, and activities will be performed, (2) the logical database model that is to be used to guide the creation of the physical databases where information will be stored, (3) the systems to be developed or acquired to support the business operations, (4) the physical infrastructure (e.g., hardware and software) that will be needed to support the business systems, (5) the organizations that will be accountable for implementing security and the tools to be used to secure and protect systems and data, and (6) the metrics that will be used to evaluate the effectiveness of mission operations and supporting system performance in achieving mission goals and objectives. By including these, the architecture would allow DOD to satisfy the act’s requirements, such as routinely providing timely, accurate, and reliable information for management decision making.

---

<sup>35</sup> See for example, Office of Management and Budget, *Federal Enterprise Architecture Business Reference Model*, Version 1.0 (2002); Chief Information Officer Council, *A Practical Guide to Federal Enterprise Architecture*, Version 1.0 (February 2001); Office of Management and Budget, *Management of Federal Information Resources*, Circular No. A-130 (Nov. 28, 2000); Cook, M.A., *Building Enterprise Information Architectures: Reengineering Information Systems* (Prentice Hall Inc.: 1996); and National Institute of Standards and Technology, *Information Management Directions: The Integration Challenge*, Special Publication 500-167 (September 1989).



---

Version 1.0 of DOD's "To Be" architecture provides some of this descriptive content, but not to the extent needed to meet the act's requirements and permit effective acquisition and implementation of system solutions and associated operational change. On the positive side, it contains a description of the future business operations and a logical database model. However, the future business operations are not described in terms of the entities/people who will perform the functions, processes, and activities, and the locations where the functions, processes, and activities will be performed. Further, we found no linkage between the logical database model and the conceptual data model, which raises concerns regarding the utility of this model in supporting information flows for business operations and systems. In addition, it does not describe (1) the actual systems to be developed or acquired to support future business operations, (2) the physical infrastructure (e.g., hardware and software) that will be needed to support the business systems, (3) the organizations that will be accountable for implementing security and the tools to be used to secure and protect systems and data, and (4) the metrics that will be used to evaluate the effectiveness of mission operations and supporting system performance in achieving mission goals and objectives. Without this information, the organization will not have a common vision and frame of reference for defining a transition plan to guide and constrain capital investment, and thus will be unable to effectively leverage technology to orchestrate logical and systematic change and optimize enterprisewide mission performance. See table 6 for the results of our analysis of DOD's "To Be" architecture.

**Table 6: Detailed Analysis of the Extent to Which DOD’s “To Be” Architecture Satisfies Key Elements**

| Key architectural element   | Element satisfied? |    |           | Explanation of partially satisfied   |
|---|--------------------|----|-----------|--|
|   | Yes                | No | Partially |  |
| Business  |                    |    |           |  |
| A description of the strategic goals, which define what an organization wants to achieve.   |                    |    | X         | The architecture contains a description of the strategic goals, but does not address how it will support the department's warfighter goals.  |
| A business strategy, which defines how the strategic goals and objectives will be achieved.   |                    |    | X         | The architecture lists business strategies, such as utilizing more commercial practices to promote private sector partnerships, but does not describe how these strategies will be implemented.  |
| Common policies, procedures, and business rules for consistent implementation of architecture.  |                    |    | X         | <p>The architecture does not have common policies and procedures, nor has it defined a plan for achieving this. It does, however, recognize the need for such policies, procedures, and business rules, and provides a general time frame for when they will be developed.</p> <p>The architecture includes high-level descriptions of business rules, but does not formally define how these rules will be automated and implemented.</p> |
| A description of key business processes and how they support the agency's mission, including the organizational units responsible for performing the business processes and the locations where the business processes are performed. |                    |    | X         | The architecture has a high-level description of processes, without a specific identification of organizations and locations.  |
| A description of the architecture governance structure and processes to ensure that the department's business transformation effort remains compliant with the architecture.  |                    |    | X         | The architecture has a draft concept for governance, but does not describe, for example, the process for ensuring compliance with the architecture and the processes for managing risks and approving the architecture and systems investments.  |
| A listing of opportunities to unify and/or simplify systems and processes across the agency.  |                    |    | X         | The architecture contains a list of deficiencies for the operational activities, but not for systems. For example, it does not identify the specific pilot projects that will be conducted, nor does it identify the resources (funding and staffing) needed for conducting these pilots.  |
| A description of the organizational approach for communications and interactions among business lines and program areas for management reporting, operational functions, and architecture development and use.                        |                    |    | X         | The architecture has a notional organizational structure for communications and interactions among departmental entities for reporting and management purposes.  |
| Information/Data  |                    |    |           |  |
| Description of data management policies, processes, procedures, and tools (e.g., CRUD Matrix) for analyzing, designing, building, and maintaining databases in an enterprise architected environment.                                 |                    |    | X         | The architecture contains a high-level data management strategy, including guidelines, and an approach for managing the data in an EA environment. However, it does not identify the policies, processes, procedures, and tools to be used.  |

(Continued From Previous Page)

| Key architectural element   | Element satisfied? |    |           | Explanation of partially satisfied   |
|---|--------------------|----|-----------|--|
|   | Yes                | No | Partially |  |
| A description of the business and operational rules for data standardization to ensure data consistency, integrity, and accuracy, such as business and security rules that govern access, maintenance, and use of data.   |                    |    | X         | The architecture contains descriptions of data standards upon which business rules can later be developed. The architecture contains rules for security, but lacks the details needed to consistently enforce these rules (e.g., the rules do not always identify the event, entity name, and the action to occur). In addition, the architecture does not provide any evidence as to whether these business rules have been verified and validated for completeness.  |
| A data dictionary, which is a repository of standard data definitions for applications.   |                    |    | X         | The architecture contains a data dictionary comprised of a list of terms and their respective definitions. However, the architecture does not have a complete list of terms nor does it contain a list of the data elements <sup>a</sup> needed to support systems and database design.  |
| A conceptual data model that describes the fundamental things/objects (e.g., invoices, financial statements, inventory) that make up the business and how they are used, but without regard for how they will be physically stored. It represents the consolidated structure of business objects to be used by business applications. |                    |    | X         | The architecture contains a high-level conceptual data model that does not specify how the business objects are used by applications (i.e., does not show how the information is used by the enterprise). Further, this model does not show a consolidated view of the data (business objects) to be used by applications.   |
| A logical database model that provides the data structures that support information flows, and that provides the basis for developing the schemas for designing, building, and maintaining the physical databases.  |                    |    | X         | The architecture contains data structures, which describe, for example, data entities, attributes, and relationships among data. However, the model has not been verified or validated for completeness with respect to business relevance (i.e., business scenarios do not show evidence of this validation), nor are there criteria for defining the number of business scenarios that have to be completed. In addition, it does not show the relationship among the data structures in this data model nor the data structure underlying the data/information flows for business operations and systems. Further, the architecture does not contain a unified enterprise data model that reconciles the independent data models that have been developed for each business process area. |
| A metadata model that specifies the rules and standards for access to information.  |                    |    | X         | The architecture notes that an approach, strategy, and plan for creating and managing metadata have not yet been developed. However, it notes that these documents will be created at a later time.  |
| A description of information flows and relationships between organizational units, business operations, and system elements.  |                    |    | X         | The architecture contains notional system-to-system relationships, including how the system may support business activities, which can be used to extend development of the architecture, but the architecture does not link organizational units to business operations and system elements (e.g., hardware and software).  |

(Continued From Previous Page)

| Key architectural element   | Element satisfied? |    |           | Explanation of partially satisfied   |
|---|--------------------|----|-----------|--|
|   | Yes                | No | Partially |  |
| Services/Applications   |                    |    |           |  |
| A description of the business application systems and system components and their interfaces.   |                    |    | X         | The architecture has grouped business functions into system entities <sup>b</sup> and identified the communication paths between these entities; however, these entities are notional.   |
| A description of the common technical approach, policies, and procedures for developing/acquiring business application systems throughout their life cycle, including requirements management, design, implementation, testing, deployment, operations, and maintenance. The common technical approach should also describe the process for integrating legacy systems with the systems to be developed/acquired. |                    |    | X         | The architecture does not have a common technical approach and policies and procedures, nor has it defined a plan for achieving this. It does, however, recognize the need for having an approach and policies and procedures, and provides a general time frame for when they will be developed.                      |
| Technical   |                    |    |           |  |
| Descriptions of the enterprise infrastructure services to include specific details regarding the functionality and capabilities these services will provide to enable systems applications.   |                    |    | X         | The architecture contains high-level definitions for the enterprise services. However, the specific enterprise services for this architecture are to be developed within the context of the GIG's enterprise services, and, according to DOD, the GIG is not complete and is still evolving.                           |
| Identification of the technical standards to be implemented for each enterprise service.  |                    |    | X         | DOD has identified enterprise infrastructure services for system entities. However, standards profiles that support the services, and commonly apply to all system entities, are not clearly identified and described. DOD has not yet defined standards profiles to be employed in the conduct of business processes. |
| A description of the physical IT infrastructure needed to support the developed and/or acquired systems, including the relationships among hardware, software, and communications devices.  |                    | X  |           |  |
| Common policies and procedures for developing/acquiring infrastructure systems throughout their life cycle including requirements management, design, implementation, testing, deployment, operations, and maintenance. These policies and procedures should also address the integration of applications, including legacy systems.  |                    |    | X         | The architecture does not have common policies and procedures, nor has it defined a plan for achieving this. It does, however, recognize the need for having these policies and procedures, and provides a general time frame for when they will be developed.   |

(Continued From Previous Page)

| Key architectural element   | Element satisfied? |    |           | Explanation of partially satisfied   |
|---|--------------------|----|-----------|--|
|   | Yes                | No | Partially |  |
| Security  |                    |    |           |  |
| A description of the policies, procedures, goals, strategies, and requirements relevant to information assurance and security.  |                    |    | X         | <p>The architecture refers to policies, but application of the policies is inconsistent within the architecture. It does not contain procedures; but recognizes the need for them and provides a general time frame for when they will be developed. The architecture contains hypothetical security goals for such attributes as risk and impact assessments. It also contains a high-level strategy that explains where information assurance should be addressed in the architecture and the target capabilities needed for information assurance (e.g., threat/vulnerability assessments). In addition, the architecture lists relevant security requirements.</p> <p>However, the goals, strategies, and requirements have not been mapped to specific physical security systems solutions. It is also unclear how information assurance activities will support the department's warfighter goals.</p> |
| A listing of security and information assurance related terms.  |                    |    | X         | <p>The data dictionary does list some security-related terms (e.g., availability, integrity, and authentication); however, the definitions for these terms are inconsistent with the definitions contained in the existing policy.</p> <p>In addition, some of the terms that are not listed (e.g., need-to-know and nonrepudiation) are critical to implementing effective information assurance controls.</p>  |
| A listing of accountable organizations and their respective responsibilities for implementing enterprise security services.   |                    | X  |           |  |
| A description of operational security rules that are derived from security policies.  |                    | X  |           |  |
| A description of enterprise security infrastructure services (e.g., identification and authentication) that will be needed to protect the department's assets, and the means for implementing such services (e.g., firewalls and intrusion detection software). |                    |    | X         | The architecture contains generic descriptions of enterprise security services, but does not specify the means for implementation.   |
| A description of the security standards to be implemented for each enterprise service to secure assets. These standards should be derived from security requirements.   |                    |    | X         | The architecture describes the enterprise services and associated standards that apply to individual system entities. However, it does not link requirements to standards and vice versa.  |

(Continued From Previous Page)

| Key architectural element  | Element satisfied? |    |           | Explanation of partially satisfied  |
|--|--------------------|----|-----------|---|
|  | Yes                | No | Partially |   |
| A description of the protection mechanisms that will be implemented to secure the department's assets, such as firewalls and intrusion detection software, including a description of the relationships among these protection mechanisms. |                    | X  |           |   |
| <b>Performance</b>   |                    |    |           |   |
| A description of the performance management process, including how the organization will measure, track, evaluate, and predict business performance with respect to business functions, baseline data, and service levels.                 |                    |    | X         | The architecture contains a high-level proposal to develop this process; however, buy-in has not been achieved. Until buy-in is obtained, the development of such a process will not be an architectural requirement.     |
| A description of customer-focused measurable goals and outcomes for business products and services.  |                    |    | X         | The architecture contains performance metrics for operational activities and notional systems; however, these metrics are not linked to measurable goals associated with business products and services.                  |
| A description of measurable goals and outcomes for managing technology to enable the achievement of business goals and outcomes.   |                    |    | X         | The architecture contains plans to establish baseline measures that can be used to establish technical performance measures, but it does not yet recognize the need to tie these measures to the business goals/outcomes. |

Source: GAO analysis of DOD data.

<sup>a</sup>Data elements are basic units of information that cannot be further subdivided. For example, you may create a data structure called 'Address,' which contains the data elements 'Street Address, City, State, and Zip Code.'

<sup>b</sup>System entities are logical groups of system functions (e.g., general ledger, payroll) representing "To Be" capabilities and requirements.

---

*Transition Plan:* According to relevant guidance and best practices,<sup>36</sup> the transition plan should provide a temporal roadmap for moving from the “As Is” to the “To Be” environment. An important step in the development of a well-defined transition plan is a gap analysis that compares the “As Is” and “To Be” architectures to identify differences. Other important steps include analyses of technology opportunities and market place trends as well as assessments of fiscal and budgetary realities and institutional acquisition and development capabilities. Using such analyses and assessments, options are explored and decisions are made regarding which legacy systems to retain, modify, or retire, and which new systems to introduce on either a tactical (temporary) basis or to pursue as strategic solutions. Accordingly, transition plans identify legacy, migration, and new systems, and sequence them to show, for example, the phasing out and termination of systems and capabilities, and the timing of the introduction of new systems and capabilities. Furthermore, they do so in light of resource constraints, such as budget, people, acquisition/development process maturity, and associated time frames. Recognizing the importance of a well-defined transition plan, the act<sup>37</sup> also required DOD to identify (1) all mission-critical or mission-essential operational and developmental financial and nonfinancial systems, (2) the actual costs to operate and maintain these systems during fiscal year 2002, and (3) the estimated costs for fiscal year 2003.

DOD’s transition plan generally does not possess these attributes, and is basically a plan to develop a transition plan. Specifically, it does not (1) provide a gap analysis identifying the needed changes to current business processes and systems, (2) identify all of the systems that will not become part of the “To Be” architecture as well as the time frames for phasing out these systems, (3) show a time-based strategy for replacing legacy systems, including identification of intermediate (i.e., migration) systems that may be temporarily needed, and (4) define the resources (e.g., funding and staff) needed to transition to the target environment. Further, while the transition plan contained system cost information for fiscal years 2002 and 2003, it did not associate this information, as specified in the act,

---

<sup>36</sup> See for example, Office of Management and Budget, *Federal Enterprise Architecture Business Reference Model*, Version 1.0 (2002); Chief Information Officer Council, *A Practical Guide to Federal Enterprise Architecture*, Version 1.0 (February 2001); and Office of Management and Budget, *Management of Federal Information Resources*, Circular No. A-130 (Nov. 28, 2000).

<sup>37</sup> Section 1004 of Public Law 107-314.

---

with mission-critical or mission-essential operational and developmental financial and nonfinancial systems.

DOD attributed the state of its transition plan to attempting to develop this plan concurrently with developing its “As Is” and “To Be” architectures, which it found was not feasible. As a result, DOD does not yet have a meaningful and reliable basis for managing the disposition of its existing inventory of about 2,300 systems or for sequencing the introduction of modernized business operations and supporting systems. See table 7 for the detailed results of our analysis of DOD’s transition plan.



**Table 7: Detailed Analysis of the Extent to Which DOD’s Transition Plan Satisfies Key Architectural Elements**

| Key architectural element   | Element satisfied? |    |           | Explanation of partially satisfied   |
|---|--------------------|----|-----------|--|
|   | Yes                | No | Partially |  |
| Transition Plan   |                    |    |           |  |
| Analysis of the gaps between the baseline and target architecture for business processes, information/data, and services/application systems to define missing and needed capabilities.   |                    |    | X         | <p>The transition plan does not contain a detailed gap analysis that shows how and when operational and system deficiencies will be addressed.</p> <p>The transition plan does, however, provide general time frames for when some potential needed capabilities will be developed, such as incentives and training plans.</p> |
| <p>A high-level strategy<sup>a</sup> for implementing the enterprise architecture, including specific time-phased milestones for acquiring and deploying systems, performance metrics, and financial and nonfinancial resource needs.</p> <p>This strategy should include:</p> <ul style="list-style-type: none"><li>• A listing of the legacy systems that will not be part of the “To Be” environment and the schedule for terminating these systems.</li><li>• A strategy that recognizes the need to train staff relevant to changes to policies, procedures, business processes, and systems to enable operational efficiency and effectiveness. This strategy should contain milestone dates for training staff and associated costs.</li><li>• A list of the systems to be developed/acquired to achieve business needs.</li><li>• A strategy for employing enterprise application integration (EAI) plans, methods, and tools to, for example, provide for efficiently reusing applications that already exist concurrent with adding new applications and databases.</li></ul> |                    |    |           |  |
|   |                    |    | X         | Of the about 2,300 existing systems in DOD’s current inventory, DOD has identified 558 legacy systems and provided retirement dates for 68 (31 have specific termination dates and 37 have only fiscal year). In other cases, DOD has not specified any time frames or schedules for termination.                              |
|   |                    |    | X         | The transition plan recognizes that training will be needed, but does not contain specific information as to when training will occur, the types of training that will be needed to address changes, and the anticipated costs.  |
|   |                    |    | X         | A description of future systems has been provided; however, the systems described are notional.  |
|   |                    |    | X         | The transition plan contains a high-level strategy that could be employed for EAI. However, it does not address the plans, methods, and tools to be used.  |

(Continued From Previous Page)

| Key architectural element  | Element satisfied? |    |           | Explanation of partially satisfied |
|--|--------------------|----|-----------|------------------------------------|
|  | Yes                | No | Partially |                                    |
| A technical (systems, infrastructure, and data) migration plan that shows:   |                    |    |           |                                    |
| • the transition from legacy to replacement systems with explicit sunset dates and intermediate systems that may be temporarily needed to sustain existing functionality during the transition period;                 |                    | X  |           |                                    |
| • an analysis of system interdependencies, including the level of effort required to implement related systems in a sequenced portfolio of projects that includes milestones, time lines, costs, and capabilities; and |                    | X  |           |                                    |
| • a cost estimate for the initial phase(s) of the transition, and high-level cost projection for transition to the target architecture.  |                    | X  |           |                                    |

Source: GAO analysis of DOD data.

<sup>a</sup>An acquisition/business strategy is a plan of action for achieving a specific goal or result through contracting for software products and services.

## Contractor Review of Version 1.0 of the Architecture Also Identified Weaknesses

DOD's verification and validation contractor assessed Version 1.0 of its architecture against relevant best practices to determine its quality. In June 2003,<sup>38</sup> consistent with our assessment, this contractor reported that while DOD's architecture contained significant content, it lacked the depth and detail needed to begin building and implementing modernized systems and making operational changes. Further, the contractor reported that the architecture was not easily understandable and that its utility to stakeholders in system acquisition planning was limited. According to the contractor, these conclusions were based on the following findings.

- Linkages among architecture products had not been defined, making it difficult to navigate through the architecture.
- Architecture products did not adequately describe the "As Is" environment, including business processes and existing business application systems and supporting technology, which would make it

<sup>38</sup> MITRE Technical Report: Review of Financial Management Enterprise Architecture (FMEA), Version 1.0 (June 2003).

---

difficult for DOD to perform a gap analysis to support development of a transition plan.

- Architecture products did not adequately describe the “To Be” environment, including (1) business rules governing how data are to be accessed and used within the automated environment, (2) migration and target systems and applications, (3) enterprise infrastructure services and the technical standards relevant to each service, (4) security needs, including standards and protection mechanisms (e.g., firewalls), and (5) performance metrics.
- The transition plan was merely a plan to develop a transition plan.

As a result, the contractor recommended, among other things, that the department discontinue further development of the “To Be” architecture until it addressed identified deficiencies. Program officials stated that they will address these comments in subsequent versions of the architecture. However, they could not provide us with any written plans governing the scope of comments to be addressed, and how they will be addressed and validated.

---

## DOD Has Yet to Establish an Effective Investment Management Process for Selecting and Controlling Business System Investments

Using the architecture as an integral investment management frame of reference is essential to effectively selecting and controlling business system investments and to moving the organization toward the target architecture. Such use of an architecture is provided for in legislation, federal guidance, and best practices. In addition, subsection 1004(d) of the act stipulates that any amount in excess of \$1 million may be obligated for system improvements only if the DOD Comptroller makes a determination that the improvement is necessary for (1) critical national security capability or critical safety and security requirements or (2) prevention of significant adverse effect on a project that is needed to achieve an essential capability. The act further states that once the architecture is approved, the DOD Comptroller must determine that expenditures for system improvements are consistent with the enterprise architecture and the transition plan. These legislative requirements are consistent with our open recommendations to DOD for selecting and controlling business systems investments. Specifically, we recommended that DOD gain control over business system investments by establishing a hierarchy of investment review boards from across the department, establishing a standard set of criteria to ensure alignment and consistency with the architecture, and directing the boards to perform a comprehensive review of all ongoing

---

business system investments. (App. III contains details on the status of DOD's efforts to address our open recommendations.)

To comply with the legislative requirement and address our recommendations, the DOD Comptroller issued a memorandum on March 7, 2003, to DOD's component organizations stating that the BMSI office—which is responsible for overseeing the development and implementation of the architecture—must review all system initiatives with expenditures in excess of \$1 million. In addition, the memorandum directs the DOD components, as an integral part of the review and approval process, to present information to DOD Comptroller officials and relevant domain owners that demonstrates that each investment (1) complies with the architecture, and (2) is economically justified.

DOD has not yet defined and implemented an effective investment management process to proactively identify and control system investments exceeding \$1 million while the architecture is being developed and after it is completed. Based on DOD data, as of June 6, 2003, the DOD Comptroller had approved one system initiative with expenditures exceeding \$1 million since enactment of the act, and was reviewing four others. The one system approval for \$10 million was an enhancement to the Mechanization of Contract Administrative Services (MOCAS) system—which is DOD's primary contractor pay system and is used to maintain data on the majority of DOD's weapons systems as well as service contracts administered by the Defense Contract Management Agency. According to DOD, the enhancements to MOCAS are essential because the system intended to replace MOCAS—Defense Procurement Payment System—was terminated in December 2002 by the DOD Comptroller after 7 years of effort and an investment of \$126 million because of poor program performance and increasing costs. In approving the enhancements to MOCAS, the DOD Comptroller determined that it was needed to assure continued system operations and that the failure of MOCAS would jeopardize DOD's ability to pay contractors on time, which is one of the criteria in the act.

BMSI officials stated that the department's current process for selecting and controlling business system investments depends on the system owners coming forward with the request for approval, and that it has not established the means to determine which systems should be submitted for review. In response to our prior open recommendations, the DOD Comptroller states that the department is currently establishing a governance structure that includes an investment review board and making

---

the domain owners an integral part of the review and approval process for selecting and controlling business system investments. According to DOD officials, the board is to utilize a portfolio management approach based on established approval thresholds to address investment decisions across the department. Further, DOD officials state that the department is developing standard criteria to be used by the investment boards to assess business system investments, including consistency with the architecture. However, this proposed governance concept has not yet been adopted. We discuss this process in more detail later in this report.

Our analysis of DOD's fiscal years 2003 and 2004 IT budget requests shows that over 200 systems in each year's budget, totaling about \$4 billion per year, could involve obligations of funds that meet the \$1 million threshold. This indicates that the majority of the billions of dollars that DOD invests in business system improvements annually have not been subjected to the scrutiny of the DOD Comptroller as now called for in the act. The act places limitations on the legal authority of individual program and government contracting officials to obligate funds in support of the systems for which they are responsible, but DOD has yet to proactively manage investments to avoid violations of the limitations and to review investments in any meaningful way to enforce these statutory limitations. Program officials acknowledge that the department, at a minimum, could use DOD's IT budget documentation to proactively fulfill the act's requirements. Until DOD strengthens its process for selecting and controlling business system investments and adopts an effective governance concept, it remains exposed to the risk of spending billions of dollars on duplicative, stove-piped, nonintegrated systems that do not optimize mission performance and accountability and, therefore, do not support the department's transformation goals.

---

---

## DOD's Plans for Evolving and Extending Its Enterprise Architecture and for Improving Business System Investment Decision Making Are Unclear

According to DOD officials, it intends to (1) further develop, evolve, and extend the architecture, including the transition plan, and issue a revised version, and (2) improve processes for selecting and controlling business systems investments. However, DOD's plans for this next phase have not been explicitly defined. Until they are clearly and completely defined and effectively implemented, the department risks perpetuating past business system investment practices and spending tens of billions of dollars on incompatible, duplicative, and nonintegrated systems.

---

## DOD's Plans for Issuing Next Version of Architecture Products Are Unclear

According to DOD, it intends to issue its next significant version of the architecture in May 2004 and this update is to extend and evolve the architecture. To accomplish this, program documentation states that DOD will, among other things,

- determine the contractor resources needed to evolve and extend the architecture;
- develop a methodology for integrating the architecture with DOD's GIG and OMB's Federal Enterprise Architecture;<sup>39</sup>
- establish an approach for maintaining its existing systems inventory; and
- evaluate the architecture for completeness, accuracy, and integration of end-to-end business processes and system functions.

However, how DOD will accomplish these and other activities associated with effectively updating its architecture has not been defined, nor have such things as roles and responsibilities for executing activities, dependencies among activities, and measures of activity progress. Rather, the department basically has plans to develop a strategy that will define

---

<sup>39</sup> See the background section of this report for a description of OMB's Federal Enterprise Architecture.

---

this next phase of activities. By following this approach, DOD will again be setting unrealistic expectations; and without clearly defined plans for evolving and extending the architecture, the department is at risk of falling short of its intended goals to centrally guide and direct its architecture efforts.

---

### DOD's Plans for Improving Controls over Ongoing and Planned Business System Investments Are Unclear

As previously described, DOD has a proposed governance concept that describes how and by whom business transformation requirements identified by the architecture will be implemented in the department. This proposal vests the business line representatives or domain owners with the authority, responsibility, and accountability for business transformation, implementation of the architecture, development and execution of the transition plan, and portfolio management within their domains. This proposal also designates the domain owners of the business process areas and provides them a high-level description of their roles and responsibilities. In addition, the proposal allocates the current inventory of about 2,300 systems to these domain owners as portfolios of investments to manage.

However, it is not clear how the proposed approach will be implemented, and how it will satisfy the act's investment selection and control requirements. Further, it is also not clear how the proposed approach will address our recommendations for establishing a hierarchy of investment review boards and an explicit set of standard criteria for selecting, controlling, and evaluating IT investments as a portfolio of options, with one criterion to ensure consistency and compliance with ongoing architecture development efforts.

According to DOD officials, as a first step, the domain owners will validate cost and other functional information associated with the existing inventory of about 2,300 systems and identify those inventoried systems that will not become part of the "To Be" architecture. According to DOD, these efforts will evolve over time and, therefore, its plans do not include a completion date.

Moreover, DOD program documentation provides for initiating pilot projects in the near term that are to demonstrate and implement a portion of the architecture and be usable across the department. In contrast, DOD officials stated that the pilot projects are intended to validate departmentwide business processes and not to implement production systems. Thus, the purpose and scope of these projects remain unclear and

---

specific projects have yet to be selected. If DOD intends for these projects to demonstrate or validate an enterprisewide business process to address a current deficiency in DOD's business operations and systems, such as the lack of common data standards, these projects could help DOD improve its architecture and thus could be reasonable investments. However, if the pilot projects are to be used to acquire and implement system solutions and place them into production to achieve an operational capability, it is unclear how DOD will ensure architecture alignment and manage the risk associated with investing in more systems before it has a well-defined blueprint and an effective investment management process to guide and control them.

---

## Conclusions

Recent legislation and our past recommendations to DOD recognize that it is absolutely essential to have and use a well-defined enterprise architecture to guide and constrain DOD's business systems modernization program. DOD's efforts to date to develop such an architecture, and satisfy its legislative mandate, are good first steps to this end, but more steps are needed before it will have an adequate basis for acquiring and implementing its desired systems environment. In our view, DOD's BEA (version 1.0) provides a foundation for it to move forward in adding missing architectural scope and detail, and ultimately validating that the architecture is sufficiently complete and correct.

DOD has not, however, made similar strides in its efforts to control its ongoing and planned systems investments. In effect, nothing significant has changed since our prior review in the way that DOD is investing billions of dollars annually in existing and new systems. This means that the department has yet to implement our prior recommendations for controlling systems funding, and it has not yet defined and implemented an effective approach to satisfy legislative requirements for approving systems investments over \$1 million. As a result, billions of dollars continue to be at risk of being spent on more systems that are duplicative, are not interoperable, cost more to maintain than necessary, and do not optimize mission performance and accountability.

The future of DOD's architecture development and implementation activities is difficult to understand because DOD's near-term plans are unclear. As a result, DOD's business systems modernization efforts remain exposed to considerable risk. It is critical for DOD to effectively expand and extend its architecture to the point that it provides a sound basis for departmentwide investment decision making, and that in doing so, it



---

continue to centrally guide and direct its architecture development efforts and not allow DOD domain owners to proceed independently. Similarly, it is critical for DOD to immediately gain control over near-term investments pending the architecture's completion. This includes justifying further investment in each ongoing system project beyond fiscal year 2003 and not starting any new projects that are intended to be put into production and provide operational capabilities, pilot or otherwise, until the (1) architecture has been sufficiently completed and (2) DOD has established an effective institutional approach to make informed systems investment decisions, including ensuring that each investment is architecturally aligned. To do less continues to put billions of dollars at unnecessary risk of perpetuating today's legacy systems environment.

---

## Recommendations

Because our open recommendations to DOD for managing the development, maintenance, and implementation of its BEA, including effectively controlling ongoing investment in business systems, are critical to the success of its modernization and transformation efforts, we reiterate the recommendations that we made in our May 2001<sup>40</sup> and February 2003<sup>41</sup> reports. To further assist the department in effectively implementing these recommendations, we are augmenting them by providing the following more specific implementation steps. Specifically, we recommend to the Secretary of Defense that he or his appropriate designee,

- define and implement an effective investment management process to proactively identify, control, and obtain DOD Comptroller review and approval of expenditures for new and ongoing business system investments exceeding \$1 million while the architecture is being developed and after it is completed, and which includes clearly defined domain owners' roles and responsibilities for selecting and controlling ongoing and planned system investments;
- implement the core elements in our *EA Framework for Assessing and Improving Enterprise Architecture Management* that we identify in this report as not satisfied, including ensuring that minutes of the executive body charged with directing, overseeing, and approving the architecture are prepared and maintained;

---

<sup>40</sup> GAO-01-525.

<sup>41</sup> GAO-03-458.

- 
- update version 1.0 of the architecture to include the 340 Joint Financial Management Improvement Program requirements that our report identified as omitted or not fully addressed;
  - update version 1.0 of the architecture to include the 29 key elements governing the “As Is” architectural content that our report identified as not being fully satisfied;
  - update version 1.0 of the BEA to include the 30 key elements governing the “To Be” architectural content that our report identified as not being fully satisfied;
  - update version 1.0 to ensure that “To Be” architecture artifacts are internally consistent, to include addressing the inconsistencies described in this report, as well as including user instructions or guidance for easier architecture navigation and use;
  - update version 1.0 of the architecture to include (1) the three key elements governing the transition plan content that our report identified as not being fully satisfied and (2) those system investments that will not become part of the “To Be” architecture, including time frames for phasing out those systems;
  - update version 1.0 of the architecture to address comments made by the verification and validation contractor;
  - develop a well-defined near-term plan for extending and evolving the architecture and ensure that this plan includes addressing our recommendations, defining roles and responsibilities of all stakeholders involved in extending and evolving the architecture, explaining dependencies among planned activities, and defining measures of activity progress; and
  - limit the pilot projects to small, low-cost, low-risk prototype investments that are intended to provide knowledge needed to extend and evolve the architecture, and are not to acquire and implement production version system solutions or to deploy an operational system capability.

---

---

## Agency Comments and Our Evaluation

In written comments on a draft of this report (reprinted in app. IV), the department concurred with 9 of our 10 recommendations, partially concurred with the remaining one, and described recently completed, ongoing, or planned efforts to address them. We will evaluate whether DOD's efforts fully address our recommendations in future BEA reviews.

DOD partially concurred with our recommendation regarding the architectural content of the "As Is" environment stating that because the current operating environment is dynamic, complete satisfaction of the 29 key elements that our report identified is not realistically achievable. DOD stated that such data, even if they were possible to obtain, would be obsolete upon arrival and, therefore, the department does not deem the data collection effort to be cost effective. DOD stated that it is currently analyzing the 29 key elements and that as part of its incremental development approach, it will collect relevant "As Is" documentation, where appropriate, and will include the data in future releases of the BEA.

We agree that architectural information that does not provide value commensurate with cost should not be captured in the BEA. However, DOD's comments concerning the missing 29 "As Is" key elements do not contain sufficient context, detail, and explanation to understand which key elements DOD proposes to satisfy and which it does not. Further, its comments do not adequately explain and justify why key elements should be waived. As noted in our report, DOD's "As Is" architecture products provide little descriptive content and do not satisfy 90 percent of the architectural elements required by relevant guidance needed to permit development of a meaningful and useful transition plan. Further, as noted in our March 2003 report,<sup>42</sup> while further development of the "As Is" environment can coincide with the development of the transition plan, not having defined the "As Is" operations and technology at this juncture is risky because it defers until too late in the architecture development cycle creation of sufficient descriptive content and context to develop an effective transition plan.

We are sending copies of this report to interested congressional committees; the Director, Office of Management and Budget; the Secretary of Defense; the Under Secretary of Defense (Comptroller); the Assistant Secretary of Defense (Networks and Information Integration)/Chief

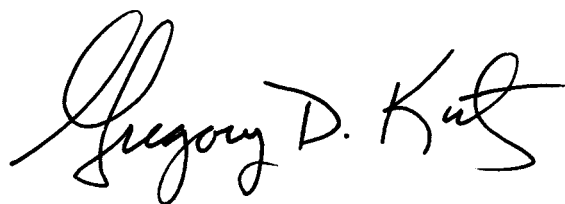
---

<sup>42</sup> GAO-03-571R.

---

Information Officer; the Under Secretary of Defense (Acquisition, Technology, and Logistics); the Under Secretary of Defense (Personnel and Readiness); and the Director, Defense Finance and Accounting Service. This report will also be available at no charge on our Web site at <http://www.gao.gov>.

If you or your staff have any questions on matters discussed in this report, please contact Gregory D. Kutz at (202) 512-9095 or [kutzg@gao.gov](mailto:kutzg@gao.gov), or Randolph C. Hite at (202) 512-3439 or [hiter@gao.gov](mailto:hiter@gao.gov). Major contributors to this report are acknowledged in appendix V.



Gregory D. Kutz  
Director  
Financial Management and Assurance



Randolph C. Hite  
Director  
Information Technology Architecture and System Issues

---

*List of Committees*

The Honorable John W. Warner  
Chairman

The Honorable Carl Levin  
Ranking Minority Member  
Committee on Armed Services  
United States Senate

The Honorable Ted Stevens  
Chairman

The Honorable Daniel K. Inouye  
Ranking Minority Member  
Subcommittee on Defense  
Committee on Appropriations  
United States Senate

The Honorable Duncan Hunter  
Chairman

The Honorable Ike Skelton  
Ranking Minority Member  
Committee on Armed Services  
House of Representatives

The Honorable Jerry Lewis  
Chairman

The Honorable John P. Murtha  
Ranking Minority Member  
Subcommittee on Defense  
Committee on Appropriations  
House of Representatives

# SEC. 1004. [of Public Law 107-314] Development and Implementation of Financial Management Enterprise Architecture

## SEC. 1004. [of Public Law 107-314] DEVELOPMENT AND IMPLEMENTATION OF FINANCIAL MANAGEMENT ENTERPRISE ARCHITECTURE

### (a) REQUIREMENT FOR ENTERPRISE ARCHITECTURE AND FOR TRANSITION PLAN—

Not later than May 1, 2003, the Secretary of Defense shall develop—

- (1) a financial management enterprise architecture for all budgetary, accounting, finance, enterprise resource planning, and mixed information systems of the Department of Defense; and
- (2) a transition plan for implementing that financial management enterprise architecture.

### (b) COMPOSITION OF ENTERPRISE ARCHITECTURE—

(1) The financial management enterprise architecture developed under subsection (a)(1) shall describe an information infrastructure that, at a minimum, would enable the Department of Defense to—

- (A) comply with all Federal accounting, financial management, and reporting requirements;
- (B) routinely produce timely, accurate, and reliable financial information for management purposes;
- (C) integrate budget, accounting, and program information and systems; and
- (D) provide for the systematic measurement of performance, including the ability to produce timely, relevant, and reliable cost information.

(2) That enterprise architecture shall also include policies, procedures, data standards, and system interface requirements that are to apply uniformly throughout the Department of Defense.

### (c) COMPOSITION OF TRANSITION PLAN—The transition plan developed under subsection (a)(2) shall include the following:

- (1) The acquisition strategy for the enterprise architecture, including specific time-phased milestones, performance metrics, and financial and nonfinancial resource needs.
- (2) A listing of the mission critical or mission essential operational and developmental financial and nonfinancial management systems of the Department of Defense, as defined by the Under Secretary of Defense (Comptroller), consistent with budget justification documentation, together with—
  - (A) the costs to operate and maintain each of those systems during fiscal year 2002; and
  - (B) the estimated cost to operate and maintain each of those systems during fiscal year 2003.

(3) A listing of the operational and developmental financial management systems of the Department of Defense as of the date of the enactment of this Act (known as ‘legacy systems’) that will not be part of the objective financial and nonfinancial management system, together with the schedule for terminating those legacy systems that provides for reducing the use of those legacy systems in phases.

### (d) CONDITIONS FOR OBLIGATION OF SIGNIFICANT AMOUNTS FOR FINANCIAL SYSTEM IMPROVEMENTS—An amount in excess of \$1,000,000 may be obligated for a defense financial system improvement only if the Under Secretary of Defense (Comptroller) makes a determination regarding that improvement as follows:

- (1) Before the date of an approval specified in paragraph (2), a determination that the defense financial system improvement is necessary for either of the following reasons:

**Appendix I**  
**SEC. 1004. [of Public Law 107-314]**  
**Development and Implementation of**  
**Financial Management Enterprise**  
**Architecture**

- (A) To achieve a critical national security capability or address a critical requirement in an area such as safety or security.
- (B) To prevent a significant adverse effect (in terms of a technical matter, cost, or schedule) on a project that is needed to achieve an essential capability, taking into consideration in the determination the alternative solutions for preventing the adverse effect.
- (2) On and after the date of any approval by the Secretary of Defense of a financial management enterprise architecture and a transition plan that satisfy the requirements of this section, a determination that the defense financial system improvement is consistent with both the enterprise architecture and the transition plan.
- (e) **CONGRESSIONAL REPORTS**—Not later than March 15 of each year from 2004 through 2007, the Secretary of Defense shall submit to the congressional defense committees a report on the progress of the Department of Defense in implementing the enterprise architecture and transition plan required by this section. Each report shall include, at a minimum—
- (1) a description of the actions taken during the preceding fiscal year to implement the enterprise architecture and transition plan (together with the estimated costs of such actions);
  - (2) an explanation of any action planned in the enterprise architecture and transition plan to be taken during the preceding fiscal year that was not taken during that fiscal year;
  - (3) a description of the actions taken and planned to be taken during the current fiscal year to implement the enterprise architecture and transition plan (together with the estimated costs of such actions); and
  - (4) a description of the actions taken and planned to be taken during the next fiscal year to implement the enterprise architecture and transition plan (together with the estimated costs of such actions).
- (f) **COMPTROLLER GENERAL REVIEW**—Not later than 60 days after the approval of an enterprise architecture and transition plan in accordance with the requirements of subsection (a), and not later than 60 days after the submission of an annual report required by subsection (e), the Comptroller General shall submit to the congressional defense committees an assessment of the extent to which the actions taken by the Department comply with the requirements of this section.
- (g) **DEFINITIONS**—In this section:
- (1) The term ‘defense financial system improvement’ means the acquisition of a new budgetary, accounting, finance, enterprise resource planning, or mixed information system for the Department of Defense or a modification of an existing budgetary, accounting, finance, enterprise resource planning, or mixed information system of the Department of Defense. Such term does not include routine maintenance and operation of any such system.
  - (2) The term ‘mixed information system’ means an information system that supports financial and non-financial functions of the Federal Government as defined in Office of Management and Budget Circular A-127 (Financial management Systems).
- (h) **REPEAL**—(1) Section 2222 of title 10, United States Code, is repealed. The table of sections at the beginning of chapter 131 of such title is amended by striking the item relating to such section.
- (2) Section 185(d) of such title is amended by striking ‘has the meaning given that term in section 2222(c)(2) of this title’ and inserting ‘means an automated or manual system from which information is derived for a financial management system or an accounting system’.

---

# Scope and Methodology

---

To accomplish our objectives for determining (1) the extent to which DOD's actions complied with the requirements of section 1004 of Public Law 107-314 and (2) DOD's plans for further development and implementation of the architecture, we assessed DOD's initial architecture, which, according to DOD, was approved by the DOD Comptroller and transmitted to the Comptroller General on May 8, 2003. This report provides specific details on our assessment results. Our overall assessment of DOD's initial architecture was issued on July 7, 2003,<sup>1</sup> which satisfied the legislative requirement that we submit a report to congressional defense committees within 60 days of the architecture's approval.

Consistent with the act and as agreed with congressional defense committees' staffs, this assessment focused on (1) compliance with all federal accounting, financial management, and reporting requirements, (2) the content of the "As Is" and "To Be" environments, (3) the content of the transition plan to include time-phased milestones for phasing out existing systems, resource needs for implementing the "To Be" environment, and information on the systems inventory, and (4) the extent to which DOD is controlling its business system investments. In addition, we used our *Enterprise Architecture Management Maturity Framework*<sup>2</sup> that describes the five stages of management maturity to determine the extent to which DOD has adopted key elements of architecture management best practices. To make this determination, we reviewed program documentation, such as program policies and procedures, steering and executive committee charters, and architecture products, and compared them to the elements in the framework. We did not validate the cost and budget information provided by the program's budget analyst.

Specific to our review of federal requirements, we could not determine whether the architecture contained all federal accounting, financial management, and reporting requirements because a central repository of all such requirements does not exist. Nevertheless, to assess the completeness of the federal requirements, we compared the about 4,000 external requirements<sup>3</sup> contained in the architecture to those listed in

---

<sup>1</sup> GAO-03-877R.

<sup>2</sup> GAO-03-584G.

<sup>3</sup> External requirements are those that are obtained from authoritative sources and constrain various aspects of the architecture.



selected JFMIP federal systems requirements publications.<sup>4</sup> Of the 4,000 external requirements incorporated in the initial architecture, we performed a detailed review of 1,767 (about 45 percent), all of which were JFMIP requirements. Specifically, we identified whether these requirements were incorporated in the initial architecture, relevant to DOD's business operations, or were current. To supplement our documentation review, we held interviews with government and contractor officials from the Office of the Under Secretary of Defense (Comptroller) and IBM.

For our review of the architecture,<sup>5</sup> our internal team of architecture experts identified relevant criteria to be used to assess the architecture products, including best practices and federal guidance.<sup>6</sup>

In reviewing the criteria, these experts categorized the key requirements according to their relevance to the three primary component parts of the architecture specified in the act and recognized in best practices and federal guidance: the "As Is" architecture, the "To Be" architecture, and the transition plan. For ease of reporting, they further divided the "As Is" and "To Be" architectures into five architectural components similar to OMB's architecture reference models: business, information/data, services/applications, technical, and performance. We added security as a sixth component because of its recognized importance in the various

---

<sup>4</sup> We used nine JFMIP systems requirements documents: JFMIP-SR-03-01, *Revenue System Requirements* (January 2003); JFMIP-SR-02-02, *Acquisition/Financial Systems Interface Requirements* (June 2002); JFMIP-SR-02-01, *Core Financial System Requirements* (November 2001); JFMIP-SR-99-5, *Human Resources & Payroll Systems Requirements* (April 1999); JFMIP-FFMSR-8, *System Requirements for Managerial Cost Accounting* (February 1998); JFMIP-FFMSR-7, *Inventory System Requirements* (June 1995); JFMIP-SR-99-9, *Travel System Requirements* (July 1999); JFMIP-SR-00-4, *Property Management Systems Requirements* (October 2000); JFMIP-SR-01-01, *Benefit System Requirements* (September 2001).

<sup>5</sup> We reviewed version 1.0 of DOD's BEA including the transition plan, which was completed on April 30, 2003, and according to program officials, approved on May 8, 2003, by the department's Comptroller.

<sup>6</sup> See, for example, Office of Management and Budget, *Federal Enterprise Architecture Business Reference Model*, Version 1.0 (2002); Chief Information Officers Council, *A Practical Guide to Federal Enterprise Architecture*, Version 1.0 (February 2001); Office of Management and Budget, *Management of Federal Information Resources*, Circular No. A-130 (Nov. 28, 2000); M.A. Cook, *Building Enterprise Information Architectures: Reengineering Information Systems* (Upper Saddle River, N.J., Prentice Hall: 1996); and National Institute of Standards and Technology, *Information Management Directions: The Integration Challenge*, Special Publication 500-167 (September 1989).

architecture frameworks and relevance to the other five architectural components. For each of these six architectural components, we identified the key architectural requirements that would need to be addressed for the “As Is” and “To Be” environments for the department to create an architecture that would be effective in facilitating its business modernization efforts and documented this information in detailed matrices. These experts also identified the key architectural requirements for the transition plan component of the architecture, which were also documented in a detailed matrix. We then compared the architecture products including the transition plan against the identified criteria governing their content and documented the results of our analysis in the matrices.

We interviewed program officials, including the program director, the Chief Architect, and contractor staff (IBM and MITRE) to discuss our preliminary findings and to clarify the intended scope and purpose of this version of the architecture. We also participated in a 2-day architecture walkthrough in which DOD officials provided a progress update on the department’s development of the architecture and future plans for further evolution and implementation of the architecture. In addition, we reviewed the program’s verification and validation contractor’s (MITRE) report<sup>7</sup> documenting its assessment of version 1.0 of the architecture including the transition plan. We also interviewed program officials as to the department’s plans for addressing MITRE’s comments.

To review DOD’s actions to comply with the conditions for obligations in excess of \$1 million for financial system improvements, we obtained and reviewed memorandums and other documentation regarding the approval of expenditures for system investments in excess of \$1 million. We also reviewed and analyzed the DOD IT budget requests for fiscal years 2003 and 2004 to identify systems that met the \$1 million threshold and compared this to the total number of systems DOD reviewed and approved to measure DOD’s progress in reviewing those systems that meet the legislative threshold. To augment our document reviews and analyses, we interviewed officials from various DOD organizations, including the Office of the Under Secretary of Defense (Comptroller); Office of the Under Secretary of Defense (Acquisition, Technology, and Logistics); and the Office of the Under Secretary of Defense (Personnel and Readiness).

---

<sup>7</sup> MITRE Technical Report: *Review of Financial Management Enterprise Architecture (FMEA)*, Version 1.0 (June 2003).

---

To determine DOD's plans for further development and implementation of the architecture, we reviewed the initial transition plan and IBM's statement of work, DOD's proposed governance concept, and program documentation pertaining to plans for implementing pilot projects. We also reviewed DOD's response to the recommendations we made in our February 2003 report<sup>8</sup> pertaining to controlling ongoing and planned IT systems investments. To augment our document reviews and analyses, we interviewed government and contractor officials from the Office of the Under Secretary of Defense (Comptroller) and IBM.

We conducted our work primarily at DOD headquarters offices in Washington, D.C., and Arlington, Virginia, and we performed our work from March 2003 through June 2003 in accordance with U.S. generally accepted government auditing standards. We requested comments on a draft of this report from the Secretary of Defense or his designee. Written comments from the Under Secretary of Defense (Comptroller) are addressed in the "Agency Comments and Our Evaluation" section of this report and are reprinted in appendix IV.

---

<sup>8</sup> GAO-03-458.

# Status of Prior Recommendations on DOD's Business Enterprise Architecture

| Recommendations   | Status of recommendation |         |                 | DOD comments and our assessment   |
|---|--------------------------|---------|-----------------|---|
|   | Implemented              | Partial | Not implemented |   |
| GAO-01-525: Information Technology: Architecture Needed to Guide Modernization of DOD's Financial Operations. May 17, 2001.   |                          |         |                 |   |
| 1) The Secretary of Defense immediately designate DOD financial management modernization a departmental priority and accordingly direct the Deputy Secretary of Defense to lead an integrated program across the department for modernizing and optimizing financial management operations and systems.   | X                        |         |                 |   |
| 2) The Secretary immediately issue a DOD policy that directs the development, implementation, and maintenance of a financial management enterprise architecture.  |                          |         | X               | As discussed in this report, DOD has a policy for developing the Global Information Grid (GIG), which requires that all departmental architectures be in alignment with the GIG. While this policy outlines the roles and responsibilities for development, maintenance, and implementation of the GIG, it does not do so for other departmental architectures, including the BEA.  |
| 3) The Secretary immediately modify the Senior Financial Management Oversight Council's charter to  |                          | X       |                 | The department has established the Financial Management Executive and Steering Committees to serve as advisory bodies to the Under Secretary of Defense (Comptroller) for financial management modernization. However, as discussed in this report, DOD has not assigned responsibility for directing, overseeing, and approving the BEA to a committee or group comprised of representatives from across the department. |
| <ul style="list-style-type: none"><li>• designate the Deputy Secretary of Defense as the Council chair and the Under Secretary of Defense (Comptroller) as the Council vice-chair;</li><li>• empower the Council to serve as DOD's financial management enterprise architecture steering committee, giving it the responsibility and authority to ensure that a DOD financial management enterprise architecture is developed and maintained in accordance with the DOD C4ISR Architecture Framework;</li><li>• empower the Council to serve as DOD's financial management investment review board, giving it the responsibility and authority to (1) select and control all DOD financial management investments and (2) ensure that its investment decisions treat compliance with the financial management enterprise architecture as an explicit condition for investment approval that can be waived only if justified by a compelling written analysis; and</li><li>• expand the role of the Council's System Compliance Working Group to include supporting the Council in determining the compliance of each system investment with the enterprise architecture at key decision points in the system's development or acquisition life cycle.</li></ul> |                          |         |                 | In addition, DOD has not yet established a hierarchy of investment review boards, each responsible and accountable for selecting and controlling investments that meet defined criteria, including compliance with the enterprise architecture.   |

**Appendix III**  
**Status of Prior Recommendations on DOD's**  
**Business Enterprise Architecture**

(Continued From Previous Page)

| Recommendations  | Status of recommendation |         |                 | DOD comments and our assessment   |
|--|--------------------------|---------|-----------------|---|
|  | Implemented              | Partial | Not implemented |   |
| <p>4) The Secretary immediately make the Assistant Secretary of Defense (Command, Control, Communications &amp; Intelligence), in collaboration with the Under Secretary of Defense (Comptroller), accountable to the Senior Financial Management Oversight Council for developing and maintaining a DOD financial management enterprise architecture.</p> <p>In fulfilling this responsibility, the Assistant Secretary appoint a Chief Architect for DOD financial management modernization and establish and adequately staff and fund an enterprise architecture program office that is responsible for developing and maintaining a DOD-wide financial management enterprise architecture in a manner that is consistent with the framework defined in the CIO Council's published guide for managing enterprise architectures. In particular, the Assistant Secretary should take appropriate steps to ensure that the Chief Architect</p> <ul style="list-style-type: none"> <li>• obtains executive buy-in and support;</li> <li>• establishes architecture management structure and controls;</li> <li>• defines the architecture process and approach;</li> <li>• develops the baseline architecture, the target architecture, and the sequencing plan;</li> <li>• facilitates the use of the architecture to guide financial management modernization projects and investments; and</li> <li>• maintains the architecture.</li> </ul> |                          | X       |                 | <p>The Assistant Secretary of Defense (Networks and Information Integration)/ Chief Information Officer, is a member of the Executive and Steering Committees; however, as discussed previously, members' roles and responsibilities are advisory in nature.</p> <p>DOD established a Financial Management Modernization Program Office in July 2001. Also, DOD has appointed a chief architect and, according to DOD, it has adequate program funding and staff for developing and maintaining its BEA. However, the chief architect's roles and responsibilities have not yet been defined.</p> |
| <p>5) The Assistant Secretary of Defense (Command, Control, Communications &amp; Intelligence) report at least quarterly to the Senior Financial Management Oversight Council on the chief architect's progress in developing a financial management enterprise architecture, including the chief architect's adherence to enterprise architecture policy and guidance from OMB, the CIO Council, and DOD.</p>   |                          | X       |                 | <p>The program office, which the chief architect is part of, briefs the Steering Committee monthly on the status of DOD's efforts for developing its BEA; however meeting minutes are not prepared and maintained. Also, as noted previously, DOD has not issued a policy on the development, implementation, and maintenance of the BEA.</p>   |

**Appendix III**  
**Status of Prior Recommendations on DOD's**  
**Business Enterprise Architecture**

(Continued From Previous Page)

| Recommendations  | Status of recommendation |         |                 | DOD comments and our assessment  |
|--|--------------------------|---------|-----------------|--|
|  | Implemented              | Partial | Not implemented |  |
| 6) The Senior Financial Management Oversight Council report to the Secretary of Defense every 6 months on progress in developing and implementing a financial management enterprise architecture.  |                          | X       |                 | Senate Report 107-213, enacted on July 18, 2002, directs that the department report every 6 months to congressional defense committees on the status of the architecture effort. DOD submitted the first report on January 31, 2003. In doing so, the Under Secretary of Defense (Comptroller), who is the chair of the Executive and Steering Committees, approved the semiannual report. |
| 7) The Secretary report every 6 months to the congressional defense authorizing and appropriating committees on progress in developing and implementing a financial management enterprise architecture.  |                          | X       |                 | Senate Report 107-213 directs that the department report every 6 months on the status of the architecture effort. DOD submitted the first report on January 31, 2003.  |
| 8) Until a financial management enterprise architecture is developed and the Council is positioned to serve as DOD's financial management investment review board as recommended above, the Secretary of Defense limit DOD components' financial management investments to <ul style="list-style-type: none"> <li>• deployment of systems that have already been fully tested and involve no additional development or acquisition cost;</li> <li>• stay-in-business maintenance needed to keep existing systems operational;</li> <li>• management controls needed to effectively invest in modernized systems; and</li> <li>• new systems or existing system changes that are congressionally directed or are relatively small, cost effective, and low risk and can be delivered in a relatively short time frame.</li> </ul> |                          |         | X               | DOD has not yet defined and implemented an effective approach for selecting and controlling business systems investments. DOD has stated that the department plans to establish a governance structure that includes investment review boards to help control investment in business systems and help ensure consistency with the architecture.  |
| <b>GAO-03-458: DOD Business Systems Modernization: Improvements to Enterprise Architecture Development and Implementation Efforts Needed.</b> February 28, 2003.   |                          |         |                 |  |
| 1) The Secretary of Defense ensure that the enterprise architecture executive committee members are singularly and collectively made explicitly accountable to the Secretary for the delivery of the enterprise architecture including approval of each version of the architecture.   |                          |         | X               | As discussed in this report, DOD has not assigned responsibility for directing, overseeing, and approving the EA to a committee or group comprised of representatives from across the department.  |

**Appendix III**  
**Status of Prior Recommendations on DOD's**  
**Business Enterprise Architecture**

(Continued From Previous Page)

| Recommendations  | Status of recommendation |         |                 | DOD comments and our assessment  |
|--|--------------------------|---------|-----------------|--|
|  | Implemented              | Partial | Not implemented |  |
| 2) The Secretary of Defense ensure that the enterprise architecture program is supported by a proactive marketing and communication program.   |                          | X       |                 | DOD has a communications and change management plan, but steps have not yet been taken to implement the plan.  |
| 3) The Secretary of Defense ensure that the quality assurance function <ul style="list-style-type: none"> <li>includes the review of adherence to process standards and reliability of reported program performance,</li> <li>is made independent of the program management function, and</li> <li>is not performed by subject matter experts involved in the development of key architecture products.</li> </ul> |                          | X       |                 | DOD's quality assurance function does not yet address process standards and program performance nor is it yet an independent function. However, DOD stated that it intends to make this function independent. Further, DOD subject matter experts continue to be involved in the quality assurance function. |
| 4) The Secretary gain control over ongoing IT investments by establishing a hierarchy of investment review boards, each responsible and accountable for selecting and controlling investments that meet defined threshold criteria, and each composed of the appropriate level of executive representatives, depending on the threshold criteria, from across the department.                                      |                          |         | X               | As discussed in this report, DOD has not yet established investment review boards to control its IT investments. DOD has stated that it is in the process of establishing a review board and defining the roles and responsibilities.  |
| 5) The Secretary gain control over ongoing IT investments by establishing a standard set of criteria to include (1) alignment and consistency with the DOD enterprise architecture and (2) our open recommendations governing limitations in business system investments pending development of the architecture.  |                          |         | X               | As discussed in this report, DOD has not yet established an investment review board nor has it established standard criteria to be used in assessing ongoing IT investments, including alignment and consistency with the BEA.   |
| 6) The Secretary gain control over ongoing IT investments by directing these boards to immediately apply these criteria in completing reviews of all ongoing IT investments, and to not fund investments that do not meet these criteria unless they are otherwise justified by explicit criteria waivers.   |                          |         | X               | As discussed above, the investment review boards and standard criteria have not yet been established. DOD states that it is working with the domain owners to develop a governance structure that identifies critical processes and enterprise requirements to improve control over its IT investments.      |

Source: GAO analysis of DOD data.

# Comments from the Department of Defense



COMPTROLLER

UNDER SECRETARY OF DEFENSE  
1100 DEFENSE PENTAGON  
WASHINGTON DC 20301-1100



AUG 18 2003

Mr. Gregory Kutz  
Director  
Financial Management and Assurance  
United States General Accounting Office  
Washington, DC 20548

Dear Mr. Kutz:

Enclosed is the Department of Defense (DoD) response to the General Accounting Office (GAO) Draft Report, "DoD Business Systems Modernization: Important Progress Made to Develop Business Enterprise Architecture, But Much Work Remains," dated July 21, 2003, (GAO-03-1018). The Department concurs or partially concurs with all 10 of the GAO's recommendations for corrective action.

My point of contact for this matter is Ms. Marilyn Fleming, Chief Architect, Directorate for Business Modernization and Systems Integration. She may be contacted by email: [flemingm@osd.pentagon.mil](mailto:flemingm@osd.pentagon.mil) or by telephone at (703) 607-3367.

Sincerely,

Dov S. Zakheim

Enclosure:  
As stated



Printed on Recycled Paper



**DoD Response to Draft GAO Report:**  
**“DoD Business Systems Modernization: Important Progress Made to Develop Business Enterprise Architecture, But Much Work Remains,” dated July 21, 2003, (GAO-03-1018)**

**1. GAO Recommendation:** The Secretary of Defense implement the core elements in our *EA Framework for Assessing and Improving Enterprise Architecture Management* that we identify in this report as not satisfied, including ensuring that minutes of the executive body charged with directing, overseeing, and approving the architecture are prepared and maintained.

**DoD Response to GAO Recommendation 1:** Concur. The Department of Defense (DoD) is taking steps to meet our near-term goal of achieving Stage 2 compliance with the GAO Enterprise Architecture Framework. A letter has been prepared that designates the Business Management Modernization Program (BMMP) Executive Committee as the body responsible for guiding, directing, and approving the Business Enterprise Architecture (BEA). Minutes of future Executive Committee meetings will be prepared and maintained. In addition, while the Department believes that policy for the DoD BEA already exists, the Information Technology Portfolio Management (ITPM) policy currently being developed will identify the major proponents in the architecture process and further define responsibilities. Also in development are charters for the BEA Architecture Review Board and the Configuration Control Board. For those framework elements related to the “As-Is” architecture that the GAO has noted as not satisfied, the Department intends to address those elements, as deemed necessary, when we extend the architecture within our overall incremental approach.

**2. GAO Recommendation:** The Secretary of Defense update version 1.0 of the architecture to include the 340 Joint Financial Management Improvement Program (JFMIP) requirements that our report identified as omitted or not fully addressed.

**DoD Response to GAO Recommendation 2:** Concur. The Department has updated version 1.0 of the architecture, to address basic errors and omissions. Version 1.1 of the BEA now includes JFMIP requirement controls (such as revenue and other controls) that were identified by GAO as being missing or only partially addressed. Furthermore, Version 1.1 of the BEA includes the new FASAB Standard #23.

**3. GAO Recommendation:** The Secretary of Defense update version 1.0 of the architecture to include the 29 key elements governing the “As Is” architectural content that our report identified as not being fully satisfied.

**DoD Response to GAO Recommendation 3:** Partially concur. Because the current operating environment is dynamic, complete satisfaction of the 29 key elements governing the “As Is” architectural content is not realistically achievable. Such data, if it were possible to obtain, might be obsolete upon arrival. The Department, therefore, does not deem the effort to obtain such data to be cost effective. The DoD currently is analyzing the referenced 29 key elements, and will leverage them effectively, where appropriate, in the further development of the architecture. The Department will collect relevant “As Is” documentation as part of its incremental

development of the BEA. This “As Is” data also will be included in future incremental releases of the architecture.

**4. GAO Recommendation:** The Secretary of Defense update version 1.0 of the business enterprise architecture to include the 30 key elements governing the “To Be” architectural content that our report identified as not being fully satisfied.

**DoD Response to GAO Recommendation 4:** Concur. The Department is developing the BEA on an incremental basis in accordance with the Architecture Development Methodology (ADM). (The Architecture Methodology Report for Global Information Grid/Federal Enterprise Architecture (GIG/FEA) Integration describes the Department’s methodology for alignment of the BEA with FEA reference models.) The DoD currently is analyzing the 30 key elements governing the “To Be” architectural content, and will satisfy fully all or most of these elements by the next significant delivery of the BEA (currently planned for May 2004). The DoD will incorporate pertinent elements of the FEA reference models during the planned extension and evolution of the architecture. Each increment of the BEA will align more fully with the FEA reference models, so that by the time the BEA is complete, it will contain all pertinent elements of the FEA reference models.

**5. GAO Recommendation:** The Secretary of Defense update version 1.0 to ensure that “To Be” architecture artifacts are internally consistent, to include addressing the inconsistencies described in this report, as well as including user instructions or guidance for easier architecture navigation and use.

**DoD Response to GAO Recommendation 5:** Concur. The Department will investigate all deliverables to determine what inconsistencies materially impact the BEA, and DoD will correct those inconsistencies. As future increments of the BEA are released, the Department will ensure that no inconsistencies exist between dependencies, such as between the narrative and the models. The DoD currently provides instruction for navigating the BEA to users, such as System Architect Users Guide, Extensibility Guide, Conversion Guide, Popkin Process Guide, and a Tutorial Guide. This instruction is available on the BEA web portal. During the architecture refinement process, DoD will assess various architectural tool mixes to determine if we could make navigation of the BEA easier.

**6. GAO Recommendation:** The Secretary of Defense update version 1.0 of the architecture to include (1) the 3 key elements governing the transition plan content that our report identified as not being fully satisfied and (2) those system investments that will not become part of the “To Be” architecture, including timeframes for phasing out those systems.

**DoD Response to GAO Recommendation 6:** Concur. Our transition approach focuses on deploying the architecture in increments by reengineering DoD’s current inefficient business processes and installing system solutions that implement leading business practices. We will eliminate from our current inventory of systems those that have redundant capability and those that are not compliant with the BEA. Based on best business practices, this reengineering effort and acquiring and deploying systems will be done incrementally, and based on the size and complexity of DoD, we expect it will take about ten years.

The first increment will begin implementing the architecture and its key business processes and technical standards. Examples of the processes and standards in the first increment include the United States Standard General Ledger, a standard accounting code structure, data standards, data storage and retrieval, and the integration of logistics business processes with the related acquisition and accounting processes.

As the Department moves into the reengineering phase for each Increment, the updated BEA Transition Plan will continue to identify the needed changes to current business processes and systems by Increment. As both the BEA and the Transition Plan mature for each Increment, the analysis will become more specific and refined. As a result, DoD will then identify which business systems will not be part of the “To Be” architecture. At that time, a plan for phasing out those systems will be completed.

**7. GAO Recommendation: The Secretary of Defense update version 1.0 of the architecture to address comments made by the verification and validation contractor.**

**DoD Response to GAO Recommendation 7: Concur.** The Department has reviewed and agrees with the comments provide by MITRE, the referenced Independent Verification and Validation (IV&V) contractor. The BEA Version 1.0 will be updated, in subsequent versions, to address the comments provided by MITRE.

**8. GAO Recommendation: The Secretary of Defense define and implement an effective investment management process to proactively identify, control, and obtain DoD Comptroller review and approval of expenditures for new and ongoing business system investments exceeding \$1 million while the architecture is being developed and after it is completed, and which includes clearly defined domain owners’ roles and responsibilities for selecting and controlling ongoing and planned system investments.**

**DoD Response to GAO Recommendation 8: Concur.** The Department is finalizing the “Information Technology Portfolio Management (ITPM)” policy for managing information technology (IT) investments. The document establishes policies and assigns responsibilities for the management of DoD IT and associated investments. This policy will be supplemented by a DoD Instruction, which will provide detailed guidance and procedures for implementing the ITPM. Implementation of the ITPM policy and procedures will take place in FY 2004.

**9. GAO Recommendation: The Secretary of Defense develop a well-defined near-term plan for extending and evolving the architecture and ensure that this plan includes addressing our recommendations, defining roles and responsibilities of all stakeholders involved in extending and evolving the architecture, explaining dependencies among planned activities, and defining measures of activity progress.**

**DoD Response to GAO Recommendation 9: Concur.** The Department is developing a detailed plan for Increment 1 (business process reengineering). First, DoD is finalizing the Architecture Development Methodology (ADM). The ADM is the near-term plan to extend and

evolve the architecture. It explains the dependencies among the planned activities for architecture evolution. The ADM also discusses the task to define measures of activity progress.

The Department also is developing Domain Plans, which extend the ADM into the Domains. The Domain Plans also define roles and responsibilities of all Domain Owner stakeholders. A framework Domain Plan was delivered in August 2003. We are working on developing a detailed plan of action and milestones for extending the Increment I of the BEA into the Domains. The first version of Domain-specific plans are planned to be completed by the end of the first quarter of FY 2004.

**10. GAO Recommendation: The Secretary of Defense limit the pilot projects to small, low-cost, low-risk prototype investments that are intended to provide knowledge needed to extend and evolve the architecture, and are not to acquire and implement production version system solutions or to deploy an operational system capability.**

**DoD Response to GAO Recommendation 10: Concur.** The Department's pilot initiatives will test and prove the ADM through a limited number of small, low cost, low risk prototype investments. These pilot initiatives also will demonstrate how Increment I of the BEA has achieved improvements in DoD operations.

---

# GAO Contacts and Staff Acknowledgments

---

## GAO Contacts

Jenniffer Wilson, (202) 512-9192  
Cynthia Jackson, (202) 512-5086

---

## Acknowledgments

In addition to the individuals named above, key contributors to this report included Beatrice Alff, Nabajyoti Barkakati, Justin Booth, Francine Delvecchio, Francis Dymond, Jason Kelly, Neelaxi Lakhmani, Anh Le, Evelyn Logue, Mai Nguyen, Darby Smith, Stacey Smith, Alan Steiner, Randolph Tekeley, William Wadsworth, and James Weidner.

---

## GAO's Mission

The General Accounting Office, the audit, evaluation and investigative arm of Congress, exists to support Congress in meeting its constitutional responsibilities and to help improve the performance and accountability of the federal government for the American people. GAO examines the use of public funds; evaluates federal programs and policies; and provides analyses, recommendations, and other assistance to help Congress make informed oversight, policy, and funding decisions. GAO's commitment to good government is reflected in its core values of accountability, integrity, and reliability.

---

## Obtaining Copies of GAO Reports and Testimony

The fastest and easiest way to obtain copies of GAO documents at no cost is through the Internet. GAO's Web site ([www.gao.gov](http://www.gao.gov)) contains abstracts and full-text files of current reports and testimony and an expanding archive of older products. The Web site features a search engine to help you locate documents using key words and phrases. You can print these documents in their entirety, including charts and other graphics.

Each day, GAO issues a list of newly released reports, testimony, and correspondence. GAO posts this list, known as "Today's Reports," on its Web site daily. The list contains links to the full-text document files. To have GAO e-mail this list to you every afternoon, go to [www.gao.gov](http://www.gao.gov) and select "Subscribe to e-mail alerts" under the "Order GAO Products" heading.

---

## Order by Mail or Phone

The first copy of each printed report is free. Additional copies are \$2 each. A check or money order should be made out to the Superintendent of Documents. GAO also accepts VISA and Mastercard. Orders for 100 or more copies mailed to a single address are discounted 25 percent. Orders should be sent to:

U.S. General Accounting Office  
441 G Street NW, Room LM  
Washington, D.C. 20548

To order by Phone:   Voice: (202) 512-6000  
                              TDD: (202) 512-2537  
                              Fax: (202) 512-6061

---

## To Report Fraud, Waste, and Abuse in Federal Programs

Contact:

Web site: [www.gao.gov/fraudnet/fraudnet.htm](http://www.gao.gov/fraudnet/fraudnet.htm)

E-mail: [fraudnet@gao.gov](mailto:fraudnet@gao.gov)

Automated answering system: (800) 424-5454 or (202) 512-7470

---

## Public Affairs

Jeff Nelligan, Managing Director, [NelliganJ@gao.gov](mailto:NelliganJ@gao.gov) (202) 512-4800  
U.S. General Accounting Office, 441 G Street NW, Room 7149  
Washington, D.C. 20548

---

**United States  
General Accounting Office  
Washington, D.C. 20548-0001**

**Official Business  
Penalty for Private Use \$300**

**Address Service Requested**

---

|  |
|--|
| <p><b>Presorted Standard<br/>Postage &amp; Fees Paid<br/>GAO<br/>Permit No. GI00</b></p> |
|--|

