United States General Accounting Office

GAO

Report to Congressional Committees

June 2001

INFORMATION TECHNOLOGY

DLA Should Strengthen Business Systems Modernization Architecture and Investment Activities

GAO-01-631

Contents

Abbreviations

BSM	Business Systems Modernization
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CIO	Chief Information Officer
COTS	commercial, off-the-shelf
DISMS	Defense Integrated Subsistence Management System
DLA	Defense Logistics Agency
DLA 21	*Strategic Plan 2000: DLA 21*
DOD	Department of Defense
DPACS	Defense Pre-award Contracting System
DT	developmental test
ERP	enterprise resource planning
FOC	full operating capability
IOC	initial operating capability
IOT&E	initial operational test and evaluation
IT	information technology
NATO	North Atlantic Treaty Organization
OA	operational assessment
OMB	Office of Management and Budget
REL	release
SAMMS	Standard Automated Materiel Management System
SPEDE	SAMMS Procurement by Electronic Data Exchange
TRR	test readiness review
Y2K	Year 2000

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United States General Accounting Office
Washington, DC 20548

June 29, 2001

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

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

The Defense Logistics Agency (DLA) plays a critical role in supporting America's military forces worldwide. To fulfill this role, DLA employs about 28,000 civilian and military workers, located at about 500 sites in all 50 states and 28 countries; in round numbers, it manages 4 million supply items and processes 30 million annual supply distribution actions. In fiscal year 2000, DLA reported that these operations resulted in sales to the military services of about $13 billion.

This report is one in a series of products to satisfy our mandate under the fiscal year 2001 Defense Authorization Act.[1] The act directed that we review DLA's efficiency and effectiveness in meeting customer requirements, application of best business practices, and opportunities for improving DLA operations. As agreed with your offices, our first review of DLA's information technology (IT) management practices focused on DLA's $900 million Business Systems Modernization (BSM) acquisition. As further agreed with your offices, our objectives were to determine (1) whether DLA is using an enterprise architecture to guide and constrain its investment in BSM and (2) whether DLA is investing in BSM in an incremental manner. Using enterprise architectures—institutional blueprints for business and technological change—and investing incrementally in large modernization programs are legislative and federal

[1] P.L. 106-398, Floyd D. Spence National Defense Authorization Act for Fiscal Year 2001, section 917.

requirements[2] and best industry practices. This review did not address other system modernization best practices, such as whether DLA is employing effective system acquisition process controls, and did not evaluate the specific commercial, off-the-shelf product that DLA chose as its BSM system solution. Details on our objectives, scope, and methodology are in appendix I.

Results in Brief

DLA does not have an enterprise architecture to guide its investment in BSM, even though the law and Office of Management and Budget (OMB) guidance recognize the importance of enterprise architectures and Department of Defense (DOD) policy requires their use. Rather, DLA plans call for creating an architecture as a by-product of BSM's implementation. Moreover, DLA's architecture development plans address only one, albeit the largest, of its six primary business areas—materiel management (also called *supply-chain management*). According to DLA's plans, its architectural products will not be extended to its other business areas until 5 years from now. This nonagencywide approach to developing and implementing an enterprise architecture is not consistent with federal guidance, and it increases the risk that DLA will modernize in a way that optimizes an individual business area but does not optimize agencywide logistics management performance and accountability. Further, DLA does not have effective management structures and processes to support architecture development, as defined in Chief Information Officers (CIO) Council guidance.[3] At the completion of our review, DLA officials stated that they would modify their plans and expeditiously pursue an agencywide architecture development and implementation approach, consistent with federal and DOD policies and guidance.

Equally if not more important, DOD has not developed a DOD-wide logistics management enterprise architecture that would promote interoperability and avoid duplication among the logistics modernization efforts now under way in DOD component organizations, such as DLA and the services. To its credit, the Office of the Deputy Under Secretary of Defense for Logistics and Materiel Readiness (the office responsible for DOD-wide logistics policy and strategy) has begun efforts to correct this

[2] Clinger-Cohen Act of 1996, P.L. 104-106; *Management of Federal Information Resources*, Office of Management and Budget Circular A-130 (November 30, 2000).

[3] *Architecture Alignment and Assessment Guide*, Chief Information Officers Council (October 2000).

architectural void, and it has initiated interim steps intended to coordinate the new logistics management system investments that DLA and the services have under way. However, according to officials in this office, plans for completing this architecture are not sufficiently advanced to be provided to us for evaluation. Moreover, the interim steps that these officials described do not provide the management control rigor and discipline that well-defined and effectively implemented enterprise architectures provide. By allowing the services and DLA (through BSM) to proceed separately with new logistics management systems in the absence of a DOD-wide enterprise architecture, DOD will not be in a position to optimize logistics operations and system performance across the department, and thus is unlikely to successfully meet its strategic logistics management goals. At the conclusion of our review, officials in the Deputy Under Secretary's office acknowledged the need to move swiftly in developing and using a DOD-wide logistics management architecture.

In addition to the enterprise architecture issues affecting BSM, DLA has not been managing its investment in this program in an incremental manner; that is, DLA has not treated the first of its four planned incremental releases of BSM as a separate investment decision, justified on the basis of release-specific analyses of costs, benefits, and risks. Instead, DLA has thus far treated the entire BSM program as a single investment decision, justified by a single, "all or nothing" economic analysis, because doing so, according to BSM officials, was consistent with DOD policy then in place for major system acquisitions.[4] At the completion of our review, DLA officials told us that they now plan to take an incremental investment approach for future releases: that is, they plan to measure the actual accrual of benefits versus costs on each incremental release (including the first) and to use this information to make investment decisions on future increments. This change in BSM investment strategy is important because an "all or nothing" approach to investment decisions is not consistent with statutory requirements and federal guidance for incremental investment management and has led agencies to invest huge sums in systems without a commensurate return.

To strengthen DLA management of BSM, we are making recommendations (consistent with officials' stated commitments) concerning the effective development and use of the DOD-wide and DLA architectural context needed for guiding BSM, and concerning the need for incremental

[4] DOD Instruction 5000.2, *Operation of the Defense Acquisition System*.

investment in BSM based on economic justification and validation of expected return on investment.

In commenting on a draft of this report, DOD agreed with the importance of using enterprise architectures and making BSM investment decisions incrementally. DOD also acknowledged that the absence of these IT management controls increased program risk. Further, DOD agreed with eight of our ten recommendations. However, DOD disagreed with our recommendations to limit investment in BSM beyond the first incremental release and to use actual benefit accrual on the first incremental release in deciding on investment in the next release, noting that this would delay BSM progress. According to DOD, our findings and conclusions regarding the overall level of risk to the successful achievement of BSM and other DOD logistics modernization program objectives are not supported by the single risk factor addressed in this report—the use of enterprise architectures. DOD also contended that all program risks are being effectively mitigated.

Notwithstanding the considerable level of agreement between DOD and us on this report, we have a differing view on the level of risk facing DOD logistics modernization programs in general, and BSM in particular, arising from the two risk factors addressed in this report: (1) the lack of effective enterprise architecture development and implementation and (2) the lack of effective incremental investment management. Our experience reviewing other federal agency modernization programs is that the use of enterprise architectures, employed in concert with other important IT management controls (such as incremental investment management), greatly increases the chances of successful modernization. Accordingly, their absence greatly reduces the chance of success. While we have modified our recommendations slightly and have clarified appropriate sections in the report to address DOD's concerns about delaying BSM progress until these IT management controls are in place, the substance of the recommendations is unchanged.

Background

DLA is DOD's logistics manager for all DOD consumable items[5] and some DOD repair items;[6] its primary business function is providing supply

[5] Consumable items include such commodities as subsistence (food), fuels, medical supplies, clothing, and construction equipment.

[6] These repair items are spare and repair parts that support about 1,400 DOD weapon systems. Each of the military services also manages its own service-unique repair items.

support to sustain military operations and readiness. In addition to this primary function, which DLA refers to as either *materiel management* or *supply-chain management*, DLA performs five other major business functions: distributing materiel ordered from its inventory, purchasing fuels for DOD and the U.S. government, storing strategic materiel,[7] marketing surplus DOD materiel for reuse and disposal, and providing numerous information services, such as item cataloging,[8] for DOD and the U.S. and selected foreign governments.

DLA consists of a central command authority supported by a number of field commands that manage the agency's six business functions. Table 1 shows DLA's field commands, their respective business functions, and examples of the consumable and/or repair items each manages.

[7] Strategic materiel is defined as any item or materials needed to sustain the United States in the event of a national emergency.

[8] DLA defines item cataloging as including all activities that describe the technical characteristics and data for an individual item of supply.

Table 1: DLA Field Command Management Responsibilities

Field command	Business function	Examples of items managed
Defense Supply Centers[a]	Materiel management: Procuring consumable items (except fuels) and some DOD repair parts supporting weapons systems	Food, medical supplies, clothing, construction equipment, spare and repair parts
Defense Distribution Center	Distribution: Receiving, storing, packaging, and shipping consumable items (and some DOD repair parts supporting weapons systems) procured by the Defense Supply Centers	(Same as above)
Defense Energy Support Center	Energy services: Procuring, storing, and shipping fuel and other energy sources for the federal government	Petroleum, jet fuel, coal
Defense National Stockpile Center	Strategic materiel management: Procuring, selling, and storing strategic and critical materiel	Metals, minerals, and ores (e.g., aluminum, chromium, diamonds)
Defense Reutilization and Marketing Services	Materiel reuse: Managing the reuse and disposal of excess DOD materiel	Aircraft parts, automobiles, clothing, typewriters, furniture
Defense Logistics Information Service	Information services: Providing services, such as item cataloging, for DOD, the U.S. government, and international organizations (NATO and allied militaries)	(All of the above)

[a] The three Defense Supply Centers are in Columbus, Philadelphia, and Richmond.

Source: DLA Customer Assistance Handbook, 1998.

To support the current materiel management business function, DLA reports that it relies on a collection of mainframe-based Cobol systems, which are not integrated and are more than 30 years old. These legacy systems support DLA's traditional mission as a manager of physical inventory; that is, they support materiel management functions such as acquisition/ procurement, inventory control, requirements forecasting, requisition processing, technical data maintenance, and financial management. The systems consist of two primary systems—the Standard Automated Materiel Management System (SAMMS) and the Defense Integrated Subsistence Management System (DISMS)—and two subsidiary systems—SPEDE (SAMMS Procurement by Electronic Data Exchange) and DPACS (Defense Pre-award Contracting System). The functions of these systems are summarized in table 2.

Table 2: Materiel Management Functions Performed by Legacy Systems

Materiel management function	SAMMS[a]	DISMS[b]	SPEDE[c]	DPACS[d]
Acquisition/procurement	x	x	x	x
Inventory control	x	x	x	
Requirements forecasting	x	x		
Requisition processing	x	x	x	x
Technical data maintenance	x	x		
Financial management	x	x	x	x

[a] Primary system supporting inventory management; provides information regarding stock levels, acquisition and management of wholesale consumable items, direct support for processing requisitions, generation of purchase requests, identification of items, asset visibility, and maintenance of an audit trail of transactions processed.

[b] Primary system supporting the worldwide wholesale food business in support of troop feeding and commissary resale; in supporting these commodities, performs the same functions as SAMMS.

[c] Subsystem giving DLA Supply Centers the capability to interface with vendors electronically; allows electronic transfer of requests for quotation, vendor responses, invoices, and purchase orders.

[d] Subsystem performing precontracting functions; provides purchase request management data that buyers need to complete a solicitation and award package, including item descriptions, applicable specifications/drawings, synopsis information, histories of past procurements, and other purchase requests and/or contracts open for the same National Stock Number.

Source: DLA Y2K Program Software Development Plan.

DLA reports that these legacy systems are the product of decades of accumulated and divergent business practices and use obsolete technology that is no longer supported by the original equipment manufacturers and the software support provider. Further, DLA maintains that these systems, consisting of several million lines of unstructured and expensive-to-maintain code, provide inadequate analytical capability and no real-time data access.

DOD Has Issued Strategic Plans for Modernizing Logistics Management

DOD's logistics management strategy is set forth in two strategic planning documents: *Joint Vision 2020*[9] and *21st Century Logistics: DOD Logistics Strategic Plan.*[10] *Joint Vision 2020* is DOD's primary strategic plan, covering all missions and business areas. This plan introduced what DOD calls *focused logistics*, described as the ability to provide the joint

[9] *Joint Vision 2020*, published in June 2000, was preceded by *Joint Vision 2010*, published in 1996. It was issued by the Chairman, Joint Chiefs of Staff.

[10] *21st Century Logistics*, published in August 1999, defines more specifically the strategic vision and objectives for logistics management. It was issued by the Deputy Under Secretary of Defense for Logistics and Materiel Readiness.

force[11] the right assets (personnel, equipment, and supplies) in the right place, at the right time, and in the right quantity. To achieve this goal, DOD envisions a real-time, Web-based[12] information system providing both logisticians and field commanders with total asset visibility within a given theater of operations. Additionally, this system is to include decision support tools to improve requirements analysis and planning, as well as provide real-time control of the logistics supply chain, regardless of whether the requirements are to be fulfilled by the commercial sector or within DOD.

21st Century Logistics calls for the military services and DLA to pursue system modernization efforts to bring about the focused logistics goals described in *Joint Vision 2020*. The systems are to be an integrated collection of applications sharing a common data environment, which are to be deployed to all forces by fiscal year 2006.

To fulfill *Joint Vision 2020*, the Deputy Secretary of Defense issued a memorandum in March 2000 to the military services and DLA requiring submission of logistics transformation plans, documenting, on an annual basis, planned actions and related resources for implementing focused logistics, as well as any other logistics initiatives. The military services and DLA were directed to satisfy the *21st Century Logistics* objectives by fiscal year 2006, including developing logistics process and system modernization plans by the end of fiscal year 2001 and implementing these plans by fiscal year 2006. DLA was directed to submit its transformation plan to the Under Secretary of Defense for Acquisition, Technology, and Logistics by July 1, 2000.

[11] *Joint force* is a general term applied to a force composed of significant elements, assigned or attached, of two or more military departments, operating under a single joint force commander.

[12] According to DLA, *real-time*, *Web-based* means immediate computer responsiveness through the Internet or an intranet.

DLA Has Developed a Strategic Plan and Logistics Transformation Plan

To fulfill its direction under DOD's *21st Century Logistics* plan, DLA has outlined strategic goals and objectives in its *Strategic Plan 2000: DLA 21*[13] and *Logistics Transformation Plan*.[14] Under Goal 2 of DLA 21, DLA plans to reduce costs, improve efficiency, and increase effectiveness through organizational redesign, business systems modernization, strategic sourcing, infrastructure consolidation, and optimally sized inventories.

To achieve this goal, DLA is first focusing on transforming its materiel management (supply-chain management) function, because according to the DLA Director, this is DLA's most critical business function. More specifically, it plans to implement a Web/network-based logistics system using commercial, off-the-shelf (COTS) products.

To select the most appropriate COTS products, DLA evaluated potential solutions against business processes for certain of its commodities (including clothing, aircraft parts, and medical supplies). According to DLA, it chose important, widely differing commodities so that its analysis would be sufficiently comprehensive to be extrapolated to the rest of the commodities within the materiel management business function. Further, DLA chose to evaluate solutions against business processes that had been previously reengineered, so that the system solution chosen would be based on modernized business processes. Through this analysis, which used scripted demonstrations of the reengineered requirements, DLA sought to ensure that the chosen applications could effectively meet DLA's materiel management/supply-chain management requirements.

The resulting COTS-based system is to be used to reengineer the agency's materiel management business processes. DLA refers to its acquisition and implementation of this COTS-based system, and the associated business process reengineering, as Business Systems Modernization (BSM).

DLA Has Begun Implementing its Business Systems Modernization Program

DLA's BSM program is intended to modernize DLA's materiel management business function, changing DLA from solely a provider and manager of physical inventory to primarily a manager of supply chains. In this role, DLA would link customers with appropriate suppliers and track physical and financial assets. DLA expects this approach to enhance supply-chain

[13] DLA refers to this plan, published in September 1999, as *DLA 21*.

[14] DLA's *Logistics Transformation Plan* was approved by the Under Secretary of Defense for Acquisition, Technology, and Logistics on July 11, 2000.

visibility and capabilities, resulting in reduced logistics cycle times, increased customer satisfaction, reduced customer wait time, and decreased materiel costs. In short, DLA's goal is "to do business as business does business."

According to BSM program documents, DLA's transformation from its current to its future role requires modernization of the IT systems that now support DLA's materiel management business function, subfunctions, and processes. The BSM system solution is envisioned as consisting of Web- and COTS-based applications supported by an enterprise application tool.[15] Through the use of COTS products, DLA expects to reduce materiel management systems operating costs and take advantage of the continuous technology insertion and continuous functional improvement that COTS packages allow. The BSM COTS will consist of enterprise resource planning (ERP)[16] software.

DLA plans to acquire and deploy its BSM COTS system solution through a series of four system releases/increments. First, it plans to demonstrate successful application of its new concept of doing business to selected commodities, namely, earth-moving equipment, medical/pharmaceutical supplies, and F/A-18 engine components. These commodities were chosen for the first release because each is an important responsibility of one of the three Defense Supply Centers. Thus, the first release will be deployed to all three Defense Supply Centers at once. Once this first release is successfully demonstrated, DLA plans to expand the system solution to other commodities and to other users within the materiel management business function.

According to DLA's fiscal year 2001 budget submission, DLA will invest approximately $897 million to acquire and implement BSM from fiscal years 2000 through 2007 (see table 3). Thus far, DLA has obligated about $150 million for BSM. From this total, about $56 million was obligated in

[15] According to DOD, this enterprise application tool is an integration tool that effects application-to-application interfacing, supports new "business-to-business" relationships, and mitigates the risk of introducing new business functions into the BSM architecture.

[16] ERP software packages provide a suite of software applications and modules, usually employing a common relational database, that provide functionality for managing a range of tasks, such as planning, purchasing, maintaining inventories, interacting with suppliers, providing customer service, and tracking orders. These packages are intended to provide a generic set of enterprise management applications that can be used to reengineer business operations.

fiscal year 2000 to prepare and validate functional requirements, conduct pre-award contract functions for selection of the systems integration contractor, perform initial work on the program by awarding the integration contract, and begin detailed business process reengineering planning for the first increment of the program.

Table 3: BSM Investment According to Fiscal Year 2001 Budget Submission

Fiscal year	Dollars[a] (in millions)	Cumulative percentage of total
2000	$56	6
2001	93	17
2002	104	28
2003	151	45
2004	176	65
2005	116	78
2006	101	89
2007	100	100
Total	**$897**	

[a] Costs include $183 million for maintenance.

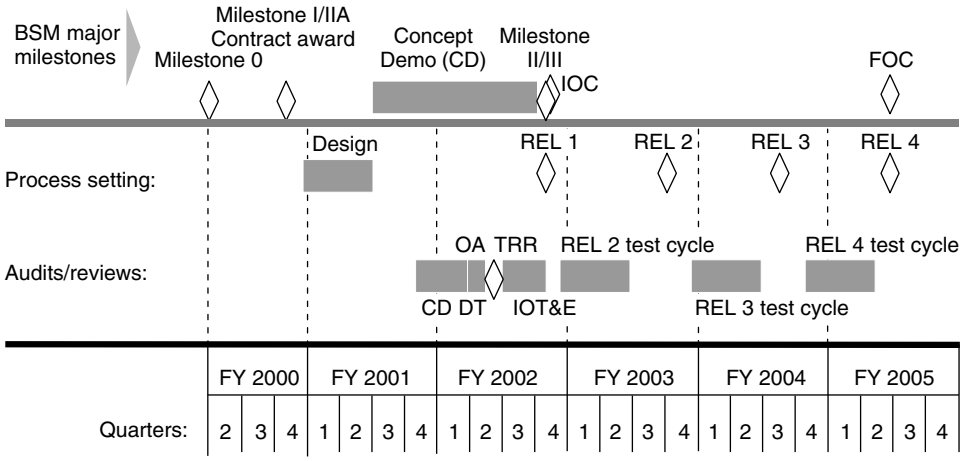
Source: DLA budget for fiscal year 2001.

The remaining approximately $93 million was obligated in fiscal year 2001 for the development of a materiel management enterprise architecture (referred to by DLA as the BSM Business Architecture Blueprint) and for the initial implementation, including testing, of the BSM concept demonstration. Of the unobligated portion of the BSM budget, about $549 million is to fund implementation and sustainment of the COTS solution (system releases 1 through 4) within the materiel management business area, including its extension to the commodities not covered by the concept demonstration. DLA officials told us that the remaining unobligated funds for fiscal years 2006 and 2007, about $201 million, are to be used for extending the BSM ERP software to the distribution and cataloging business areas.

Only about 1 percent of the BSM budget is for new network and computing platform infrastructure (hardware and systems software). This is because DLA's current and future investments in IT infrastructure, which will support ongoing DLA operations as well as the BSM program, are funded separately. The infrastructure investments in fiscal year 2001 amount to about 45 percent of DLA's approximately $680 million IT budget.

BSM is expected to take 6 years to acquire and implement for materiel management (fiscal years 2000 through 2005). DLA has structured the BSM life cycle to comply with DOD 5000.2[17] milestone phases for major systems acquisitions. Figure 1 summarizes the BSM development timeline.

Figure 1: BSM Timeline



Legend

IOC: initial operating capability
FOC: full operating capability
REL: release
OA: operational assessment
TRR: test readiness review
DT: developmental test
IOT&E: initial operational test and evaluation

Source: BSM program documents.

The first milestone phase (phase 0, December 1999 through July 2000) of the BSM program focused on evaluation of alternative concepts and potential system integrators.

The second and current milestone phase (phase I/IIA[18]) covers program definition (design), risk reduction, and concept demonstration. The current phase includes implementation and testing/evaluation of the system solution for certain commodities, as well as such implementation

[17] DOD Instruction 5000.2, *Operation of the Defense Acquisition System*.

[18] BSM is following a modified acquisition process, as allowed by DOD Instruction 5000.2. The traditional acquisition process consists of four discrete phases: 0 (concept exploration), I (program definition and risk reduction), II (engineering and manufacturing development), and III (production, fielding/deployment, and operational support).

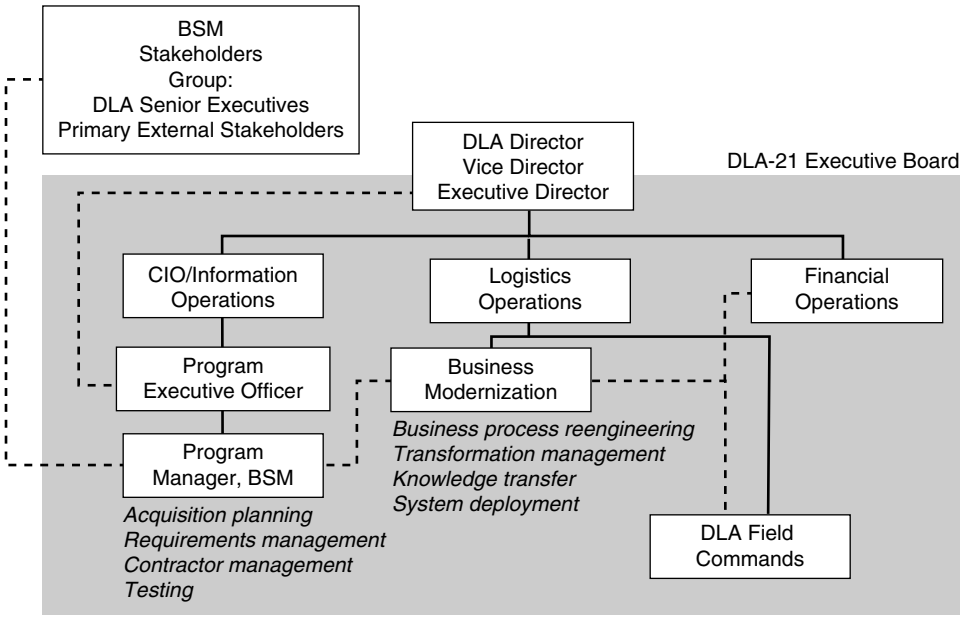
activities as training and site preparation. This phase is scheduled to run from September 2000 through September 2002.

The third phase (phase II/III) is referred to as initial fielding/deployment and operational support. This phase focuses on implementing the system beyond the scope of the concept demonstration, operating and maintaining the system, and modifying and upgrading the system as required. This phase is scheduled to run from October 2002 through March 2005.

Investment decisionmaking for BSM (and other DLA major modernization programs) is vested in the DLA 21 Executive Board, chaired by the Chief Acquisition Executive of DLA, who is the Vice Director. BSM life-cycle management is the responsibility of the BSM Program Manager, who runs the BSM program office and reports to the DLA Program Executive Officer,[19] who oversees the program in coordination with the DLA Chief Information Officer (CIO). Figure 2 shows this BSM program management and oversight structure.

[19] Under DOD 5000 regulations, Program Executive Officers are to oversee major systems acquisitions.

Figure 2: BSM Within DLA's Organization and Oversight Structure



Organizations within grey box are represented on the DLA-21 Executive Board.
Dotted lines represent communication and coordination.

Source: BSM program documents.

BSM Is Not Being Guided by Either a DLA Architecture or a DOD-wide Logistics Architecture

Using enterprise architectures to guide and constrain information technology investments is called for by law, OMB, and DOD, and is an industry best practice. An enterprise architecture is a blueprint for guiding and constraining business and technological change for the enterprise, which can be an organization (e.g., DLA or the services) or a functional or mission area spanning more than one organization (e.g., logistics management or financial management). In some cases, both organizational and functional/mission area architectures are appropriate, because organizations interrelate closely, sharing functional and mission area responsibilities. This is the case for DOD and its component organizations.

DLA is managing its BSM program without having either a DLA enterprise architecture or a DOD-wide logistics management enterprise architecture. In doing so, DLA risks investing in significant business process and system change that does not optimally support enterprise (DLA and DOD) requirements (operational, system, and technical). To their credit, officials from both DLA and the Office of the Deputy Under Secretary for Logistics

and Materiel Readiness recognize the need to take an enterprise approach to transforming logistics management, and at the conclusion of our work, they committed to doing so.

Enterprise Architectures: A Cornerstone of Successful Modernization Programs

Enterprise architectures are essential tools for effectively and efficiently reengineering business processes and for implementing and evolving their supporting systems. Enterprise architectures systematically capture—in useful models, diagrams, and narrative—the full breadth and depth of the mission-based mode of operation for a given enterprise, which can be (1) a single organization or (2) a functional or mission area that transcends more than one organizational boundary (e.g., financial management, acquisition management, logistics management). An architecture describes the enterprise's operations in both (1) logical terms, such as interrelated business processes, information needs and flows, work locations, and system applications, and (2) technical terms, such as hardware, software, data, communications, and security attributes and performance standards. It provides these perspectives both for the enterprise's current or "as is" environment and for its target or "to be" environment, as well as an IT capital investment road map for moving between the two environments.

The development, implementation, and maintenance of enterprise architectures are recognized hallmarks of successful public and private sector organizations. Managed properly, an enterprise architecture can clarify and help optimize the interdependencies and interrelationships among an organization's business operations and the underlying IT infrastructure and applications that support these operations. Employed in concert with other important IT management controls, such as portfolio investment management (selection, control, and evaluation) practices[20] and continuous information security management practices,[21] enterprise architectures can greatly increase the chances that modernization programs will succeed. Our experience with federal agencies has shown that attempting to define and build major IT systems without first completing an enterprise architecture often results in IT systems that are duplicative, are not well integrated, are unnecessarily costly to maintain and interface, and do not effectively optimize mission performance.

[20] *Information Technology Investment Management: A Framework for Assessing and Improving Process Maturity* (Exposure Draft) (GAO/AIMD-10.1.23, May 2000).

[21] *Executive Guide: Information Security Management* (GAO/AIMD-98-68, May 1998).

Congress, OMB, and the federal CIO Council have recognized the importance of enterprise architectures. The Clinger-Cohen Act, for example, requires that agency CIOs develop, maintain, and facilitate the implementation of enterprise architectures as a means of integrating business processes and agency goals with IT. Further, OMB has issued guidance on the development and implementation of agency IT architectures. Among other things, OMB guidance directs that agency investments in information systems be based on these architectures.[22] Similarly, the CIO Council has issued guidance providing (1) a federal framework for the content and structure of an enterprise architecture,[23] (2) a process for assessing investment compliance with an enterprise architecture,[24] and (3) a set of management controls for developing, implementing, and maintaining an enterprise architecture.[25]

According to CIO Council guidance, it is critically important that an enterprise architecture be derived through a "top-down" incremental approach, consistent with the hierarchical architectural views that are the building blocks of published architecture frameworks, including DOD's. It is equally important, according to this guidance, that the higher level views span the entire enterprise. Only through such an approach can an organization develop enterprisewide understanding of the interrelationships and interdependencies among business operations and supporting technology. Such understanding is vital for informed decisionmaking about whether the enterprise, and thus the enterprise architecture, can be divided into segments without sacrificing the goal of optimizing enterprisewide performance and accountability.

DOD has also issued enterprise architecture policy, including a framework defining an architecture's content and structure. Specifically, in February

[22] *Funding Information Technology Systems Investments*, OMB Memorandum M-97-02 (October 25, 1996); *Information Technology Architectures*, OMB Memorandum M-97-16 (June 18, 1997).

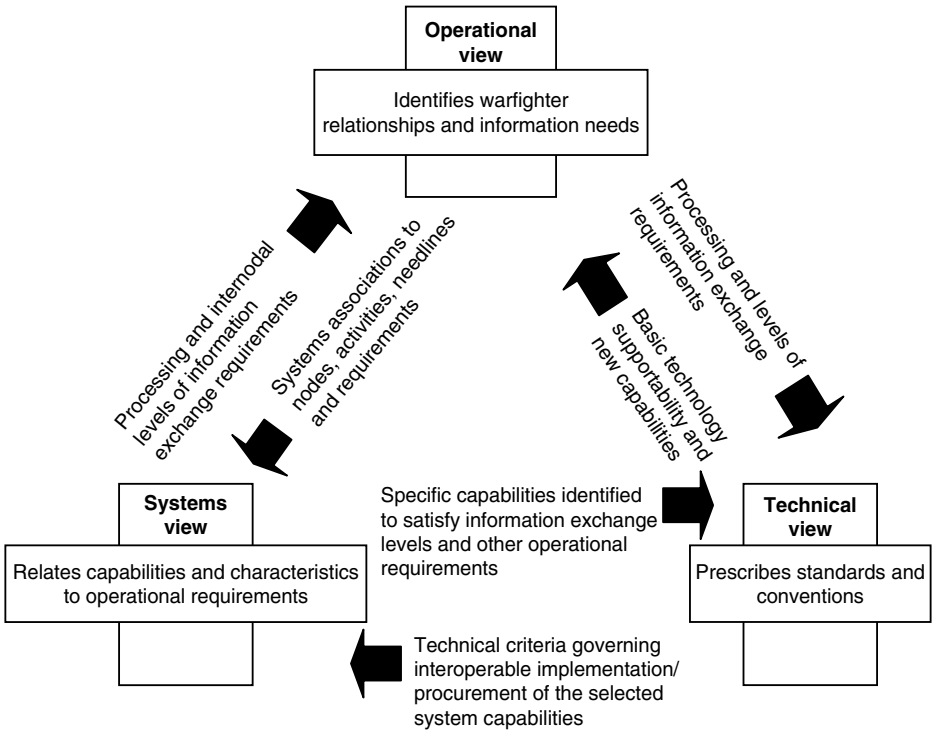
[23] *Federal Architecture Framework*, *Version 1.1*, Chief Information Officers Council (September 1999).

[24] *Architecture Alignment and Assessment Guide*, Chief Information Officers Council (October 2000).

[25] *A Practical Guide to Federal Enterprise Architecture*, *Version 1.0*, Chief Information Officers Council (February 2001).

1998,[26] DOD directed its components and activities to use the C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) Architecture Framework, Version 2.0. According to DOD, this framework is a critical tool in achieving its strategic direction, and all DOD components and activities should use the framework for all functional areas and domains within the department. This framework is also recognized in the CIO Council published guide as a model architecture framework. Figure 3 shows the views required by the C4ISR framework and their relationships.

Figure 3: C4ISR Architecture Framework: Views and Description



Source: C4ISR Architecture Framework, Version 2.

[26] The February 28, 1998, memorandum was jointly signed by the Under Secretary of Defense for Acquisition and Technology, the Acting Assistant Secretary of Defense for Command, Control, Communications, and Intelligence, and the Director for C4 Systems, Joint Chiefs of Staff.

Briefly, the C4ISR Architecture Framework decomposes an enterprise architecture into three primary views (windows into how the enterprise operates): the operational, systems, and technical views. According to DOD, these three interdependent views are needed to ensure that IT systems are developed and implemented in an interoperable and cost-effective manner. Each of these views is summarized below.

- The *operational architecture view* defines the operational elements, activities, tasks, and information flows required to accomplish or support an organizational mission or business function. According to DOD, it is useful for facilitating a number of actions and assessments across DOD, such as examining business processes for reengineering or defining operational requirements to be supported by physical resources and systems.
- The *systems architecture view* defines the systems and their interconnections supporting the organizational or functional mission, including how multiple systems link and interoperate, and may describe the internal construction and operations of particular systems. According to DOD, this view has many uses, such as helping managers to evaluate interoperability improvement and to make investment decisions concerning cost-effective ways to satisfy operational requirements.
- The *technical architecture view* defines a minimum set of standards and rules governing the arrangement, interaction, and interdependence of system applications and infrastructure. It provides the technical standards, criteria, and reference models upon which engineering specifications are based, common building blocks are established, and applications are developed.

Within the three architectural views, the C4ISR Architecture Framework identifies 26 graphical, textual, and tabular architectural artifacts or products. Of the 26 products, DOD specifies that 7 are essential and must be developed for each enterprise architecture. Table 4 briefly describes the content of each essential product.

Table 4: Seven Essential Products for the DOD C4ISR Architecture Framework

Essential product	Description
Overview and summary information	Serves as planning guide and summarizes "who, what, when, why, and how" for architecture to be developed
Integrated dictionary	Provides a central source for definitions of all terms used in all architecture products
High-level operational concept graphic	Shows a high-level graphic description of operational concept, including organizations, missions, and geographic distribution of assets
Operational node connectivity description	Identifies organizational elements that produce, process, and consume information; need to exchange information between elements; and characteristics of information exchanged (content, media, volume requirements, security classification, timeliness, and interoperability requirements)
Operational information exchange matrix	Provides information exchange requirements, identifying who exchanges what information with whom, why information is necessary, and how it is needed
System interface description	Links operational and systems architecture views by depicting information systems and their interfaces to organizational elements that produce, process, and consume information
Technical architecture profile	Establishes a set of rules governing system implementation and operation; normally, references existing technical guidance and discusses how that guidance has been or needs to be implemented

Source: C4ISR Architecture Framework, Version 2.

DLA's Approach to Developing an Architecture Is Not Enterprise Focused

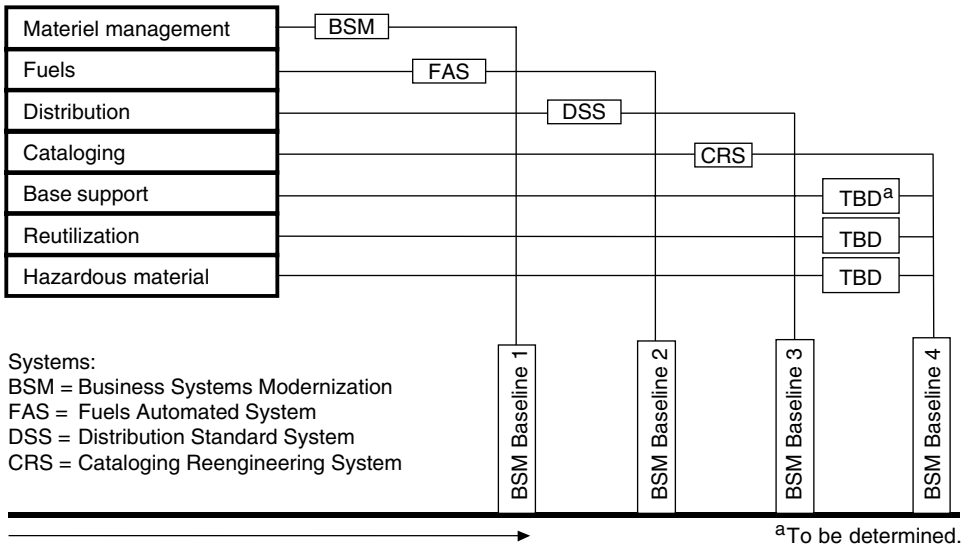
BSM officials, including the BSM program manager and chief architect, have acknowledged that DLA does not have an enterprise architecture. However, these officials also maintain that BSM still has had enterprisewide architectural direction, because although the program did not have C4ISR-compliant architectural artifacts, the strategic direction of the agency (as defined in strategic plans) was the primary focus of BSM.[27] Nevertheless, these officials also stated that they planned to develop a C4ISR-compliant DLA enterprise architecture.

Subsequently, the BSM program office prepared a draft enterprise architecture development plan that focused first on developing a materiel management architecture, which DLA calls the BSM Business Architecture Blueprint, as a by-product of acquiring and implementing its BSM COTS solution. According to the draft plan, once BSM is completed (scheduled for fiscal year 2005), DLA will add other business functions to the BSM

[27] *Strategic Plan 2000: DLA 21* (September 1999); *Logistics Transformation Plan* (June 28, 2000).

Business Architecture Blueprint so that the end result is an enterprisewide architecture (see fig. 4).[28]

Figure 4: DLA's Approach to Creating an Enterprise Architecture



Note: Base support, although not included by DLA among its major business functions, is included in this diagram because it is supported by a legacy system that would have to be modernized.

Source: *Enterprise Information Architecture Plan* (draft, 28 July 2000), DLA.

DLA's approach to developing and implementing a C4ISR-based, agencywide enterprise architecture is thus one of compliance after the fact (that is, after acquiring and implementing its system solution), rather than development before the fact (and application during the fact). DLA plans to fill out the essential products of the C4ISR framework as by-products of implementing its COTS solution, rather than developing these products beforehand, so that they could be used as the basis for guiding and constraining its acquisition and implementation of system solutions.

[28] DLA's plan shows each of the business functions being incorporated separately into the enterprise architecture; however, for materiel management operations that are to be fulfilled through commercial supply chains, some aspects of other functions (such as distribution) will be included in the BSM Business Architecture Blueprint.

Although DLA has not yet formally developed the seven essential products in the C4ISR format, BSM program officials point out that some of the information needed for these products is available, and DLA is relying on that information in its direction of BSM. For example, BSM officials acknowledged as enterprise requirements the following: technology infrastructure standards, a transition strategy, technical reference models, standards profiles, and information assurance policies at the enterprise level. In our view, such information would be valuable and useful in building a DLA enterprise architecture.

However, DLA nevertheless does not have a complete enterprise architecture as defined by DOD's C4ISR framework, and its plans for developing one are not consistent with a fundamental best practice in CIO Council guidance. That is, DLA's approach is focused on only part of its enterprise (albeit the largest), whereas CIO Council guidance promotes a process to ensure development of an enterprisewide perspective. According to this guidance, the scope of the architecture for the operational view needs to encompass the entire enterprise. Only then can the agency understand the relationships and dependencies among its business areas and position itself to make informed decisions about the level of depth and detail to include in the architecture. Necessarily, this level of depth and detail will be tailored to each enterprise based on its size and complexity, as well as the purpose of the architecture and the riskiness of the modernization effort to be undertaken.

Although DLA's approach does not preclude success, it does introduce a risk of misalignment between the COTS solution and the enterprise's strategic operational vision. To manage this risk, the enterprise would have to fully evaluate the COTS solution against the business requirements for the whole enterprise, not just a portion of it. Such an enterprisewide perspective is what *Strategic Plan 2000: DLA 21* and the *Logistics Transformation Plan* envision. (For instance, DLA 21 refers to logistics solutions that are integrated from two standpoints: throughout the supply chain and throughout the agency.) An approach that lacks an enterprisewide perspective does not adequately ensure that the COTS system solution being acquired and implemented will optimally support all logistics business functions.

Despite the existence of some enterprisewide architectural information, DLA's plan for building an architecture for its future operational, systems, and technical environment does not have an enterprisewide perspective. Instead, DLA is defining and implementing its architecture by first focusing on one of its six business functions (materiel management)

separately from the others. For DLA, this is particularly problematic because DLA's six business functions are interrelated and interdependent. For example:

- Materiel management and cataloging are related, because how an item is procured is determined in part by how an item is classified during the cataloging process.
- Materiel management and distribution are related, because decisions about whether DLA will distribute the materiel (or the vendor will deliver directly to the requisitioner) are made at the same time the materiel is bought.
- Distribution and cataloging are related, because how materiel is stored and transported is determined by how it is classified during cataloging (e.g., hazardous materiel has special storage and transportation needs).

DLA adopted its approach to developing and implementing an enterprise architecture because the agency believed that using materiel management—its largest business process—as a starting point would lead to a solution with a baseline functionality that could be augmented as DLA evolves. Further, DLA expected that addressing materiel management would lead to the inclusion of some aspects of its other business functions, such as distribution and cataloging, for that part of materiel management operations to be performed via private sector supply chains.

However, DLA also recognized that postponing consideration of some business functions might lead to disconnects later in the development. According to DLA, if the later DLA business functions could not be incorporated into the BSM Business Architecture Blueprint without major redesign, then DLA would construct linkages between BSM and the other business areas to produce an enterprisewide architecture. This approach introduces the risk that DLA will sacrifice optimizing enterprisewide performance and accountability in order to optimize the performance and accountability of its individual components—the risk that well developed and implemented enterprise architectures are intended to prevent.

At the conclusion of our review, DLA officials stated that they intend to expand the scope of their enterprise architecture program to provide for an agencywide, C4ISR-compliant architecture.

DLA Does Not Have Effective Management Structures and Processes for Developing and Implementing an Enterprise Architecture

CIO Council guidance defines a set of recognized key practices (management structures and processes) for developing and implementing an enterprise architecture that are hallmarks of successful public and private sector organizations. Among other things, these practices include the following:

- Because the enterprise architecture is a corporate asset for systematically managing institutional change, the head of the enterprise should support and sponsor the architecture, giving it a clear mandate in the form of an enterprise policy statement. Such support is crucial to gaining the commitment of all organizational components of the enterprise, all of whom should participate in developing and implementing the enterprise architecture.
- The enterprise architecture effort should be directed and overseen by an executive body, empowered by the head of the enterprise, with members who represent all stakeholder organizations and have the authority to commit resources and to make and enforce decisions for their respective organizations.
- The enterprise architecture effort should be led by a Chief Architect who reports to the enterprise CIO, and it should be managed as a formal program. A formal program entails creating a program office, committing core staff, implementing a program management plan that details work breakdown structure and schedules, allocating resources and tools, performing basic program management functions (e.g., risk management, change control, quality assurance, configuration management), and tracking and reporting progress against measurable goals.
- The enterprise architecture should conform to a specified framework.

DLA is following some of these recognized key practices: it plans to follow the DOD C4ISR Architecture Framework, and a BSM Chief Architect has been designated. However, DLA is not following most key practices. It is not, for example,

- approaching the architecture as a corporate endeavor, with explicit support and sponsorship from the DLA Director in the form of an agency policy statement;
- using an executive body consisting of stakeholders from across DLA to direct and oversee the architecture effort; or
- managing the architecture effort as a formal program.

Additionally, while an architecture development plan was drafted following our inquiries, neither the DLA CIO nor any DLA executive body has taken any action to approve the draft plan (dated July 2000), and

thereby demonstrate their commitment and accountability for the architecture.

Moreover, the Chief Architect is assigned to the BSM program rather than to an organization with authority and responsibility for DLA-wide logistics modernization, and the draft architecture development plan focuses solely on materiel management, only providing a notional sequence for possibly incorporating DLA's five other business functions at some time after 2005. Further, no work breakdown structures and schedules are provided for adding these other business functions, no estimates of resources are provided for implementing the plan, no measures are provided for managing progress in developing the architecture, and no enterprise stakeholders outside the BSM program participated in drafting the plan.

At the conclusion of our review, DLA officials stated that they will expand the architecture program to provide an agencywide focus, assign responsibility and accountability for the program accordingly, and formalize their approach to its management.

DOD Does Not Have a Departmental Logistics Management Enterprise Architecture

Beyond the need for a DLA organization-based enterprise architecture, DLA needs a DOD-wide logistics enterprise architecture, which would also serve DOD's other component organizations that have interrelated and interdependent logistics management missions. However, DOD does not yet have such an architecture, although it has begun efforts to develop one.

Despite the lack of a DOD-wide logistics architecture, in March 2000, the former Deputy Secretary of Defense directed DLA and the military services to develop plans for modernizing their respective logistics processes and systems by July 2001 and to implement their respective plans by September 2006. No DOD-wide architectural blueprint to promote operational and system commonality and integration accompanied this direction.

According to the Director of Logistics Systems Modernization within the Office of the Deputy Under Secretary of Defense for Logistics and Materiel Readiness (the DOD organization responsible for overseeing the implementation of systems modernization efforts in *21st Century Logistics*), DOD needs a departmental logistics management enterprise architecture to achieve its logistics management vision and optimize DOD-wide logistics management performance and accountability. Without such an architecture, the Director stated that the services' and DLA's

investments in new logistics management systems would result in operations and systems that, although modernized, would continue to be "stovepiped," rather than optimized and integrated across DOD. Accordingly and as an outgrowth of Year 2000 testing, efforts were started to develop a DOD-wide logistics enterprise architecture concurrently with DOD components' efforts to modernize their respective operations and systems. According to the Director, modernization of component operations and systems is the single most important factor in being able to effectively and efficiently optimize and integrate operations and systems across DOD. The Director's position is that components' modernization efforts and DOD-wide logistics architecture efforts should proceed in parallel.

To date, according to the Director,

- a plan has been drafted for creating a departmental logistics management enterprise architecture;
- a description of the department's current or "as is" logistics management enterprise architecture is being developed; and
- descriptions of both near-term and long-term future ("to be") logistics management enterprise architectures are being developed.

However, the Director would not provide us a copy of the enterprise architecture development plan, noting that it has yet to be approved and that a milestone for completing the enterprise architecture was not available. He also would not provide us copies of any "as is" architectural products, acknowledging that these products were based on data obtained under DOD's Year 2000 Conversion Program and thus needed to be modified in light of the ongoing modernization activities in the military service and DLA. He added that the near-term and long-term "to be" architecture efforts are being managed by two different organizations within the Office of the Deputy Under Secretary for Logistics and Materiel Readiness, and that these architectures are to be based on yet-to-be-developed business rules and operational and technical agreements among the services and DLA. The Director specifically cited efforts under way to develop an architecture for DOD-wide management of conventional ammunition, DOD's most critical commodity for the warfighter, as the prototype effort for developing a logistics management architecture and policies for architecture-based portfolio investment management.

The Director also told us that the Office of the Deputy Under Secretary of Defense for Logistics and Materiel Readiness would control these investments using traditional means, such as exercising oversight of the

acquisition and budget processes. This oversight role will be augmented, according to the Director, by a DOD enterprise integration consortium, established in December 2000, made up of component organizations that are pursuing logistics enterprise resource planning system solutions, and led by the Director. The purpose of this consortium is to update plans for community services and DOD-wide logistics rules, develop enterprisewide interfaces between logistics and other functional areas, and develop mechanisms for sharing development plans and technical artifacts among programs and for sharing lessons learned.

These controls, however, are not sufficient substitutes for having a well-defined enterprise architecture. As discussed earlier, an enterprise architecture defines the business and technical rules, standards, and protocols that govern how the entire enterprise will operate in the future, and provides a common road map for getting to this future operational state. It thus serves as the explicit, documented change management tool that the Office of the Deputy Under Secretary for Logistics and Materiel Readiness needs to effectively discharge the very acquisition and budget oversight role that the Director cited. Without an enterprise architecture to guide and constrain the components' modernization efforts, there is not adequate assurance of common understanding of the nature and content of the change.

At the conclusion of our review, an official in the Deputy Under Secretary's office acknowledged that DOD needs to move swiftly to develop and use a DOD-wide logistics management architecture.

DLA Has Not Invested Incrementally in BSM

Incremental investment management involves three fundamental components: (1) developing/acquiring a large system in a series of smaller projects or system increments; (2) individually justifying investment in each separate increment on the basis of costs, benefits, and risks; and (3) monitoring actual benefits achieved and costs incurred on ongoing increments and modifying subsequent increments/investments to reflect lessons learned.[29] Using this approach prevents agencies from discovering too late that their systems are not cost beneficial and allows them to reduce the enormous risks associated with large, expensive projects. Such an approach does not preclude overlap and smooth transition among

[29] *Customs Service Modernization: Serious Management and Technical Weaknesses Must Be Corrected* (GAO/AIMD-99-41, February 26, 1999).

increments, because lessons learned from the actual results of ongoing increments should be monitored and evaluated continuously so that these results are available for use in defining and justifying future increments.

DLA has not yet followed an incremental approach to investment in BSM. To date, DLA has treated the entire BSM program as one investment decision, justified by a single economic analysis, because this approach was consistent with DOD policy for major system acquisitions[30] that were in effect until January 2001. DLA invested in its preliminary work (the analysis of candidate COTS systems against previously reengineered business processes) and in the initial release of BSM on the basis of this economic analysis. As a result, DLA did not justify and decide on investing about $150 million thus far in BSM on the basis of release-specific analyses of costs, benefits, and risks.

This kind of approach to making investment decisions has historically resulted in agencies investing huge sums of money in systems that do not provide commensurate benefits, and thus has been abandoned by successful organizations. The need to avoid this pitfall was a major impetus for the Clinger-Cohen Act investment management reforms.

At the conclusion of our review, DLA officials told us that in future, they plan to make investment decisions on BSM incrementally.

Incremental Investment Management Spreads the Risk of Large Programs Across Smaller, Incremental Parts

The Clinger-Cohen Act of 1996 requires agencies to follow, to the maximum extent practicable, an incremental approach to investing in IT development/acquisition projects. Additionally, OMB policy requires that investments in major information systems be implemented in increments, with each increment delivering measurable benefits.[31] More specifically, OMB's *Capital Programming Guide*[32] describes the use of modular contracting or incremental investment, including its application and benefits. In particular, OMB states that project increments should provide for the following:

[30] DOD Instruction 5000.2, *Operation of the Defense Acquisition System.*

[31] *Memorandum for Heads of Executive Departments and Agencies*, OMB Memorandum M-97-02 (October 25, 1996); *Capital Programming Guide*, *Version 1.0*, OMB Circular A-11, part 3 (July 1997), pp. 545–572.

[32] *Capital Programming Guide*, *Version 1.0*, OMB Circular A-11, part 3, Supplement, *Planning*, *Budgeting*, *and Acquisition of Capital Assets* (July 2000), pp. 35–37.

- *Separability:* Each increment should be fully funded, have substantial programmatic use that is not dependent on any subsequent increment, and be capable of performing its principal functions even if no subsequent increments are acquired.
- *Interoperability:* Each increment should comply with a common architecture or commercially acceptable technology standards and should be compatible with and capable of being integrated with other increments.
- *Performance requirements:* Each increment's performance requirement should be consistent with the performance requirements of the completed overall system and should address interface requirements with other increments.

In short, incremental investment helps to mitigate the risks inherent in large IT acquisitions/developments by breaking apart a single large project into smaller, independently useful components with known and defined relationships and dependencies. Making investment decisions up front on large-scale, long-term projects is generally risky: their economic justification is based on costs, benefits, and risks that are difficult to forecast reliably, partially because later increments are not well understood or defined, and partially because they are subject to change in light of experience on nearer term increments and changing business needs. Through incremental investment management, organizations can

- reduce the level of project risk and complexity faced at any one time by spreading this risk and complexity across a series of smaller investments;
- permit the delivery of some part of the expected business value earlier rather than waiting until later for the total, but more uncertain, business value;
- continuously monitor and evaluate the delivery of cost and benefit expectations on ongoing increments and use this information to better define and economically justify these increments; and
- permit later increments to exploit technology advances or accommodate evolving business needs.

In January 2001, DOD issued a change to its major system acquisition policy[33] requiring incremental investment management; specifically, the policy notes that a program's milestone decision authority must verify that each increment meets part of the mission need and delivers a measurable benefit, independent of future increments.

[33] DOD Instruction 5000.2, Change 1, *Operation of the Defense Acquisition System*.

DLA Has Not Yet Made Investment Decisions Incrementally

Although DLA plans to acquire and implement its BSM system solution in four increments, it has not so far managed BSM investments incrementally. Specifically, (1) DLA has not justified proposed investment in the first BSM increment on the basis of costs and benefits, (2) the DLA 21 Executive Board[34] has not made decisions about whether to invest in each discrete BSM increment, and (3) the BSM program office has not measured actual return on investment from each increment and used the results to better inform decisionmaking about future increments.

DLA's position is that BSM was being managed according to DOD Instruction 5000.2, which until January 2001 required a single economic analysis of a system's life-cycle costs and benefits before the system entered the concept demonstration phase. Accordingly, DLA prepared a program life-cycle economic analysis for BSM, according to which the program is expected to produce a positive net present value over its 15-year life cycle and improve military readiness. As a result, DLA officials stated that investing about $900 million to acquire and implement the BSM system solution is prudent, and DLA committed itself to funding, acquiring, and implementing all four BSM phases or increments.

Relying on a single economic analysis to make an investment decision for a program that is large and risky, involving many things to be done over many years, is neither prudent nor consistent with the principles of incremental investment management embodied in the Clinger-Cohen Act and OMB requirements. Approaching the BSM investment decision in this way was especially risky, since at the time that DLA prepared the BSM program life-cycle economic analysis, it had defined BSM business requirements for only the reengineered part of the materiel management business area. Thus, DLA was not only attempting the daunting task of accurately estimating the costs and benefits of many things over many years, it was doing so without knowing its BSM requirements beyond the reengineered parts of the materiel management business area. Our experience in reviewing IT investments across the federal government has

[34] This board is DLA's senior investment decisionmaking body. It is responsible for investment selection, control, and evaluation decisions for all investments.

shown that such estimating does not produce reliable results and cannot provide a sufficient basis for informed investment decisionmaking.[35]

To date, the BSM program office has not analyzed the costs, benefits, and risks of what DLA defines as its first BSM release. Program officials told us that they justified this release, which is to cost $93 million (not including the $56 million that was spent on BSM before the first release), on the basis of the program life-cycle economic analysis.

At the conclusion of our review, however, DLA officials informed us that they do now plan to make decisions on the last three releases incrementally: they plan to justify release 2 on the basis of its costs, benefits, and risks, and to verify that the first release produced benefits commensurate with costs before deciding to invest in release 2. They also stated that they would follow this approach to investing in later releases. According to program officials, because DLA is still working on its first release (concept demonstration), the investment decision for release 2 will not be made until fiscal year 2002.

However, the program office does not yet have plans or measures to determine, once an increment is implemented, whether its expected value is actually accruing. The implementation plans for the first BSM increment (release 1) were completed in April 2001, but no specific plans or measures were developed to determine whether benefit versus cost expectations would be met for this increment. Clinger-Cohen requires that agencies identify quantifiable measurements for determining costs and benefits. Until the program office has some means of measuring expected value, DLA will not be able to determine whether this first increment is performing at a level equal to or better than its current materiel management systems—SAMMS and DISMS.

According to the BSM program manager, the investment management plans and measures are not in place because DLA's policies and procedures on investment portfolio management are still in draft. When

[35] *Air Traffic Control: Complete and Enforced Architecture Needed for FAA Systems Modernization* (GAO/AIMD-97-30, February 3, 1997); *Air Traffic Control: FAA's Modernization Investment Management Approach Could Be Strengthened* (RCED/AIMD-99-88, April 1999); *Customs Service Modernization: Architecture Must Be Complete and Enforced to Effectively Build and Maintain Systems* (GAO/AIMD-98-70, May 5, 1998); *Information Technology: INS Needs to Strengthen Its Investment Management Capability* (GAO-01-146, December 2000); *Information Technology Management: Coast Guard Practices Can Be Improved* (GAO-01-190, December 2000).

these are completed, they should govern, for example, (1) how investment increments are to be defined, prioritized, and sequenced, (2) how performance criteria are to be applied to each increment, and (3) how accrued earned value from each investment increment will be measured.

Until these investment management plans and measures are in place, the program manager stated that incremental investment will be accomplished through a series of 11 planned contract task orders, consisting of 105 more specific subtasks, which are to span the four BSM increments. However, merely structuring contract task orders into incremental pieces is not a sufficient substitute for making investment approval and funding decisions incrementally.

Conclusions

DLA has already invested significant sums of money in its BSM program, and its plans call for investing hundreds of millions of dollars more. To invest this money wisely and in a way that minimizes risks, DLA will need to acquire BSM within the context of an enterprise architecture and on an incremental basis. To date, DLA has not used an enterprise architecture or applied management controls for developing, implementing, and maintaining one, as described in CIO Council guidance. Additionally, DLA has not employed incremental investment practices.

Officials of DLA and the Office of the Secretary of Defense have committed to correcting these management weaknesses. We view these commitments as positive first steps for two primary reasons. First, if DLA continues to invest large sums of money in BSM without a DLA- or DOD-wide logistics enterprise architecture, it runs the serious risk that it will acquire a system solution that focuses narrowly on DLA materiel management performance and accountability at the expense of DLA- and DOD-wide performance and accountability. Second, until DLA begins justifying the return on its BSM investment incrementally, making BSM investment decisions incrementally, and measuring actual return on this investment incrementally, it will not be able to make well-informed and prudent investment decisions, and it will not know whether its BSM system solution is cost-effective until it has already spent hundreds of millions of dollars.

Recommendations

To address DLA's need for an enterprise architecture to guide and constrain its IT capital investments, including BSM, we recommend that the Secretary of Defense direct the DLA Director to designate and treat

development, implementation, and maintenance of a DLA enterprise architecture as an agency priority.

We recommend that in fulfilling this direction from the Secretary, the DLA Director (1) issue a policy governing development, implementation, and maintenance of an enterprise architecture and (2) establish a DLA enterprise architecture steering committee, chaired by the DLA Vice Director, to provide a DLA-wide direction and focus to the enterprise architecture, and to ensure that one is developed and maintained in a manner consistent with the CIO Council published guide on managing enterprise architectures.

To provide for the effective development and maintenance of the DLA enterprise architecture, we recommend that the DLA Director make the CIO accountable to the enterprise architecture steering committee for developing and maintaining the agency's enterprise architecture. We recommend that in fulfilling this responsibility, the CIO appoint a Chief Architect for DLA and establish a program office responsible for developing and maintaining a DLA-wide enterprise architecture. We further recommend that the CIO direct the Chief Architect to work collaboratively with the appropriate offices within the Office of the Deputy Under Secretary for Logistics and Materiel Readiness to appropriately align the DLA enterprise architecture with this office's ongoing efforts to develop a DOD-wide logistics enterprise architecture. Additionally, we recommend that the CIO have the Chief Architect, as appropriate, follow the steps outlined in the CIO Council's published guide for managing enterprise architectures, including

- obtaining executive buy-in and support,
- establishing architecture management structure and controls,
- defining the architecture process and approach,
- developing the baseline architecture, the target architecture, and the sequencing plan,
- facilitating the use of the architecture, and
- maintaining the architecture.

To ensure that, once developed, the enterprise architecture is effectively implemented, we also recommend that the Director require the DLA 21 Executive Board and its subsidiary investment review boards to ensure that only architecturally compliant IT investments are approved and funded, unless the investment decisionmaking authority issues a written waiver in response to a written justification.

Until a DLA enterprise architecture is developed and can be used to effectively guide and constrain DLA IT investment, we also recommend that the DLA Director limit future investment in BSM to only its first incremental release.

To address DLA's need to incrementally invest in BSM, we recommend that the DLA Director impose three further conditions on investment in BSM beyond its first increment. Specifically, such investment should not occur until plans have been developed and processes implemented for (1) measuring and validating whether ongoing BSM increments are actually producing benefits commensurate with costs, (2) developing economic justifications for each subsequent increment that consider the actual performance of ongoing increments, and (3) ensuring that decisions on each subsequent increment are based on these incremental economic justifications.

To ensure that the approach to DLA's logistics modernization (as well as that of other DOD component organizations) recognizes the logistics management interdependencies and interrelationships among DOD components and aims to optimize departmentwide performance and accountability, we recommend that the Secretary of Defense direct the Under Secretary of Defense for Acquisition, Technology, and Logistics to (1) expedite development of a DOD-wide logistics management enterprise architecture in a manner consistent with CIO Council published guidance and (2) establish effective controls for ensuring that component investments in modernized logistics systems are compliant with the architecture or are otherwise granted an explicit waiver to this requirement on the basis of analytical justification.

Agency Comments and Our Evaluation

In written comments on a draft of this report (reprinted in appendix II), the acting Deputy Under Secretary of Defense for Logistics and Materiel Readiness agreed with us on the importance of developing and maintaining enterprise architectures and making BSM investment decisions incrementally, concurring with eight of our ten recommendations. DOD also acknowledged that the absence of these IT management controls increased program risk. Despite these areas of substantial agreement, the Deputy Under Secretary disagreed with our recommendations that the DLA Director limit future investment in BSM to the first incremental release until (1) a "full-blown" (as DOD termed it) DLA enterprise architecture is developed and (2) the BSM program manager has the means in place to measure actual benefit accrual on the

first incremental release and to use this information in deciding on investment in the next release.

According to DOD, our findings and conclusions regarding the overall level of risk to the successful achievement of BSM and other DOD logistics modernization program objectives are not supported by the single risk factor addressed in this report—the use of enterprise architectures. DOD's stated view is that the risks associated with delaying BSM are greater than the risks of modernizing while concurrently developing the architecture. DOD also stated that while the conditions that we recommended regarding measurement and use of actual benefit accrual are valuable and will be performed by DOD, they should not be performed by the program manager and should not be on the critical path for undertaking future incremental releases.

While DOD agrees that the absence of an "end-to-end" enterprise architecture for DLA is a risk, DOD strongly believes that this risk is amply mitigated by measures already taken. As examples, the Deputy Under Secretary's comments refer to the preparation of an enterprisewide logistics implementation plan for community data management services that defines the future information and business rules interaction among DOD components; the existence of an "as is" logistics architecture (documented during the Y2K campaign); the recent establishment of an OSD-led enterprise integration consortium that, according to the comments, will ensure optimal collaboration among programs; and the commercial architecture and process reengineering procedures being followed by DLA's BSM program.

Notwithstanding the considerable level of agreement between DOD and us on this report, we have a differing view on the level of risk facing DOD logistics modernization programs in general, and BSM in particular, in the absence of the two risk mitigators addressed in this report: (1) effective enterprise architecture development and implementation and (2) effective incremental investment management.

Our experience in reviewing other federal agency modernization programs has shown that the absence of these program management controls are two of the root causes for other programs' lack of success.[36] The two recommendations that DOD disagrees with are intended to strike a

[36] GAO/AIMD-97-30, RCED/AIMD-99-88, GAO/AIMD-98-70, GAO-01-146, and GAO-01-190.

reasonable balance between the risk that DOD will suffer the same fate as these other agencies and the risk that DOD points out of delaying BSM. These recommendations permit DLA to make progress on the first BSM increment while developing and implementing the two missing management controls and thus becoming better equipped to move forward on subsequent increments. Therefore, we continue to believe that DOD should limit investment in BSM beyond the first increment until certain conditions are met.

We agree with the Deputy Under Secretary that the risk mitigation strategies that DOD has followed can lower the risk associated with the lack of a complete enterprise architecture. However, we continue to believe that these efforts are not a sufficient substitute for having an explicit enterprise architecture and effectively using it to guide and constrain modernization investment decisions. At most, these mitigation strategies should be viewed as temporary controls until the architecture is available, as well as useful starting points for the development and use of an enterprise architecture.

With regard to risk mitigation, the Deputy Under Secretary comments further that commercial implementation of enterprise resource planning (ERP) is a proven means for achieving an enterprise business strategy, adding that a key requirement of DLA's BSM program is to move to a commercial approach for achieving its end-state enterprise architecture. We agree that the use of commercial products can be a less risky approach than the development of custom applications, but we believe that success still depends on effective implementation and in particular on ensuring that the chosen products meet the needs of the enterprise; this requirement is best fulfilled by having and using an enterprise architecture. The main point of our recommendations is that DLA has yet to define its end-state enterprise architecture and therefore cannot know whether its chosen ERP solution will satisfy requirements beyond the materiel management business area. Accordingly, we stand by our recommendation in this area, which is intended to significantly lower the risk for the BSM program in relation to its role in developing DLA's enterprise architecture, not just in achieving DLA's requirements for modernizing its materiel management systems.

We would add that DOD's characterization of the enterprise architecture that we recommend as "full-blown" and "end-to-end" suggests that we are prescribing the full depth and detail of this architecture. We are not. In fact, effective architecture management practices recognize that there is no one-size-fits-all architecture solution and that the driving goal in

developing an architecture is to make it useful for the task at hand, meaning that its depth and detail will vary from enterprise to enterprise.

The Deputy Under Secretary also disagreed with our recommendation to impose additional conditions on investment in BSM beyond its first increment, specifically concerning the development of processes for performing cost/benefit analyses of ongoing and completed increments. According to the Deputy Under Secretary, the BSM program does plan to prepare a business case to support each of four scheduled releases and to include in each of these increments a projection of business process performance and an evaluation of empirical results of the program to that point. These are the very activities that we recommend as conditions for investing beyond the first increment. The Deputy Under Secretary's disagreement with our recommendation appears to center on who should be required to measure and use actual benefit accrual in making decisions on continuing the program to the next increment. It is not our intent to suggest that only the BSM program manager should measure and use actual benefit accrual or that one increment must be fully completed and fully evaluated before another can begin. In fact, effective incremental investment management necessitates some overlap among increments, and our recommendations do not contradict this. On the matter of who should measure and validate actual benefit accrual, we are not opposed to DLA assigning this responsibility to someone other than the program manager, and we acknowledge that the program manager should not be solely responsible for ensuring that investment decisions on subsequent increments are based on economic justifications. Accordingly, we have modified the recommendation to reflect this.

DOD also provided specific comments on other aspects of the report. These comments have been incorporated throughout the report where appropriate.

We are sending copies of this report to the Chairmen and Ranking Minority Members of the Senate Appropriations Subcommittee on Defense; the Subcommittee on Readiness and Management Support, Senate Committee on Armed Services; the House Appropriations Subcommittee on Defense; and the Subcommittee on Readiness, House Committee on National Security. We are also sending copies to the Director, Office of Management and Budget, and the Director, Defense Logistics Agency. Copies will be made available to others upon request.

If you have any questions regarding this report, please contact me at (202) 512-6256 or Carl M. Urie, Assistant Director, at (202) 512-6231. We can also be reached by e-mail at hiter@gao.gov and uriec@gao.gov. Other key contributors to this report are listed in appendix III.

Randolph C. Hite
Director, Information Technology Systems Issues

Appendix I: Objectives, Scope, and Methodology

Our objectives were to determine (1) whether DLA is using an enterprise architecture to guide and constrain its investment in its Business Systems Modernization (BSM) program and (2) whether DLA is investing in BSM in an incremental manner. Using enterprise architectures—institutional blueprints for business and technological change—and investing incrementally in large modernization programs are legislative and federal requirements and best industry practices. This review did not address other system modernization best practices, such as whether DLA is employing effective system acquisition process controls, and did not evaluate the specific commercial, off-the-shelf product that DLA chose as its BSM system solution.

To determine whether DLA has an enterprise architecture to guide BSM, we identified the DOD organizations involved in efforts to reform and modernize DOD logistics management operations and systems, as well as organizations responsible for DOD policy and guidance on enterprise architectures, including the Office of the Under Secretary of Defense (Acquisition, Technology, and Logistics); the Director of Logistics Systems Modernization; the DLA Logistics Operations Directorate; and the DLA Director of Information Operations, who is in charge of corporate information policy. From each of these organizations, we solicited information on plans and activities that defined the form and content of these reform and modernization efforts. We then questioned officials from each organization about planned and existing architectural artifacts and obtained copies of all such plans and artifacts. Next, we analyzed the information provided, including DOD's *Joint Vision 2020*, *21st Century Logistics: DOD Logistics Strategic Plan*, and available DLA enterprise architecture artifacts, against DOD's C4ISR Architecture Framework to determine the extent to which these organizations individually or collectively had produced architectural artifacts that satisfied DOD requirements. In our analysis, we also considered other published architectural guidance, including Office of Management and Budget memorandums and the *Federal Enterprise Architecture Framework* of the Chief Information Officers Council.[1]

We also obtained and reviewed the federal CIO Council's *A Practical Guide to Federal Enterprise Architecture*, *Version 1.0*, as well as

[1] *Funding Information Systems Investments*, OMB Memorandum M-97-02 (October 25, 1996); *Information Technology Architectures*, OMB Memorandum M-97-16 (June 18, 1997); *Federal Enterprise Architecture Framework*, *Version 1.1*, Chief Information Officers Council (September 1999).

published information on the enterprise architecture best practices that the guide is based upon. We compared DLA's *Enterprise Information Architecture Plan* (draft, 28 July 2000) with this guidance.

To determine whether DLA is following an incremental investment strategy for BSM, we compared DLA's Single Acquisition Management Plan, Operational Requirements Document, and other program-related material against the Clinger-Cohen Act, OMB's *Capital Programming Guide*, and the associated assessment method. We evaluated policies, procedures, and guidance related to DLA's IT modular contracting activities. We evaluated task order plans and performance data against commonly accepted IT investment methodologies.

Additionally, we reviewed economic analysis of DLA's BSM program and the related cost justifications. We also used DOD's *Logistics Transformation* guide and the Defense Fiscal Year 2001 Budget to obtain information about other DOD and military service supply-chain logistics initiatives.

We conducted our work at DLA headquarters, located at Fort Belvoir, VA, from February to April 2001 in accordance with generally accepted government auditing standards.

Appendix II: Comments From the Department of Defense

DEPUTY UNDER SECRETARY OF DEFENSE FOR
LOGISTICS AND MATERIEL READINESS
3500 DEFENSE PENTAGON
WASHINGTON, DC 20301-3500

Mr. Randolph Hite
Director Information Technology
Systems Issues
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Hite:

This is the Department of Defense (DoD) response to the GAO draft report, "INFORMATION TECHNOLOGY: DLA Needs to Strengthen Management of its Business Systems Modernization" dated May 11, 2001 (GAO Code 310206/OSD Case 3095). Thank you for the opportunity to comment on this report.

The Department disagrees with some recommendations and findings made by GAO. Specific responses to GAO recommendations are included in the first enclosure. Additionally, DoD comments on the report are included as the second enclosure.

See comment 1.

While the Department remains a strong advocate for developing and maintaining enterprise architectures, we do not believe that there is benefit in holding the Business System Modernization (BSM) program "hostage" to the architecture's full development. Rather, we advocate an evolutionary approach to developing the architecture that will parallel the "spiral development" process used in software development. Maturing the architecture incrementally will help to develop a durable, truly useful tool to guide BSM and other DoD programs. We have established clear direction for the BSM program, and we are managing all the risks associated with the program. Since the program uses a commercially developed software infrastructure, we ameliorate a good deal of the risk often found in other programs developing new infrastructure. For example, if we find that the program requirements evolve as the architecture matures, the selected commercial software will facilitate cost-effective program adjustments. We are providing strong program management to the BSM program. We will continue developing the architecture as the draft report recommends. We believe the Department can be best served, however, by developing and maturing the architecture in parallel with the BSM program itself.

See comment 2.

In the report, GAO presents only one risk factor associated with information technology programs -- the existence and use of enterprise architectures. Yet the report draws conclusions about a program's *overall* risk. We are managing this aggregate risk in the BSM program, and we believe the program should not be delayed while we fully develop architectural artifacts. Consequently, although we support the need for enterprise architectures, we are compelled to non-concur with two of GAO's recommendations and many of the conclusions.

GAO's conclusions regarding the likelihood that BSM or other programs will achieve their objectives are not supported by the report. We agree that the absence of full-blown enterprise architectures adds risk to a program, but strongly believe that this risk is mitigated by measures already taken, such as:

- the preparation of a logistics enterprise-wide implementation plan for community data management services that define the future information and business rules interaction among DoD Components
- the existence of an "as-is" logistics architecture documented during the Y2K campaign
- an Office of the Secretary of Defense-led enterprise integration consortium that will ensure optimal collaboration among programs, and
- the commercial architecture and process reengineering procedures being followed by DLA's BSM program.

See comment 3.

We believe an enterprise architecture is required to mitigate the risk that "yet to be determined" user requirements cannot be rapidly allocated to solutions and realized as capabilities. Our legacy logistics information systems are difficult to maintain and modernize. We need modern systems that are responsive to evolving requirements. Thus, one should not conclude from this report that there is *unacceptable* risk associated with modernizing systems while developing an enterprise architecture. Rather, *we believe the risks from delayed modernization are greater to the Department.*

See comment 4.

Implementation of Enterprise Resource Planning (ERP) is a proven commercial means for achieving an enterprise business strategy, to include: a business architecture (i.e. business processes); a systems architecture that supports that business architecture, and; a foundation for achieving collaborative eCommerce/eBusiness. As such, a key requirement of DLA's BSM Program is to move to a commercial approach for achieving its end-state enterprise architecture. This approach, validated in industry over the past decade, reduces implementation time and allows the benefits of a new business architecture to be realized in the near-term.

See comment 5.

The Department supports the need for an enterprise architecture *and* the integration of that enterprise architecture into the portfolio management and investment management processes. Our issue is one of timing. We cannot stop modernizing systems in order to develop an "end to end" architecture, and we believe the risk to the BSM program that GAO attributes to a lack of an enterprise architecture is overstated. BSM is guided by sound architectural discipline. Use of best commercial practices is a driving tenet of the BSM program. From the prerequisite demonstration of the viability of COTS products, to the reengineering of business processes, to the selection and integration of the COTS products, to incremental development and implementation, DLA has made the commitment to adhere to best practices. The lack of completed C4ISR architecture framework artifacts is not evidence of a lack of architectural discipline. Technology infrastructure, transition strategy, technical reference models, standards profiles and information assurance are all being viewed as enterprise requirements. Business processes, information flows and relationships, data descriptions and relationships are

being recorded so that business process interfaces can be easily identified and additional mission requirements can be easily accommodated. These attributes are consistent with Office of Management and Budget Circular A-130 requirements for an Enterprise Architecture.

See comment 6.

To further mitigate risk, DUSD(L&MR) is leading an enterprise integration consortium to optimize collaboration among ERP and related efforts of the services and agencies. Working groups of this consortium are updating the plans for community services and DoD-wide logistics business rules, developing enterprise-wide interfaces between logistics and other functional areas, developing mechanisms for sharing development plans and technical artifacts among programs and sharing lessons learned. DUSD (L&MR) is using this forum to ensure policies such as those in DoD Directive 8190.1 that require the use of commercial data interchange standards and compliance with logistics enterprise community services for inter-component interaction are understood and to identify the policy changes needed to improve further each project's probability of success.

See comment 7.

Regarding incremental investment decision making, the BSM program will prepare a business case to support each of four scheduled releases. Each increment will include a projection of business process performance as well as an evaluation of empirical results. The business case will also include an earned value analysis of program deliverables to ensure that each remains in accordance with program expectations. These progressive business cases will afford management a mechanism to assess the worthiness of the program and ensure that continued investment is warranted by demonstrated performance.

We appreciate the opportunity comment on this report. A "recommendation by recommendation" response and other substantive comments are attached. Note that these comments (at enclosure 2) include corrections to the context of the statements made by the Director of Logistics Systems Modernization. For further information, my project officer is Col Terry Kinney, ODUSD(L&MR) Logistics Systems Modernization (703) 697-9196.

Sincerely,

Allen W. Beckett
Acting

2 Enclosures
1. Response to GAO Recommendations
2. Specific Comments on the Draft Report

3

See comment 8.

GAO DRAFT REPORT – DATED JUNE 2001
DLA Needs to Strengthen Management of Its Business Systems Modernization
GAO CODE/01-631

RECOMMENDATION 1: GAO recommends that the Secretary of Defense direct the DLA Director to designate and treat development, implementation, and maintenance of a DLA enterprise architecture as an agency priority.

DoD RESPONSE: Concur, with the following comments. While we agree that additional DLA and DoD-wide architecting is warranted, modernization programs like BSM should not be delayed while the architecture is developed. DLA urgently needs the process improvements promised by ERP implementation, and the Department is managing any risks associated with concurrent BSM development and architecture maturation.

RECOMMENDATION 2: GAO recommends DLA (1) issue a policy governing development, implementation, and maintenance of an enterprise architecture, and (2) establish a DLA enterprise architecture steering committee, chaired by the DLA Vice Director, to provide a DLA-wide direction and focus to the enterprise architecture, and to ensure that one is developed and maintained in a manner consistent with the CIO Council published guide on managing enterprise architectures.

DoD RESPONSE: Concur. The DLA 21 Executive Board charter will be amended to include the responsibility to direct and approve development and maintenance of the enterprise architecture.

RECOMMENDATION 3: GAO recommends DLA make the CIO accountable to the enterprise architecture steering committee for developing and maintaining the agency's enterprise architecture.

DoD RESPONSE: Concur.

RECOMMENDATION 4: GAO recommends the DLA CIO appoint a Chief Architect for DLA and establish a program office responsible for developing and maintaining a DLA-wide enterprise architecture.

DoD RESPONSE: Concur.

RECOMMENDATION 5: GAO recommends the DLA CIO direct the Chief Architect to work collaboratively with the appropriate offices within the Office of the Deputy Under Secretary for Logistics to appropriately align the DLA enterprise architecture with this office's ongoing efforts to develop a DOD-wide logistics enterprise architecture.

DoD RESPONSE: Concur.

RECOMMENDATION 6: The GAO recommended that the DLA CIO have the Chief Architect, as appropriate, follow the steps in the CIO Council's published guide for managing enterprise architectures, including: obtaining executive buy-in and support, establishing architecture management structure and controls, defining the architecture process and approach, developing the baseline architecture, the target architecture, and the sequencing plan, facilitating the use of the architecture, and maintaining the architecture.

DoD REPONSE: Concur.

RECOMMENDATION 7: GAO recommends DLA Director require the DLA 21 Executive Board and its subsidiary investment review boards to ensure that only architecturally compliant IT investments are approved and funded, unless the investment decision making authority issues a written waiver in response to a written justification.

DoD RESPONSE: Concur, with the following comment. Architecture compliance will be determined by comparison with the appropriate portions of the enterprise-wide architecture, in accord with a risk-managed, evolutionary approach to architecture development.

RECOMMENDATION 8: GAO recommends until a DLA enterprise architecture is developed and can be used to effectively guide and constrain DLA IT investment, that the DLA Director limit future investment in BSM to only its first incremental release.

See comment 9.

DoD RESPONSE: Nonconcur . We agree that planned ERP increments should be re-evaluated as the decision to execute the increment approaches. It is important that this re-evaluation be based on a simple, marginal architectural compliance and cost/benefit analysis. However, for the risk evaluation reasons discussed previously, we do not believe BSM progress should be delayed pending completion of the enterprise architecture. For risks on future increments to be sufficiently mitigated, it is necessary only that an increment be architecturally consistent with that portion of an enterprise view that covers the increment's functionality and all interfaces. BSM's blueprinting-related processes will ensure this consistency. BSM is an ACAT 1AM major automated information system and as such is subject to the DoD 5000 acquisition process. BSM has received authorization to proceed with concept demonstration in accordance with DoD CIO direction and limitations. Before authorization for fielding of the first increment,

See comment 10.

Milestone C, and further investment in subsequent increments, the DoD CIO, in concert with the DUSD(L&MR) will conduct a BSM program review that will include DLA enterprise architecture considerations.

RECOMMENDATION 9: GAO recommends DLA Director impose three further conditions on investment in BSM beyond its first increment. Specifically, such investment should not occur until the BSM program manager develops plans and implements processes for (1) measuring and validating whether completed BSM increments actually produce benefits commensurate with costs, (2) developing economic justifications for each subsequent increment that consider the actual performance of preceding increments, and (3) ensuring that decisions on each subsequent increment are based on these incremental economic justifications.

DoD RESPONSE: Nonconcur. Retrospective analysis is valuable and can provide insights about how to measure actual benefits received. However, prospective investment decisions should be based on prospective marginal analysis germane to the functions and benefits of the proposed future increment. Just as BSM should not be "held hostage" to enterprise-wide architecture development, its progress should not be tied to retrospective analysis. The program manager's incremental and progressive business case analysis, combined with DLA leadership's analysis of actual benefits achieved will meet the objective of continually improving the quality of incremental decision making. The three conditions to further investment recommended by GAO are in part, the standard by which the DoD CIO, DUSD(L&MR) and other OSD oversight officials plans to assesses BSM. It is not appropriate to impose the requirement for benefit follow-up on the program manager, whose job is program delivery and whose success orientation could raise issues of independence. Moreover, given the extensive risk management structure in place for BSM, the conditions recommended should not be placed on the BSM critical path but should instead be parallel considerations.

RECOMMENDATION 10: GAO recommends that the Secretary of Defense direct the Under Secretary of Defense for Acquisition, Technology, and Logistics to (1) expedite development of a DOD-wide logistics management enterprise architecture in a manner consistent with CIO Council published guidance and (2) establish effective controls for ensuring that component investments in modernized logistics systems are compliant with the architecture, or are otherwise granted an explicit waiver to this requirement on the basis of analytical justification.

DoD RESPONSE: Concur. As the report and our comments have noted, however, the Department recognizes the complexity of this work and the significant resources and time required.

Specific Comments to the GAO draft report, "INFORMATION TECHNOLOGY: DLA Needs to Strengthen Management of its Business Systems Modernization" dated May 11, 2001 (GAO Code 310206/OSD Case 3095)

See comment 11.

COVER PAGE
COMMENT: The title of the report suggests a comprehensive review of the BSM program. The review was limited to enterprise architecture and incremental investment. A suggested alternative title is "DLA Needs to Strengthen Management of Enterprise Architecture and Incremental Investment of the Business System Modernization Program."

Results in Brief PAGE 2
According to DLA's plans, its architectural products will not be extended to its other business areas until 5 years from now…

See comment 12.

COMMENT: The statement that DLA will not extend the BSM architecture to remaining business areas is a misinterpretation of the intended direction. DLA's plan is to incorporate the additional business areas based upon the mission needs of the business area and certainly prior to the approval of any significant Information Technology investments.

Results in Brief PAGE 3
Equally if not more important, DOD has not developed a DOD-wide logistics management enterprise architecture that would promote interoperability and avoid duplication among the logistics modernization efforts now underway in DOD component organizations, such as DLA and the services. To its credit, the Office of the Deputy Under Secretary of Defense for Logistics…

See comment 13.

COMMENT: While the DoD does not have a published Enterprise Architecture, logistics programs are supported by a DoD Logistics Strategic Plan as well as Joint Vision 2010/2020 and other strategic planning directions. Therefore, the functional tenets and business process changes included in BSM are consistent with DoD strategic direction. Defense Reform Initiative Decision (DRID) 48 resulted in corporate and DoD Component plans for implementing commercial transaction standards for improved interoperability and for modernizing the community services that ensure interoperability and the implementation of corporate business rules (a narrative "to-be" operational view) that improve logistics operations across the DoD enterprise. The corporate plan was signed by the Deputy Under Secretary of Defense for Logistics and the Deputy CIO after being prepared via an extensive collaborative effort across the Department.

Results in Brief PAGE 3
Moreover, the interim steps that these officials described do not provide the management control rigor and discipline that well-defined and effectively implemented enterprise

architectures provide. By allowing the services and DLA (through BSM) to proceed separately with new logistics management systems in the absence of a DoD-wide enterprise architecture, DoD will not be in a position to optimize logistics operations and system performance across the department and thus is unlikely to successfully meet its strategic logistics management goals.

See comment 14.

COMMENT: We disagree with this assessment. We fully intend to evolve to formal architecture-based portfolio management. These techniques will be a more efficient means for end-to-end optimization. However our interim measures are effective in enforcing basic architectural tenets such as implementing DoD-wide logistics business rules, using community services for data exchange and rather than point-to-point interfaces, buying commercial-off-the-shelf software rather than building unique capabilities, and moving from standard but developed applications to logistics-relevant application standards that support commercial products. Regarding the second sentence, there is a DoD-wide architecture; the "as-is" is defined by the current MILS process, and, to the extent a "to-be" has been defined, it's contained in the collection of not-yet-implemented business rules changes managed by DLA's Defense Logistics Management Standards Office. The DRID 48-based plans and DoD Directive 8190.1 squarely address the means for updating and implementing these "to-be" business rules. GAO implies that the risk of not having a formal representation of these business rules arises because the modernization programs are already underway. In fact, the major impediment to implementing the official to-be business rules has little to do with architecture and much to do with the difficulty of implementing new business processes in old, poorly documented system applications. Thus, the greater risk to achieving our strategic goals would be if system modernizations were delayed pending creation of a formal enterprise architecture.

Results in Brief PAGE 3
Instead, DLA has thus far treated the entire BSM program as a single investment decision, justified by a single, "all or nothing" economic analysis, because doing so, according to BSM officials, was consistent with DOD policy then in place for major system

See comment 15.

COMMENT: The statement that DLA has treated BSM as a single investment decision is erroneous. Each major decision point of the BSM program is presented to the DLA 21 Executive Board, chaired by the Vice Director, for consideration and direction. The board meets every two weeks. As was explained to the GAO review team, the BSM program will prepare a business case to support each of four scheduled releases. Each business case will be supported by a simulation of planned versus existing functionality and the projected simulated change in business metrics. Simulations will be compared to actual empirical data to validate the simulation model. As implementations mature, empirical data will be collected to evaluate the actual effect of changes and to support future implementations. The business case will also include an earned value analysis of program deliverables that are not applicable to business process simulation to ensure that each remains in accordance with program expectations. These progressive business cases

will be offered to the DLA 21 Board for consideration in support of program decisions to proceed with development and implementation plans. This practice to support BSM management was established prior to the GAO review.

DLA Has Begun Implementing its Business Systems Modernization Program - Page 9-10
The BSM system solution is envisioned as consisting of Web- and COTS-based applications supported by a corporate relational database. ...

See comment 16.

COMMENT: While it is the DLA intent to integrate the selected COTS packages as efficiently as possible, the COTS package selected by DLA requires that integration be accomplished through the application layer of the implied COTS architecture rather than through the fusion of databases into a single relational database. BSM includes an Enterprise Application Tool to effect this application to application interface. The EAI tool also equips BSM to support new Business to Business (B2B) relationships as well as mitigate the risk of introducing additional business functions to the BSM architecture.

DLA Has Begun Implementing its Business Systems Modernization Program - Page 11
Only about 1 percent of the BSM budget is for new network and computing platform infrastructure (hardware and systems software). This is because DLA's current and future investments in IT infrastructure, which will support ongoing DLA operations as well as the BSM program, are funded separately.

COMMENT: Information Technology infrastructure is no longer program specific at DLA. Infrastructure requirements consider program requirements in the aggregate. Hardware configurations, operating software as well as many utility software applications are consistent with the DLA technical architecture which govern standards and solutions for the DLA enterprise requirements. In this way, the agency is working towards a corporate infrastructure that efficiently supports an enterprise architecture.

BSM Is Not Being Guided by Either a DLA Architecture or a DOD-wide Logistics Architecture - PAGE 14 - 19
DLA is managing its BSM program without having either a DLA enterprise architecture or a DOD-wide logistics management enterprise architecture.

See comment 17.

COMMENT: While it is ideal that a major Information Technology investment be preceded by a completely attributed enterprise architecture, discussions with leading commercial providers indicate that this is rarely if ever the case. Most commercial endeavors are supported by a high level information technology strategy and a focus on core business processes. As discussed above, DoD is committed to evolving architectures such that the risks associated with ongoing system modernization remain managed and acceptable.

See comment 18.

Enterprise Architectures: A Cornerstone of Successful Modernization Programs – Page 15
Our experience with federal agencies has shown that attempting to define and build major IT systems without first completing an enterprise architecture often results in IT systems that are duplicative, are not well integrated, are unnecessarily costly to maintain and interface, and do not effectively optimize mission performance.

COMMENT: This GAO statement implies specific "bad" effects will result if modernization programs proceed absent a formal enterprise architecture. This statement is not applicable to BSM or the other DoD modernization programs referenced in the report. We believe the selected commercial ERP systems are well integrated and not duplicative. The Enterprise Integration Consortium should eliminate unnecessary cross-Component duplication. Further, commercial experience has been that ERPs lower maintenance costs and are easier to interface, especially when combined with community interface services of the kind operated (and being improved) by the DoD logistics community. Lastly, we note that the "bad" effects cited by GAO may have had causes other than the absence of an enterprise architecture. As the previous statement in the report notes, "Employed in concert with other important IT management controls…enterprise architectures can…", other factors contribute also to the probability of success.

See comment 19.

DLA's Approach to Developing an Architecture Is Not Enterprise Focused - Page 20 –21
BSM officials, including the BSM program manager and chief architect, have acknowledged that DLA does not have an enterprise architecture. However, these officials also maintain that BSM still has had enterprise wide architectural direction, because although the program did not have C4ISR-compliant architectural artifacts, the strategic direction of the agency (as defined in strategic plans) was the primary focus of BSM. DLA plans to fill out the essential products of the C4ISR framework as by-products of implementing its COTS solution, rather than developing these products beforehand, so that they can be used as the basis for guiding and constraining its acquisition and implementation of system solutions.

COMMENT: The lack of complete C4ISR artifacts is not evidence of the absence of architectural discipline as implied in the report. Additionally, DLA has met all of the C4ISR requirements to support the Milestone I/II acquisition decision granted in the fall of 2000 and will update and upgrade the C4ISR artifacts to support all future oversight reviews and Milestone decisions. The BSM "blueprint" is an architectural approach. DLA's effort in using the blueprint is a best commercial practice and the sequence of work is such that architectural products do guide and constrain system solutions.

See comment 20.

DLA's Approach to Developing an Architecture Is Not Enterprise Focused - Page 20 –21
According to the draft plan, once BSM is completed (scheduled for fiscal year 2005), DLA will add other business functions to the BSM Business Architecture Blueprint so that the end result is an enterprise wide architecture.

COMMENT:
The statement that DLA will not extend the BSM architecture to remaining business areas until BSM is completed is a misinterpretation of the intended direction. DLA's plan is to incorporate the additional business areas based upon the mission needs of the business area and certainly prior to the approval of any significant Information Technology investments.

See comment 21.

DLA's Approach to Developing an Architecture Is Not Enterprise Focused - PAGE 22
…For DLA, this is particularly problematic because DLA's six business functions are interrelated and interdependent. For example:
• Materiel management and cataloging are related, because how an item is procured is determined in part by how an item is classified during the cataloging process.
• Materiel management and distribution are related, because decisions about whether DLA will distribute the materiel (or the vendor will deliver directly to the requisitioner) are made at the same time the materiel is bought.
• Distribution and cataloging are related, because how materiel is stored and transported is determined by how it is classified during cataloging (e.g., hazardous materiel has special storage and transportation needs).

COMMENT:
The cataloging and distribution interfaces are critical and integral parts of the BSM program. Individuals from the DLIS and the DDC are actively involved in identifying and defining BSM requirements and the resolution to interface requirements. As an example, stock positioning policies and practices as well as the "single" accountable asset record have been integrated into the BSM blueprint and coordinated with DDC plans for business process reengineering of the distribution process. The report erroneously implies that there is little interaction and consideration of the enterprise cataloging and distribution requirements.

DLA's Approach to Developing an Architecture Is Not Enterprise Focused - PAGE 23
This approach introduces the risk that DLA will sacrifice optimizing enterprisewide performance and accountability in order to optimize the performance and accountability of its individual components—the risk that well developed and implemented enterprise architectures are intended to prevent.

See comment 22.

COMMENT: The incorporation of an EAI tool into the BSM systems architecture will mitigate the risk associated with unplanned and future interfaces. In addition, BSM is properly scoped to prevent "sub-optimization". All external interfaces are being defined and business process reengineering is preceding IT decisions within BSM's bounds. Attempting to perform process optimization across a much larger functional scope at this time could jeopardize the process reengineering now ongoing by diluting management focus. Choosing the scope of optimization was an important DLA leadership prerogative given that their continued involvement will be key to BSM success.

DOD Does Not Have a Departmental Logistics Management Enterprise Architecture - page 25-26
Despite the lack of a DoD-wide logistics architecture, in March 2000, the former Deputy Secretary of Defense directed DLA and the military services to develop plans for modernizing their respective logistics processes and systems by July 2001 and to implement their respective plans by September 2006. No DOD-wide architectural blueprint to promote operational and system commonality and integration accompanied this direction.

See comment 23.

COMMENT: Guidance on how to achieve integration preceded the direction in March 2000. GAO is referring to DRID 54. The plans created by the Components and the logistics community pursuant to DRID 48 provided essential guidance and enterprise architectural perspective for the Component DRID 54 plans. Also, all Components had access to the "as-is" representations from the Y2K campaign. Regarding operational and system commonality, no guidance was provided because they are not objectives in themselves as long as each Component has statutory responsibility for optimizing their logistics mission end-to-end. Thus, the enterprise focus is on the process among the Components (not a standard process) and the inter-Component touch points, the very focus of DRID 48 and DoD Directive 8190.1. Note however, that a few "targets of opportunity" in logistics process and standardization were being pursued by DoD, notably in medical logistics and force deployment. These initiatives were fully documented and well known to the Components prior to DRID 54.

DOD Does Not Have a Departmental Logistics Management Enterprise Architecture - page 26
According to the Director of Business Modernization within the Office of the Deputy Under Secretary of Defense for Logistics..., DOD needs a departmental logistics management enterprise architecture.

See comment 24.

COMMENT: The title of the person interviewed was Director, Logistics Systems Modernization (LSM) and the office is of the Deputy Under Secretary of Defense for Logistics and Materiel Readiness.

DOD Does Not Have a Departmental Logistics Management Enterprise Architecture - page 26
Without one, the Director stated that the services' and DLA's investments in new logistics management systems would result in operations and systems that, although modernized, would continue to be "stovepiped," rather than optimized and integrated across DOD. Accordingly, during the course of our review, efforts were started to develop a DOD-wide logistics enterprise architecture.

See comment 25.

DUSD(L&MR) COMMENT
These words from the Director, LSM were not in context. The following represents the Director, DUSD(L&MR)/LSM's views in the context of the GAO report:
"Without an enterprise-wide logistics architecture, it would be difficult to rapidly develop a vision of future, optimized supply chain operations across DoD and to assign responsibility for implementing that vision among DoD Components system efforts. Individual Components would modernize and optimize their end-to-end logistics missions and supporting systems. Pursuant to OSD-guided mission analyses and business rule identification, DoD would still streamline the cross-component logistics process and optimize support to the joint warfighter. Because Components would have modernized their supporting information systems, these changes would be less costly, time consuming and risky than they would be to implement today. However, without an enterprise-wide logistics architecture to assist in the visioning and process streamlining, some opportunities for more economical and effective warfighter support would be delayed or forgone. Furthermore, absent architecture-based portfolio management, OSD oversight and program manager compliance with DoD requirements would be more costly and time consuming and opportunities to reduce the time to field capabilities would be missed. Because the biggest factor in the cost, time and risk of implementing change is the agility of the installed information system infrastructure, system modernization should not be delayed for the purposes of developing an enterprise logistics architecture. Rather, the efforts should proceed in parallel."

Contrary to the report language, the office of the DUSD(Logistics) began the efforts to develop a DoD-wide logistics enterprise architecture before the GAO review was initiated, as a direct outgrowth of the logistics Y2K "end-to-end" test.

DOD Does Not Have a Departmental Logistics Management Enterprise Architecture - page 26
He also would not provide us copies of any "as is" architectural products, acknowledging that these products were based on data obtained under DOD's Year 2000 Conversion Program and thus needed to be modified in light of the ongoing modernization...

See comment 26.

COMMENT: GAO was provided with the mission critical threads that represent the "as-is" during the Y2K exercise. We will gladly provide them again in their current status. The comment on need for modification is simply a caveat to be considered when reviewing the data.

See comment 27.

DOD Does Not Have a Departmental Logistics Management Enterprise Architecture - page 27
DLA has been tasked with leading the consortium because, according to the Director, his office does not have the staff or budget to lead it.

COMMENT: The consortium leader is the Director, LSM. His staff and the consortium members provide support to the effort.

See comment 28.

DOD Does Not Have a Departmental Logistics Management Enterprise Architecture - page 28
Without an enterprise architecture, there is no common understanding of the nature and content of the change, and thus nothing to guide and constrain investments.

COMMENT: Although an enterprise architecture would be useful, it is false to state that there is no common understanding without one. Reference our above comments regarding DRID 48 and DoD Directive 8190.1 which put in place and modernize the long-standing DoD processes for achieving common understanding of business rules changes and their data and system implications. DLMSO products also include the protocols and standards necessary to implement the business rules. The plans produced under DRID 48 provide a common road-map for implementing modernized community services and interoperability. Collectively, these artifacts can provide a firm basis for the traditional oversight methods cited in the report. However, having an architecture would provide a more efficient and effective means for developing and overseeing the implementation of a common vision.

GAO Comments

1. We agree that the BSM program should not be held "hostage" to the architecture and that the program and the architecture can proceed in parallel, but only to a point. As we have recommended, this point is the start of the next BSM increment, which according to DLA is August/September 2002. Our recommendation affords DLA ample time to develop and use the missing architectural definition without delaying the program.

2. We disagree that this report draws conclusions about the program's "overall" risk based on a single risk factor. Our report is not intended to and does not provide a comprehensive BSM risk profile. Rather, it identifies important risks associated with the two IT management controls that were the focus of our work: (1) the use of an enterprise architecture and (2) the use of incremental investment controls. Further, while we acknowledge that DLA has taken risk mitigation measures, as cited in the draft report provided to DOD for comment, these measures are not a sufficient substitute for having an explicit enterprise architecture and effectively using it to guide and constrain modernization investment decisions. At most, they should be viewed as temporary controls until the architecture is available. In fact, while DOD believes that it cannot delay modernization, it nevertheless states in its comments that it supports the need for enterprise architectures and the integration of these architectures into its investment management processes.

3. We agree that one should not conclude from this report that there is unacceptable risk associated with modernizing systems while developing an enterprise architecture. We also agree that there are risks associated with delaying modernization. Accordingly, our recommendation strikes a reasonable balance between the need for an architecture and the need to modernize legacy systems by allowing DOD to continue modernization while it develops an architecture. However, it does not allow the two to proceed in parallel indefinitely, because the longer DLA proceeds without an architecture, the greater the risks will become.

4. We do not disagree and our report does not question the use of an ERP solution. Our point is that DLA has yet to define its end-state enterprise architecture and therefore cannot be sure that it is implementing its chosen ERP solution in a manner that will not suboptimize DLA enterprisewide performance and accountability, in order to optimize performance and accountability of one business area.

5. See comments 1 and 2. Also, we do not agree that BSM is currently guided by sound architectural discipline. Such discipline would be evidenced by the existence and use of architectural artifacts developed in accordance with the practices outlined in CIO Council guidance.[1] While we acknowledge the existence of some enterprise architecture information, as cited in the draft report provided to DOD for comment, and state in this report that that information would be valuable and useful in building a DLA-wide architecture, the fact remains that DLA does not currently have such an architecture.

6. We acknowledge that the Deputy Under Secretary of Defense for Logistics and Materiel Readiness has pursued risk-reducing strategies, as noted in this report. However, they are not a sufficient substitute for a DOD-wide logistics architecture.

7. We agree. The incremental investment actions described, if effectively implemented, are consistent with our recommendations.

8. See comments 1 and 2.

9. See comment 1.

10. We generally agree. The activities described in the comment are the very activities that we recommend as conditions for investing beyond the first increment. Further, it was not our intent to suggest that only the BSM program manager should measure and use actual benefit accrual or that one increment must be fully completed and fully evaluated before another can begin. In fact, effective incremental investment management necessitates some overlap among increments, and our recommendations do not preclude this. On the matter of who should measure and validate actual benefit accrual, we are not opposed to DLA assigning this responsibility to someone other than the program manager, and we acknowledge that the program manager is not the appropriate person to ensure that investment decisions on subsequent increments are based on economic justifications. Accordingly, we have slightly modified the recommendation and clarified language elsewhere in the report to reflect this.

11. We agree. We have changed the title of the report.

[1] *A Practical Guide to Federal Enterprise Architecture*, *Version 1.0*, Chief Information Officers Council (February 2001).

12. We disagree. The statement in our report is supported by DLA's draft Enterprise Information Architecture Plan, which clearly shows that the initial component of DLA's enterprise architecture will be, by design, limited to the materiel management business area. The plan also shows that DLA's other business areas are to be incorporated into the enterprise architecture following completion of the BSM program, which, according to BSM documents, is 5 years from now.

13. Our report has given the department credit for its DOD Logistics Strategic Plan, as well as Joint Vision 2020 and other strategic planning directions. However, as previously stated, these plans are not a sufficient substitute for an effective DOD-wide logistics management enterprise architecture. Moreover, in its comments, DOD states that having an architecture-based approach to investing in modernized systems is a more efficient means to optimizing enterprise performance and accountability. DOD also states that having an architecture would provide a more efficient and effective means for developing and overseeing the implementation of a common vision.

14. We disagree. While we have recognized these "interim measures" in our report, our position is that these are just what DOD terms them—temporary controls until DOD has in place the architecture-based approach to modernization that its comments state are needed to achieve end-to-end optimization. See also comment 3.

15. We disagree. Notwithstanding DLA's recent commitments to incrementally invest in BSM, DLA has so far treated BSM as a single investment decision. The economic analysis used to justify DLA's decision to invest in BSM is dated April 2000, and this analysis was for the entire program. We requested any further economic analyses developed to justify the ongoing BSM increment as well as any plans to produce such analyses. DLA did not provide either. In June 2001, DLA provided an updated economic analysis, dated March 30, 2001, which continued to treat BSM as a whole. DOD's comments are consistent with statements made by BSM officials at the conclusion of our review, which were cited in the draft report. We are encouraged by DOD's comment that DLA will prepare a business case for each release and will include a projection of business process performance as well as a retrospective evaluation of empirical results of the program to that point.

16. We have modified our report to reflect this change.

17. We disagree. As we state in the report, enterprise architectures are essential tools for effectively and efficiently reengineering business processes and for implementing and evolving their supporting systems. Their development, implementation, and maintenance are recognized hallmarks of successful public and private sector organizations. Congress, OMB, and the federal CIO Council have recognized the importance of enterprise architectures.

18. We disagree. See comments 2 and 6. Further, our report does not state that the lack of an enterprise architecture will result in "bad" effects. Our report concludes that this lack increases the probability of such effects, and our report recognizes that other IT management weaknesses can also be contributing factors.

19. See comment 5.

20. See comment 12.

21. We disagree that our report implies that there is little interaction and consideration of the enterprise cataloging requirements. Our report refers to DLA's expectation that some aspects of other business functions would be included in the BSM blueprint. At the time of our review, however, DLA recognized that postponing some business functions might lead to disconnects, requiring later linkages between BSM and other business areas to produce an architecture with an enterprisewide scope. Our point is that because these functions are interrelated, it makes sense to construct an enterprise architecture to guide and constrain BSM implementation and thereby optimize DLA-wide performance and accountability.

22. See comments 2 and 21.

23. See comment 13.

24. We have modified the report to reflect this comment.

25. We have modified the report to incorporate the additional context provided in this comment and to recognize when efforts to develop a DOD-wide logistics enterprise architecture began.

26. We disagree that we have been provided a copy of the document defining the mission-critical logistics "threads" used in DOD's Year 2000 testing "in their current status." While we did receive in 1999 a

copy of the document defining these mission-critical logistics threads, the Director also told us that these were being modified in light of ongoing modernizations, and DOD's comments acknowledge that they have since been modified.

27. We have modified the report to reflect this comment.

28. See comment 23. Also, we have slightly modified the language of our report.

Appendix III: GAO Contact and Staff Acknowledgment

GAO Contact

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Acknowledgments

In addition to the person named above, Katherine Chu-Hickman, John Christian, Barbara Collier, and Greg Donnellon made key contributions to this report.

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