BLM Enterprise Architecture Summary Report

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Credits

Name	Title	Organization
BEA Team		
Colleen Coggins	Bureau Lead Architect	WO-501
Chris Hamilton	Deputy Manager, Land & Resources Project Office	WO-330D
Renee Duval	Wyoming CIO - OR - Natural Resource Specialist	WY-957
John Broderick	Senior Economist, IRM Advisor	WO-300
Jim Rolfes	IRM Advisor	WO-600
Melanie Rhinehart	SCO Data Manager	WO-570
Jim Colby	Strategic Planner	WO-200
Ruth L. Welch	Management Analyst	WO-501
Robert DeViney	Chief of Branch of Realty and Records Services, Oregon State Office	OR-958
Clark Collins	IRM Advisor, HR and EEO	WO-700
Duane Dippon	ARD/GIS Specialist, Oregon State Office	OR-933
E. K. James	Senior Quality Specialist	WO-830
Pat Green	Senior GIS Scientist	WO-210
Michael Garratt	Manager, Systems Engineering	WO-500
John Singlaub	Field Manager	NV-030
Rick Tholen	Forest Health Program Manager (Fire)	WO-230
Jim Turner	E-GIS Program Manager	ST-131
Jim Horan	Bureau Data Administrator	WO-560
Daryl Koncer	Management/Program Analyst	WO-830
BEA Advisors		
Kit Muller	Special Assistant to the Director	WO-101
John W. Foster	System Coordination Office Manager	WO-570D
Joseph C. Chesser	DOI Oversight, Office of CIO	DOI
Don Hinrichsen	Deputy State Director (DSD), Support Services	AK-950
Other Contributors		
Systems Engineering ITAT Group		
Subject Matter Expert Session Participants (per appendix in full report)		
System Coordination Office		
Dozens of individual contributors throughout the BLM not listed		
SOZA Team		
Mike Kraft	Senior Business Process Analyst	SOZA
Chris Ervin	Business Process Analyst	SOZA
Tom Chatfield	GIS Business Process Analyst	SOZA
Trilby Hunt	Project Repository Administrator	SOZA
Brian Price	Senior Business Process Analyst	SOZA
Bill Snead	Data Architecture Analyst	SOZA
Brent Lambert	Senior Technical Architect, Applications & Technology	SOZA
Bob Perkins	Lead Senior Data Architect	SOZA
John Taylor	Enterprise Architect, Project Manager	SOZA
Kitty Boehs	Senior Systems Analyst, Data	SOZA
Charles Davis	Information Engineer Architect, Data	SOZA
Jeanne LeFevre	Vice President, Systems Integration Group	SOZA

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I. Executive Summary

BEA—Active Agent for Supporting Changing Business Needs

For the BLM Enterprise Architecture (BEA) to be successful, it must support the goals, strategies and business needs of the Bureau of Land Management (BLM). An understanding of the challenges and business priorities of the BLM over the next several years is essential for proper alignment of the BEA's overall direction and ensuing actions. We must also understand the priorities of an organization may change overnight. The September 11 terrorist attacks on our country made this very evident. Yesterday's business priorities may not be today's, and both the BLM and its BEA must adjust accordingly.

The BEA provides the road map for guiding the BLM's information technology (IT) investments in order to meet its business needs. It also provides a tool for supporting business process improvement and redesign. A close alignment and interface with process owners, BLM managers, and executives and their needs is crucial to understanding all aspects of the challenges the BLM is facing. This is the first step in leveraging technology to meet these challenges.

BEA—Making the BLM's Outreach Message a Reality

The BLM Outreach Message, which is based on the fiscal year (FY) 2002 budget, identifies four specific focus areas:

- ***Energy, Minerals, and Rights-of-Way***—We recommend the BLM strengthen its energy and minerals programs in order to combat America's energy shortage and promote the dependable, affordable, and environmentally sound production of energy. The processing of right-of-way (ROW) applications, which currently suffer from backlogs, is a dependent process in delivering local energy.
- ***Urban Interface and Community Support***—Western towns and cities near once-remote BLM lands are expanding and growing and the use of BLM lands for recreation is increasing. As a result, the BLM must significantly strengthen and update its land use plans (LUPs). This is the backbone of the process needed to make sound resource decisions. Updated planning is also needed to enable energy development and ROWs.
- ***Critical Resources Protection***—The BLM can effectively manage and protect critical resources by carefully identifying land management priorities. This will aid in maintaining the health of the land for a variety of public values such as watershed protection, exotic weed control, and abandoned mine restoration.
- ***Special Areas***—Specific western public lands that include spectacular landscapes have been designated for special management by the Congress and the President. The BLM welcomes the public interest and looks forward to working with State, local, and tribal governments; local businesses and conservation groups; and the general public in developing land use plans for each of these newly designated areas.

An analysis of these focus areas suggests several key messages the BEA staff must integrate into its architecture priorities and direction. In the coming year, the BEA staff will emphasize planning- and energy-related business processes in its efforts to support the achievement of the above priorities. Several findings and recommendations included in this report identify areas for

potential process improvement, improved data access and use, and proposed application components. All of these are critical mechanisms in ensuring the success of the BLM's goals. The BEA staff looks to the Outreach document and other sources, including the Department of the Interior (DOI) and BLM strategic and annual performance plans, to help it gauge the business drivers the architecture must successfully accommodate.

BEA—FY-2002 Focus Areas

This report contains several general and specific findings and recommendations based on analysis of the information flow modeling sessions and accompanying subject matter expert notes, analysis of data requirements and existing data redundancies, and a review of how well our current national applications support existing business needs. Based on these analyses, we recommend the BEA staff concentrate on several specific focus areas in FY02. These areas are described in Table I-1 below.

Architecture Layer	FY01 Findings	FY02 Focus
Process	Analysis of models indicates areas for process improvement in: ♦ Perform Planning ♦ LUP ♦ Authorize Use (Manage Land Use Activities) ♦ Application for Permit to Drill (APD) ♦ ROW	♦ Partner with process owners to provide reengineering expertise to improve business processes. ♦ Recommended focus of reengineering efforts should follow Pareto's 80/20 rule. Focus resources in areas where most improvements can be made. ♦ Reengineered processes will be captured as "Target Process Model" in BEA repository.
Data	♦ Data redundancy, sharing, and quality areas have been identified in existing applications through the Corporate Metadata Repository (CMR). ♦ The BLM has gained knowledge of how data is used (e.g., create, read, update, delete) at the data class level for the BLM's business processes. This knowledge can be used to further the data standardization process and improve data quality.	♦ Partner with business process owner, Data Stewards, and Data Administrators, in accordance with the WO-200-sponsored data management plan, to plan, prioritize, and implement standardization. For example, this effort will provide support to the IT for a LUP business case, which, if approved, will be a significant BLM investment. ♦ Capture other data modeling and standardization efforts underway and integrate into the BLM's Target Data Architecture. ♦ Develop a web-based searchable database to publish the BLM's national data standards through the corporate metadata repository.

Architecture Layer	FY01 Findings	FY02 Focus
Applications	♦ Analysis of models and existing applications indicates areas for crosscutting application components and data stores. ♦ Project managers need assistance in reengineering business processes, particularly for major IT application system development efforts.	♦ Seek sponsorship and assist sponsor in developing business cases for the following crosscutting applications and enterprise data stores: ♦ Customer name and address ♦ Corporate document management system ♦ Continue data gathering and analysis of applications architecture (e.g., planned retirement/upgrade/replacement of existing apps.) to provide migration strategies from existing "As-Is" to Target Applications Architecture. Provides a plan for transitioning the BLM's application portfolio to a defined target. This is an iterative effort that will grow over time.
Technology	♦ Future infrastructure requirements including network bandwidth are dependent upon emerging business needs.	♦ Leverage existing Enterprise Architecture Infrastructure project in concert with the National Operations Center to undertake a BLM-wide infrastructure requirements analysis.
Consolidation	♦ A conceptual Target Architecture approach has been developed that promotes reusability in data and program logic.	♦ Continue to evolve the Business-Driven Target Architecture that integrates the PDAT layers into a comprehensive approach with migration strategies that move the BLM from its stovepiped "As-Is" architecture. This is an iterative approach that will grow with time.

Table I-1. FY01 Findings and Recommended Focus Areas for FY02.

As indicated above, our analysis of the BLM's existing business processes, associated data requirements, and current automated applications points to several opportunities where the BEA staff can make positive, tangible business improvements. For example, we recommend the staff partner with the Project Manager for LUP. The goal would be to establish standard implementation and tracking processes and mechanisms for approved land use plans at the national level. Some of the recommendations in this report are already being pursued through recently approved business cases such as providing information technology support for LUP. The BEA staff will partner with the business proponents to provide support in business process transformation and data standardization. The staff will also guide efforts to develop applications that can be integrated into the BLM's target architecture.

In this report, we present a conceptual target architecture that will promote the reusability of program logic and data. We also offer the initial components of this target architecture for implementation. This target architecture will provide an evolutionary, rather than a revolutionary, approach to migrating the BLM's enterprise architecture (EA) toward its defined vision while emphasizing integration with the BLM's existing legacy systems.

BEA—2001 Overview of Summary Report

Finally, as you read this Summary Report of Version 2 of the BEA, you will find discussions of the following topics:

- A summary of the history of the BEA project, with a description of the modeling methodology used.
- A description of the emergence of and transition to a target BEA, moving from a picture of today to a vision of the future.
- A detailed presentation of our recommendation for a Component-Based Applications Architecture—founded on the principles of software reuse and a common data repository.
- General and specific Findings and Recommendations, including 20 actions for review.
- Planning and scheduling considerations.
- A discussion of Architecture Governance, a guide to making "good" IT investments.

Of all of the accomplishments of the BEA Core Team thus far, the most significant is the understanding of the need to adopt a component-based applications architecture where reusability of data and program logic can be put to good use. This understanding underpins most of the other Findings and Recommendations contained in this report.

As with all documents of this nature, the scope of the recommendations may seem daunting at first. However, improving the BLM's business processes is imperative to the health of the enterprise. Improvements will be implemented one step at a time, with reusability, reengineering, and teamwork foremost.

II. Introduction

The discussion that follows in this Summary Report addresses the BLM Enterprise Architecture (BEA) in a holistic manner. It identifies drivers within the Federal Government for enterprise architectures (EA), defines the term as it is used within the Federal Government, and differentiates between current and target BLM architectures. It also describes the critical relationships among EA, agency-level strategic planning, and capital investment planning. The discussion highlights the accomplishments of the BLM Core Team to date, and addresses how those accomplishments might lead to future efforts. Recommended future efforts are proposed based on specific findings resulting from past efforts.

Two themes are emphasized throughout this report: (1) institutionalizing the integration of the BEA with IT investment management, including capital planning investment procedures, and (2) evolving a component-based applications architecture where reusability can be used to support future BLM business requirements. In support of the evolution toward a component-based applications architecture, we recommend the BEA staff concentrate its recommended efforts over the next year in the following areas:

- Creation and implementation of data standards in specific functional areas.
- Business process transformation in specific functional areas that meet high-priority program needs, such as Land Use Planning (LUP), Application for Permit to Drill (APD), Expression of Interest (EOI), and Right of Way (ROW).
- Evolution and definition of a Target Architecture.
- Development of a sequencing plan to migrate from the current BLM architecture to the target architecture.

III. Background

A. Purpose

The purpose of this Summary Report is to communicate major findings from the analysis performed on information collected to date and, more important, to present recommendations for enhancing the current environment while simultaneously moving toward an improved target environment.

B. The BLM Enterprise Architecture

The BLM's business is to manage public land and resources. To manage the land and resources effectively, the BLM needs to manage information about both those resources and its customers. Understanding and improving the BLM's business processes, data, and supporting applications are crucial in managing that information. The BEA effort is the primary vehicle used by the BLM to analyze and document its processes, data, applications, and technology infrastructure. The analysis, in turn, leads to recommendations that translate into improved business-driven land- and resource-management decisions.

The method used to organize and analyze the BEA focuses on four discrete but interrelated enterprise areas: business processes, data, applications, and technology (the enterprise's infrastructure). Whereas architecture should always be viewed as whole, and not just broken down into discrete areas, the analysis also addresses a "consolidation" area that draws together each of the four areas. In abbreviated form, the four areas are referred to as "PDAT," which represents:

- **P**rocess,
- **D**ata,
- **A**pplications, and
- **T**echnology.

The four areas are related as indicated in Figure III.B-1.

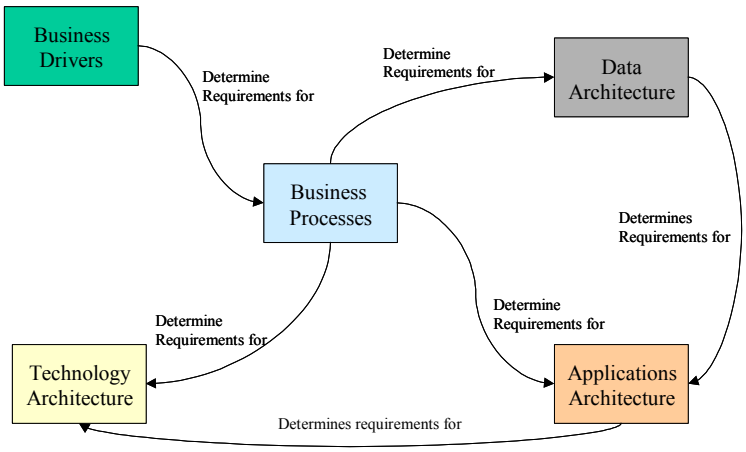


Figure III.B-1. PDAT Relationships

In short, the BEA is a representation of all the BLM is and does. With both what the BLM is and, in particular, how it performs its work change over time, the BEA is an evolving representation of the BLM—as the BLM changes, the BEA must also change. One of the most important reasons for developing and maintaining an EA is to support change management within the enterprise. As knowledge about the enterprise increases and is captured in the EA, change management becomes a more manageable task. EA efforts necessarily begin with a high-level understanding of the enterprise's processes, data, applications, and technology. Ultimately, the goal is to understand each of these areas in detail. Any information that is not fully known and understood requires an assumption—increasing the level of uncertainty during the decision-making process. Although the architecture typically focuses on technological change, it also supports business process improvement and change independently of technology.

The BLM initiated action in FY99 to develop its BEA to align its information technology more effectively with the needs of the BLM business programs. Version 1.0 of the BEA, published in March 2001, focused on depicting the BLM's current environment. This Summary Report of BEA Version 2.0 is a continuation of that initial effort and builds on the findings and recommendations included in the Version 1.0 report with more detailed findings and recommendations. It adds to the understanding of the current environment and presents a conceptual target environment. A key focus of the BEA effort over the next year will be to use the target environment concept to design critical elements of the target environment.

Development of the target environment will set the stage for a gap analysis to determine more precisely what needs to be done to move from the current environment to the desired target environment. The gap analysis also provides the basis for developing a multi-year transition. The transition plan, in turn, provides input to the BLM's IRM planning efforts and serves as the basis for capital investment planning.

C. ALIGNMENT WITH THE DOI ARCHITECTURE VISION

The Department of the Interior (DOI) recently published a Common Requirements Vision (CRV) that will provide the basis for the development of the DOI Enterprise Architecture. This vision document is used to ensure the DOI's IT products and services are aligned with the business community's strategic direction. It was derived from executive and management interviews, reviews, and analyses of strategic plans at the DOI and Bureau levels. This document identifies the following focus areas in technology, based on environmental trends and DOI business strategies:

1. Improve data management systems (e.g., policy and procedures relating to data standards, data privacy, data security, etc.).
2. Encourage innovation in our products and services by keeping abreast of and applying new technologies and work practices.
3. Use new collections management software to improve the efficiency of inventory data entry and management.
4. Develop reusable, consistent, and sharable components (e.g., standards, guidelines, procedures, etc.) for the Information (Interior-wide) Architecture Service Areas.
5. Complete implementation of an off-the-shelf software product with improved functionality and ad-hoc reporting capabilities to enable the DOI to consolidate tracking of material

weaknesses (both program and financial management) and OIG, GAO and Single Audit recommendations and provide for direct Bureau updates on the status of corrective action and implementation activities.

6. Respond to the increasing need for faster, more complete access to information by Interior personnel to improve service delivery, worker productivity, and management of public resources.
7. Address the increasing demand for the capture, electronic storage, delivery, and archiving of Interior resources (including those currently paper-based).
8. Close the growing gap between the cycles of technology evolution and the planning, budgeting and procurement cycle within government (e.g., acquisitions are often obsolete before deployment).
9. Align the BLM's architecture direction with the Department's IT focus areas. For example:
   - ▲ Data is a key BLM focus area, as demonstrated in six recommended actions to be taken to improve the quality, access, and storage of data.
   - ▲ Reusable components are used where appropriate in BEA's target, component-based architecture.
   - ▲ Standardization is a recurring theme throughout this document.
   - ▲ The BEA approach is one of evolution. Architectural integrity, completeness, and currency must be maintained or these efforts will not achieve their intended results.

The BEA staff fully supports each of these areas and will continue to implement them in a proactive manner.

D. VALUE OF ENTERPRISE ARCHITECTURE (EA) TO THE BLM

The Clinger-Cohen Act of 1996 requires each federal agency to have an EA. The value of an EA to the BLM goes far beyond meeting statutory requirements. In its higher-level versions, the BEA provides the BLM's management with information for making and justifying critical business decisions, e.g., where business processes should be transformed to gain greater efficiencies, how to make information more accessible to both the public and managers, or how best to invest IT resources to achieve the highest possible return on investment.

In addition, in its more detailed versions, the BEA will provide essential information enabling the BLM to do the following:

- ❖ Transform business processes into more efficient work efforts.
- ❖ Standardize data within the BLM.
- ❖ Design more efficient use of applications for automating work processes and sharing data between those processes.
- ❖ Design, develop, or procure specific technological solutions.

Figure III.D-1 depicts how the BEA effort is integrated with and supports strategic planning, capital investment management, and acquisition capability within the BLM.

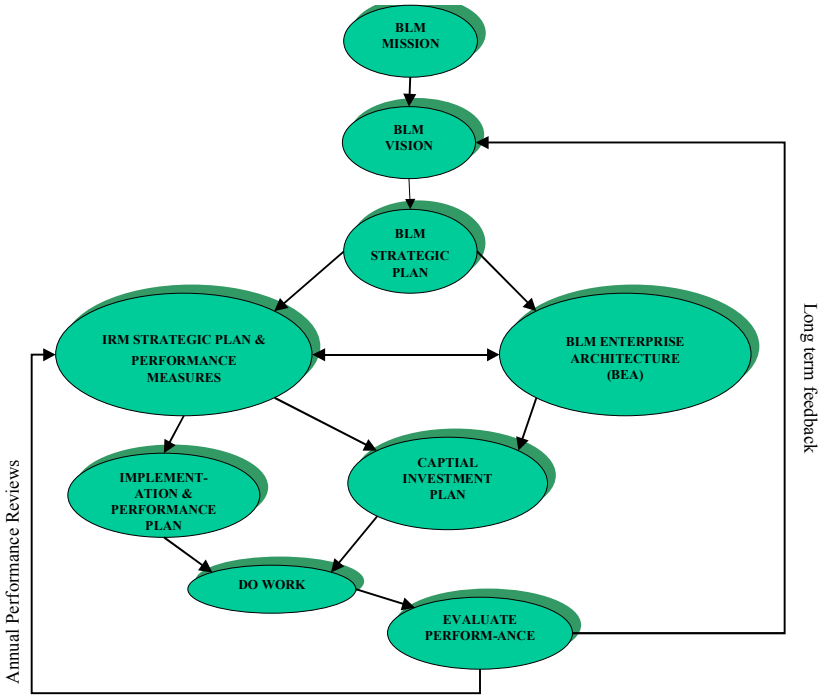


Figure III.D-1. Integration of the BEA with Strategic and Capital Investment Planning.

Figure III.D-1 indicates the BLM's strategic plan and resulting business requirements should drive the BEA. This is already happening within the BLM, as shown by the concentration of recommendations (see Section V) dealing with applications for permit to drill (APD), rights-of-way (ROW), and land use planning (LUP). The BLM's 2002 Budget Justifications repeatedly mention the growing importance of those three processes in meeting emerging demands for BLM land use.

The recommendations included in Section V of this report respond directly to the focus areas cited in the 2002 Budget Justifications. These areas identify critical business requirements within the BLM. The analysis of the "As-Is" BEA identified similar critical business requirements. We have responded to them with practical evolutionary steps that will enhance the BLM's ability to improve both the efficiency of its relevant business processes and the quality and accessibility of the information necessary to meet customer needs and support sound decision-making.

E. BLM INITIATIVES

Over the past year, the BLM has initiated action in three broad areas. The BLM will: (1) continue development and analysis of the current BEA in terms of business processes, data, and applications; (2) integrate the BEA with the strategic and capital investment planning and budget priorities; and (3) develop a concept of a target BEA environment toward which the BLM can migrate. These three initiatives have led to numerous specific accomplishments summarized in Table III.E-1.

Initiative	Accomplishments
1. Continue development and analysis of the current BEA.	♦ Expanded knowledge of the BLM's business processes through subject matter expert (SME) sessions. ♦ Identified areas where current process models suggest opportunities for process improvement. ♦ Developed a streamlined target process model that consolidates nine Activity-based Costing (ABC) process areas into six. ♦ Mapped high-level data classes to business processes. ♦ Identified data quality issues through the corporate metadata repository (CMR) to use as a basis for improving the BLM's data. ♦ Inventoried 26 national applications and mapped them to processes and data.
2. Integrate the BEA with strategic planning and capital investment planning.	♦ Established architecture alignment criteria for evaluating business cases. ♦ Evaluated business cases for architectural conformance and made recommendations to the Information Technology Investment Board (ITIB).
3. Develop a concept for a target BEA environment.	♦ Defined concept for a component-based applications architecture to guide future applications development efforts.

Table III.E-1. Initiatives and Accomplishments.

Of all the accomplishments thus far, the most significant is the understanding of the need to adopt a component-based applications architecture that provides for the reusability of both data and program logic. It became clear, during analysis of the current BEA, that the present situation regarding both data and existing applications needs to be changed if the BLM is to improve its ability to make information available to its customers and managers. Applications in the current environment have limited sharing of appropriate data, resulting in redundant data of reduced quality. The component-based applications architecture, which will continue to reflect PDAT, will provide a means to correct this situation as well as the opportunity to further enhance the automation available to the BLM's business processes. Figure III.E-1 compares the characteristics of the current and target environments.

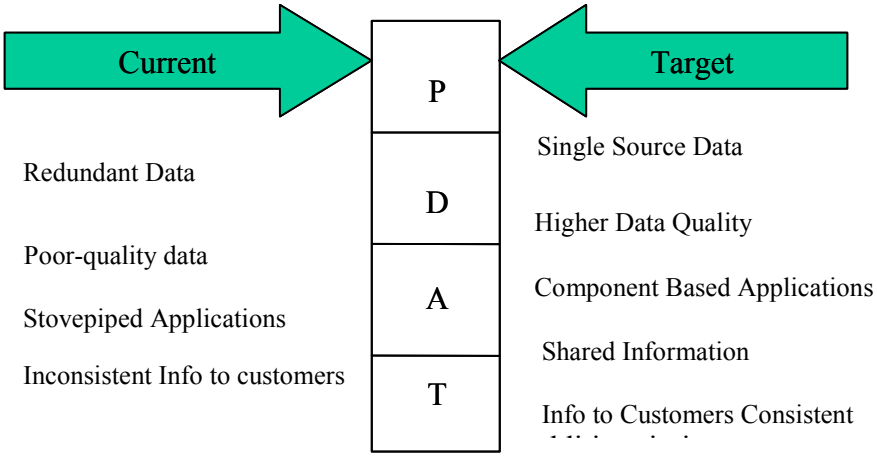


Figure III.E-1. Characteristics of Current vs. Target Environments.

F. BLM ACCOMPLISHMENTS

Defining the Baseline Architecture

In FY 2001, the BLM made substantial progress in defining its baseline, or current, architecture. This is the first step in developing an enterprise architecture (EA). The current architecture allows future progress to be measured against an established baseline. The old saying "You don't know where you're going if you don't know where you've been" is also true for architecture development. The first step is to establish a set of architectural products that describe and document the current state of the enterprise, from business functions to technology infrastructure. This sets the stage for establishing a plan for moving toward, and measuring progress against, a "To-Be" architecture.

> ***"In building the EA, a logical first step is describing the current or "As-Is" state."***
> **—A Practical Guide to Federal Enterprise Architecture (2/2001)**

Process Layer

For an architecture development effort to be successful, it must be driven by the needs of business, not those of technology. Architectures driven by technology are akin to a solution looking for a problem. We must first understand the BLM's business processes. This understanding, in turn, enables us to define data, applications, and technology requirements.

> ***In order to improve our business processes, we must first identify them.***

The first step in building a business-driven architecture is identifying the current business processes. Dr. Michael Hammer, a well-known expert in business process reengineering, stated: "Only processes can be reengineered. Before you can reengineer your processes, you must identify them." This statement holds true for any process improvement effort. To improve our business processes, we must first identify them.

BLM expanded the definition of its current business processes in FY01 through the use of facilitated subject matter expert (SME) teams. These teams included representatives from program offices at the field, State, and headquarters levels. Each SME team furthered the documentation of the BLM's business processes by identifying "What We Do" in relation to a specified business subject area. These process models pinpointed potential areas for business process improvements and reengineering efforts. We analyzed them to define the following needs:

- Opportunities to streamline and improve the BLM's business processes
  - Duplication of processes that "touch" same/similar data
  - Overly complex processes
- Areas where business processes are not well established, resulting in:
  - Inconsistent business practices
  - Inconsistent results

The BLM has used the Activity-based Costing (ABC) model, which originally included nine business subject areas, to further define and analyze its business processes. Based on the input of the SMEs and the analysis of the ABC-derived process model, the BEA Team has realigned the business processes into a model with six business subject areas for the target business process architecture. The target process model eliminates duplication and will better support business process redesign. Process owners may use these models as a baseline for future process improvement and reengineering efforts.

Each level of decomposition, or breakdown, in a process model provides the BLM with increasingly more detail about its business processes. Figure III.F-1 shows the level of decomposition modeled for each business subject area by the end of FY01.

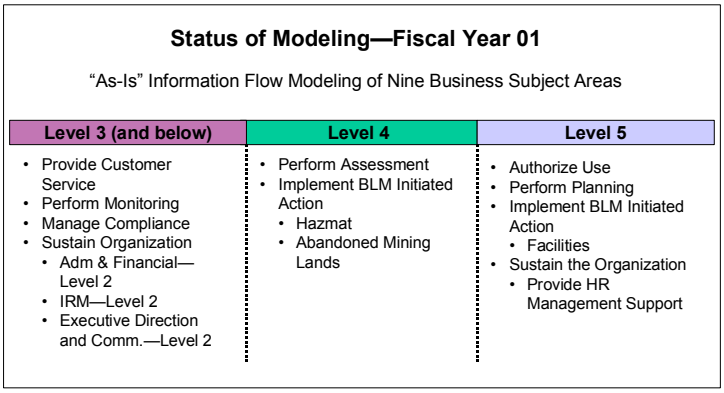


Figure III.F-1. Decomposition Levels by Business Subject Area.

Data Layer

Data is the "Rosetta Stone" of architecture. This includes ownership, integration, integrity, quality, reuse, security, privacy, and use of the data. All of these areas must be addressed, both within each process and across processes. Access to information, from the backbone network to the privileges afforded BLM personnel and the general public, must be provided for within the framework of the architecture.

Business processes drive data requirements. Data is a key layer in defining the BEA. The BLM leveraged information from prior data modeling efforts (e.g., its 1989 enterprise data model) to expedite the definition of its enterprise data architecture. As this new model is further refined, it will become a critical component in guiding future application development efforts intended to minimize existing data redundancies and guide corporate data standardization efforts. Architecture outputs at the data layer include:

We have a better understanding of what data is used by our business processes, which will aid in minimizing data redundancy and improving data quality.

- Enterprise-wide Data Requirements
- Existing Data Redundancies within National Applications
- Existing Data Quality Issues
- Areas for Standardization Recommendations

Mapping Data to Business Processes

This year, the BLM mapped approximately 90 data classes to 260 business processes. This helped the BLM to improve its understanding of how data is used in the organization and to determine the data used by each business process. That data can be divided into classes and elements.

A data class is a high-level grouping of data. For example, Case Information is a data class, while application information, case action information, and case status information are examples of data entities within that data class. Through this better understanding of the data used by its business processes, the BLM will be able to minimize data redundancy.

In mapping data to processes, the BLM examined whether data was **C**reated, **R**ead, **U**pdated, and/or **D**eleted (CRUD) by business processes. Multiple business processes that create the same data result in data redundancy, which leads to additional data storage needs and potential data quality issues. Optimally, the BLM wants to create data once and reuse it where necessary throughout the BLM. From the CRUD matrix, the BLM has gained a better understanding of its data requirements as well as areas where data redundancy may exist. This matrix, an example of which is shown in Figure III.F-2, will be examined further and refined as necessary in FY02 to guide the continual definition of the BLM's target data architecture. Ongoing review and input of this matrix by its National and State Data Administrators, Data Stewards, and Bureau Data Administrator is essential. The CRUD matrix helped to identify some of the problems with the "As Is" business process model. The target business process model will minimize the problem of multiple processes creating the same data. This, in turn, will support improved business processes and better data management.

Business Process	Data Classes	
	Case	Case Action
Evaluate Environmental Hazard (EH)	**C**	**U**

Figure III.F-2. Example Extract from CRUD Matrix.

Investigating Data within Existing National Applications

As the BLM defines its target architecture, information about the current state of its automated data becomes crucial. The Corporate Metadata Repository (CMR) is the BLM's prime source of metadata for non-spatial national applications and the reference point for BLM-wide data standards. Combining this information with the CRUD matrix cited above provides the BLM with the information needed to convert the current systems to an architecture enabling access to shareable enterprise data. While progress is being made to adopt spatial data standards, spatial data is not currently being stored in the CMR. Thus, the efficient integration of spatial and textural data is still absent.

Thirty-two national applications, including those listed in Table III.F-1, have been loaded into the CMR by the Data Management Team in the System Coordination Office (SCO). The team examined this database to provide information associated with data quality and redundancy issues. The Data Management Team works closely with the BEA staff in defining the BLM's

target data architecture. The implementation of the BLM's target data architecture will adhere to the products of the Data Management Plan currently being implemented under the sponsorship of WO-200. This plan outlines the roles, responsibilities, and processes for managing data and establishing enterprise-wide data standards within the BLM.

System Name	Acronym	Database Loaded
Alaska Land Information System	ALIS	Yes
Automated Fleet Management System	AM	Yes
Automated Fluid Minerals Support System	AFMSS	Yes
Bond and Surety System	BSS	Yes
Cadastral Survey Field Notes Index System	CSFN	Yes
Collection and Billing System	CBS	Yes

Table III.F-1. Sample of Information Available in the Corporate Metadata Repository.

Applications Layer

Beyond examining applications from a data standpoint, 26 national applications also were analyzed to determine the "As-Is" business processes supported. Although they represent only a subset of the total national applications, we have used this analysis as a starting point in determining gaps and overlaps in the BLM's current applications architecture. During FY01, 123 business processes and 32 data subject areas were mapped to the applications evaluated. Gaining a better understanding of the national applications will lead to solid transition strategies as the target architecture is defined. National applications nearing the end of their life cycle will be reviewed for transition to the target architecture.

Table III.F-2 presents sample findings from the survey of national applications conducted in FY01.

Application	Finding
Alaska Land Information System (ALIS)	♦ Supports 19 processes across seven ABC areas ♦ Privately stores data from 17 data subject areas (DSAs) and shares data from 1 DSA
Automated Fluid Minerals Support System (AFMSS)	♦ Supports 25 processes across five ABC areas ♦ Privately stores data from 15 DSAs
Collection and Billing System (CBS)	♦ Supports 24 processes across six ABC areas ♦ Reads and writes data from 11 DSAs. Data from eight DSAs are duplicated from or to another application. Data from the other three DSAs are in private data stores.

Table III.F-2. National Application Survey Findings.

Obsolescence reviews will be conducted in FY02 to focus on defining the target applications architecture.

Technology Layer

The Technology Layer consists of the BLM's IT infrastructure—its hardware, communications systems, and operating systems. The infrastructure is literally the backbone of the enterprise. It is the structure enabling the applications to provide and manage information required by the business processes.

The Technical Reference Model (TRM) is a cross-cutting element, affecting all components of the BLM Enterprise Architecture (BEA). It identifies and describes the information services used throughout the BLM and the standards profiles that have become the cornerstone of interoperability within the BLM. During the past year, Volumes I and II of the TRM have been published. The TRM will be updated regularly to reflect business-driven requirements and improvements in technology.

IV. Emergence to a Target BEA

A. Migration from Current to Target EA

Analysis of the accomplishments of the past year provides a focus for activities in FY02 that will initiate the BLM's migration toward a target environment. The BLM now has a solid, high-level understanding of its current enterprise architecture. Analysis of that architecture has revealed potential areas for enhancement. Table IV.A-1 describes those findings and the focus they provide for FY02.

Architecture Layer	FY01 Findings	FY02 Focus

Process	Analysis of models indicate there are areas for process improvement in:
	♦ Perform Planning
	  ♦ LUP
	♦ Authorize Use (Manage Land Use Activities)
	  ♦ APD
	  ♦ ROW
		♦ Partner with process owners to provide reengineering expertise to improve business processes.
		♦ Recommended focus of reengineering efforts should follow Pareto's 80/20 rule. Focus resources in areas where most improvements can be made.
		♦ Reengineered processes will be captured as "Target Process Model" in BEA repository.

Data	♦ Data redundancy, sharing, and quality areas have been identified in existing applications through the Corporate Metadata Repository (CMR). ♦ The BLM has gained a knowledge of how data is used (e.g., Create, Read, Update, Delete) at the data class level for its business processes. It can use this knowledge to further the data standardization process and improve data quality.	♦ Partner with business process owner, Data Stewards, and Data Administrators, in accordance with the WO-200-sponsored Data Management Plan, to plan, prioritize, and implement standardization. For example, this effort will provide support to the IT for an LUP business case, which, if approved, will be a significant BLM investment. ♦ Capture other data modeling and standardization efforts underway and integrate them into the BLM's Target Data Architecture. ♦ Develop a web-based searchable database to publish the BLM's national data standards through the corporate metadata repository.

Applications	♦ Analysis of models and existing applications indicates areas for crosscutting application components and data stores.
	♦ Project managers need assistance in reengineering business processes, particularly for major IT application system development efforts.
		♦ Seek sponsorship and assist sponsor in developing business cases for the following crosscutting applications and enterprise data stores:
		  ♦ Customer name and address
		  ♦ Corporate document management system
		♦ Continue data gathering and analysis of applications architecture (e.g., planned retirement/upgrade/replacement of existing apps.) to provide migration strategies from existing "As-Is" to Target Applications Architecture. Provides a plan for transitioning the BLM's application portfolio to a defined target. This is an iterative effort that will grow over time.

Architecture Layer	FY01 Findings	FY02 Focus
Technology	♦ Future infrastructure requirements including network bandwidth are dependent upon emerging business needs.	♦ Leverage existing Enterprise Architecture Infrastructure project in concert with the National Operations Center to undertake a BLM-wide infrastructure requirements analysis.
Consolidation	♦ A conceptual Target Architecture approach has been developed that promotes reusability in data and program logic.	♦ Continue to evolve the Business-Driven Target Architecture that integrates the PDAT layers into a comprehensive approach with migration strategies that move the BLM from its stovepiped "As-Is" architecture. This is an iterative approach that will grow with time.

Table IV.A-1. Summary of FY01 Findings and Focus for FY02.

The BLM's target Enterprise Architecture (EA) will describe the environment toward which the BLM will migrate. Within each of the areas of the PDAT, some elements of the current architecture will migrate to the target environment, some will sunset, and other completely new elements will emerge. Figure IV.A-1 depicts this concept as endorsed by the Federal CIO Council in the Federal Enterprise Architecture Framework.

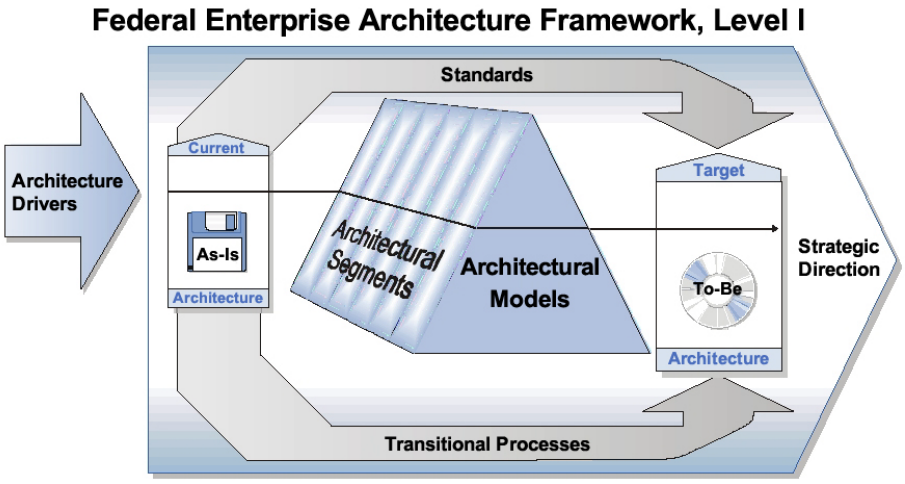


Figure IV.A-1. The Federal Enterprise Architecture Framework.

B. HIGH-LEVEL ANALYSIS OF THE CURRENT BEA

The current BEA is the product of the analysis and modeling of the BLM's current environment. It is structured in the four PDAT layers—business processes, data, applications, and technology. An analysis of each of these layers follows.

Business Processes

Business processes are identified and modeled to reflect the enterprise's activities, the relationships between processes and business drivers, the relationships among the processes themselves, and the information that flows between processes. The modeling to date has been based on the BLM's Activity-based Costing (ABC) model. This model was originally developed to employ active cost management in the BLM.

The ABC model consists of nine high-level processes that were broken down to various levels of detail, some of which are at the sixth and seventh levels, and further broken down into more than 1,200 processes. A review of those processes revealed an excessive number of redundant processes. For example, the first level of the "Use Authorization" process was broken down into 167 subordinate processes. Of those 167, there are 20 different sets of processes with the same name. This accounted for 66 of the 167 processes found in the model. In addition, five of the program elements within Use Authorization have the same set of subprocesses. Across the enterprise, 37 percent of all processes appeared to be duplicated in separate program elements. (See Initial Bureau Architecture (Version 1.0), Summary Report, page 46, for more detail.)

Participants in the SME sessions highlighted numerous examples of duplication and recommendations for change. Examples of their recommendations include the following:

- Merging Authorize Use with Implement BLM-initiated Action
- Combining all information collection processes
- Combining all planning processes
- Combining all analytical processes

Redundant processes are a symptom of the stove-piping of business activities among program elements. As typical of many organizations, this redundancy is the natural result of the historical development of the BLM. The problem has been exacerbated by new mandates and targeted funding allocations.

During the past two months, a new business process model has been developed presenting a more concise structure for analyzing the BLM's processes from an information management perspective. The new model is discussed further in the Findings and Recommendations section of this report. We expect this proposed new model will accelerate the analysis of the BLM's information requirements.

Data

We took two approaches (bottom-up and top-down) simultaneously to gain an understanding of the BLM's current data environment. In the bottom-up approach, 17 national applications identified in the CMR were reverse-engineered to identify the data used by those applications. More than 5,000 data entities were identified. One hundred and thirteen (113) data structures were identified as having properties that are independent of any unique application. As they are common to many BLM applications, they are candidates for component development.

In the process, we identified numerous Business Area Components. They may be grouped into the following major headings:

- Account
- BLM Administrative Area
- Case
- Customer
- Contract
- Document Management
- Geographic Location
- Organization
- Party
- Project
- State Relations
- Use Authorization
- Withdrawal

These Business Area Components are much too large to be architected into single components and would, therefore, be partitioned into several components as physical performance engineering requirements dictate.

The top-down approach to data modeling resulted in the development of an enterprise-wide logical data model with 13 data subject areas and more than 200 data entities. Previous data modeling efforts—for example, the 1989 Enterprise Data Model, 1991 Enterprise Data Model, and ALMRS data model—were reviewed. They served as a basis for development of the new logical data model, which now, in turn, serves as the basis upon which to build data models for specific functional areas.

Applications

We inventoried 26 of the 44 national applications listed in the Corporate Metadata Repository (CMR). Analysis of the information collected indicated the following:

- Of the 26 applications, 22 use at least some private data stores. The data in these stores is not shared with other applications. In fact, 14 of the 22 applications do not share any of their data.
- Thirteen of the 26 write customer data. Of these, seven write to private data stores.
- Six of the 26 write employee data. Of these, five write to private data stores
- Only four of the 26 applications automate a Level 3 business process. Most simply provide access to data.

Figure IV.B-1 portrays the current BLM applications architecture as gathered from system owners. Analysis of this graphic leads to several conclusions:

- A considerable amount of information flows between BLM applications and other Federal Government agencies and external organizations.
- Very little information flows between BLM applications.

Technology

Analysis of the technology layer was conducted in conjunction with the development of the Technical Reference Model Versions I and II. For further information on the analysis regarding this layer, please refer to those documents.

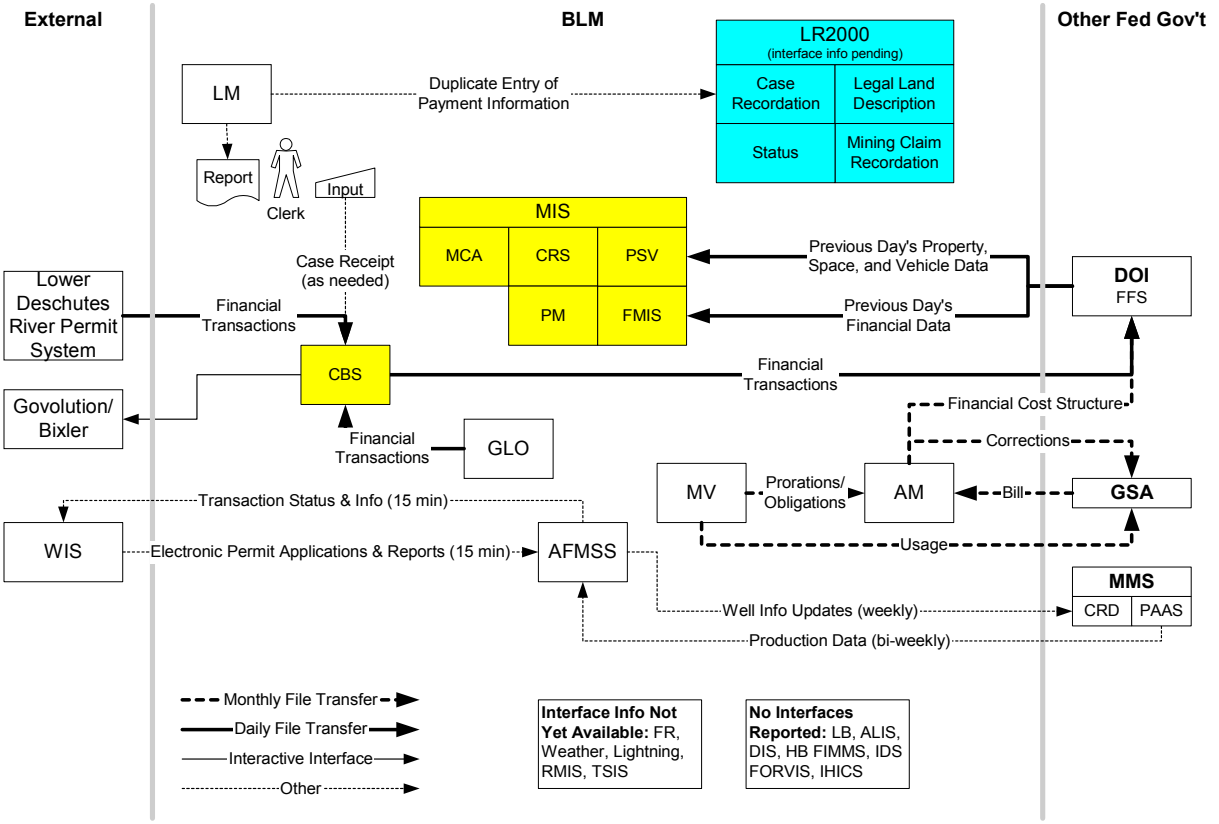


Figure IV.B-1. The BLM's Current Applications Architecture.

C. Concept for Component-Based Applications Architecture

One of the two major themes of this report is the potential value to the BLM of migrating to a component-based architecture. A component-based architecture provides a flexible software system in which newly created component-based services and features, including Commercial-Off-The-Shelf (COTS) packages, can be seamlessly integrated and manipulated by the existing system. That concept and its potential value to the BLM are discussed in this section.

A component is a reusable element of a larger system. It can be used by any application, running on any processor in the infrastructure, using data available from anywhere in the enterprise. In a component-based architecture, the applications contain pointers to components for reusable processes and data. Software is assembled rather than created. New applications are built from components that communicate with each other through well-defined interfaces. These components are individual pieces of software that provide specific functionality and may be executed together to achieve certain tasks.

In developing a component-based architecture, there are several objectives:

1. *Interoperability and plug and play.* Heterogeneous databases should be interoperable and easily integrated into the architecture.
2. *Scalability and extensibility*. Architecture components should be scalable, extensible, and easy to add to or remove from the architecture.
3. *Flexible*. The amount of data to be treated may be very large and should be able to be balanced by distributing the work among several components and machines.
4. *Transparent*. Users should be able to access different data sources in a transparent manner.

Achieving these objectives will result in numerous benefits to the BLM. For example:

- *Cost savings*. Because the components are reused and shared, their code has to be created only once instead of having to be recreated in multiple applications. This can dramatically reduce development costs.
- *Higher data quality.* The data used by the components becomes an enterprise asset. This helps to eliminate data redundancy.

Figure IV.C-1 depicts the concept of component-based applications architecture.

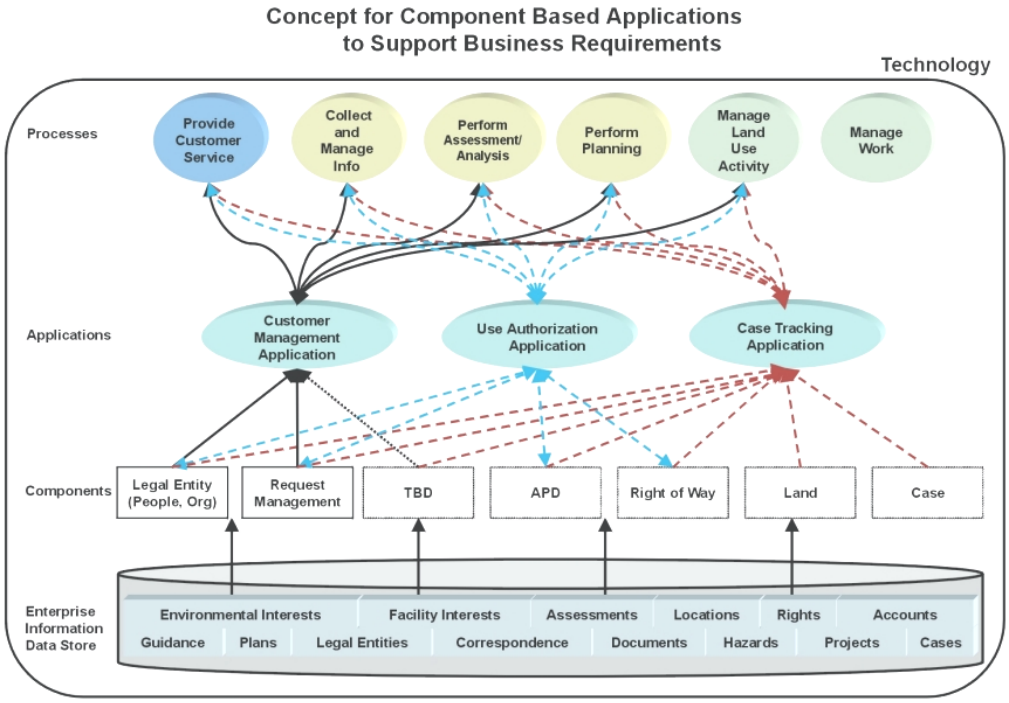


Figure IV.C-1. Concept for Component-Based Applications Architecture.

As shown in the figure, there are five types of elements in a component-based applications architecture. Starting at the bottom of the figure and working up, the elements include:

1. *Enterprise Information Data Store (EIDS).* The concept is based on quality data used as an enterprise asset and stored in an EIDS.
2. *Component*. Any number of reusable and shareable components that draw on standardized data in the EIDS can be created.
3. *Applications*. Any number of new or legacy applications that draw on the components can be created.
4. *Processes*. Processes include the major business functions performed by the BLM.
5. *Technology*. This element includes the hardware, operating systems, and communications systems that support application and data requirements. Because component-based applications are designed to be platform-independent, specific technology elements are not addressed in the figure.

EIDS Element

An EIDS can only be created after enterprise-level data standards have been established and implemented and quality data has been compiled. Quality data is the foundation upon which component-based applications architecture is built. As it takes time to add quality to data, we can expect implementation of the EIDS will occur piece by piece, with each piece representing a different data subject area. The BLM's data subject areas, as currently modeled, are indicated in the EIDS element in Figure IV.C-1. The concept of component architecture is so flexible that not all the data in a particular data subject area has to be populated in the EIDS at a single time. For example, if a decision is made to focus attention on developing a component for Rights of Way (ROW), initially the EIDS only needs to be populated with the data in the "Rights" data subject area germane to ROW.

Before data from any data subject area can be entered into the EIDS, the data model needs to address the relationship between spatial features such as roads stored in the Spatial Database Engine (SDE) and the attributes of roads stored in the EIDS. In other words, spatial data needs to be integrated with textual data in the EIDS. The Data Management Plan provides the necessary guidance and procedures for defining roles, setting standards, and managing data as an asset. They will be followed during this process. The data should first be modeled and standardized to eliminate redundancy and ensure quality. The EIDS would then be populated and the data made available for either new components or existing applications. The EIDS would grow over time as data from different data subject areas was migrated to the EIDS in a priority order established by business requirements.

The major advantages of adopting an EIDS are as follows:

- Data redundancy will be minimized.
- Greater accessibility to common types of information will be realized.
- Standardization of data will begin to improve data quality.

- Data storage requirements will be reduced.
- The BLM's data will become available to the entire enterprise rather than solely to specific applications. (The BLM could limit access to specific data by implementing and controlling access rights.)

Component Element

The primary characteristics of components are they are reusable and shareable. Reusable means that an application can employ their functionality over and over again. Shareable means more than one application can use the same component. An example of a component is the spell-check capability in the Microsoft Office suite. A single instance of spell check is coded in the suite and used jointly by Microsoft Word, Excel, and PowerPoint. Thus, the expense of coding a spell-check capability and maintaining it in three different applications is avoided. Technically speaking, a component bundles together data and business rules.

Figure IV.C-1 suggests the BLM's first two components might be Legal Entity and Request Management. (Details concerning specific recommendations for these two components are included in Section V of this report.) The Legal Entity component would address business needs to standardize data and business rules for what is commonly called "Name and Address." The Request Management component would do the same for requests submitted by customers to the BLM. Both components would support immediate business requirements to improve customer service. An essential ingredient of the concept for component-based applications architecture is that implementation can evolve at the speed the BLM chooses. Some components may be developed and implemented at later dates. COTS products also may be components.

The major advantages of component-based applications are as follows:

- Reduced cost of development and maintenance. An initial, high-level ROI study indicates the BLM could reduce development costs significantly over the next 10 years by employing components for commonly used data in the national applications in the CMR.
- Reduced time to market. Industry studies indicate a significant reduction in time to market for development when components are used.
- Components are more easily upgraded and replaced as requirements and technology opportunities dictate, without the level of impact normally associated with a more traditional, self-contained, stovepipe application environment.

Applications Element

The end products of a component-based applications architecture are the applications that support business requirements. Each application is a single object in the applications architecture. Both new custom applications, as they are developed, and compatible COTS products rely on reusable and shareable components to meet functional needs. COTS products would contain reusable and sharable components. Many organizations have found it beneficial to establish incentives for developers to employ existing components rather than to develop new application code. As more and more components are developed, new applications have more components to choose from, leading to greater flexibility for application development and greater standardization of automated processes within the BLM.

Figure IV.C-1 shows, for example, a customer management application might be developed initially using the capabilities of the legal entity and request management components, as indicated by the solid connector lines. Subsequently, as new components are developed (shown by the dashed connector lines), new Use Authorization and Case Tracking applications might use these components as well as others.

For the BLM, the major advantages of component-based applications are as follows:

- *Adaptability.* By using pre-existing components, each application can be easily and quickly designed and developed to meet specific business requirements. The application developer needs only to develop a pointer to these components to take advantage of them.
- *Reduced cost of maintenance.* The life cycle of an application is greatly lengthened. A component may become obsolete due to changes in data or functionality, but the application, because it is composed of discrete building blocks, does not lose all its functionality. The obsolete component can be replaced more quickly and inexpensively than the entire application.
- *Evolution.* The transition to a component-based applications architecture can be evolutionary rather than revolutionary. The use of components need not immediately make all legacy applications obsolete. Legacy applications can continue to function as they always have. When components are developed that could replace some functionality of a legacy application, the BLM can decide whether it is economically justifiable to reengineer the legacy application to point to the new component in order to take advantage of that new capability. Figure IV.C-2 shows how the migration process can be facilitated using middleware products.
- *Standardization of enterprise data.* The development and use of components will hasten the standardization of data within the BLM. Before a new component is implemented, its data will be standardized and migrated to the EIDS. Each application that uses the component, whether new or legacy, will be able to take advantage of the newly standardized data. The potential to use quality, standardized data should entice owners of legacy applications to reengineer those applications to take advantage of that data. This will foster the rapid adoption of the component-based application concept. Figure IV.C-2 indicates how a COTS middleware product might be used during the transition to standardize data more rapidly and make the data available to both legacy and new applications.

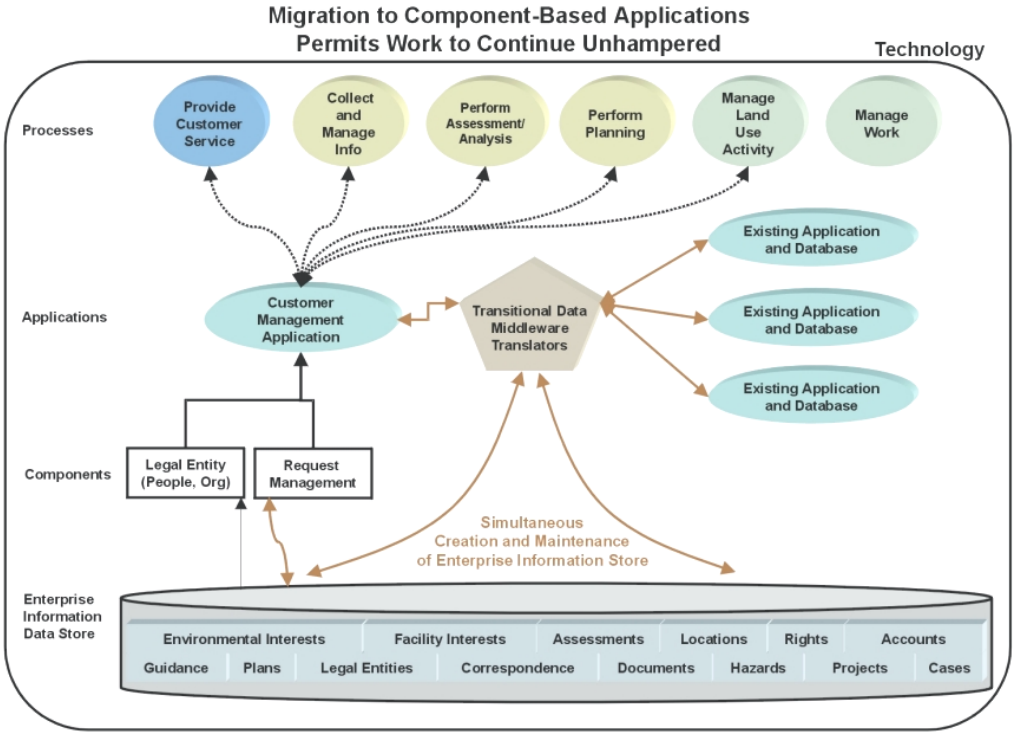


Figure IV.C-2. Migration Using Middleware.

Processes Element

An Enterprise Architecture (EA) should be driven by business, not technological, needs. Technological solutions are used to support specific business requirements. In order to understand business needs, we first need to understand what it is the business does. We gain that understanding by identifying business processes.

Processes are the activities performed by the enterprise to accomplish its mission. They represent the business of the enterprise. We develop business process models to define the enterprise's business requirements and clarify exactly what the enterprise does. The more detailed the model, the clearer our picture of the business becomes.

Figure IV.C-1 shows the six highest-level processes in the evolving target process model. These six processes represent everything the BLM does. We add detail by breaking down the high-level processes into child or subordinate processes. The greater the level of decomposition, the more the user of the model can know about the detailed activities performed by the enterprise. Once we understand the business processes, we can identify and determine the data required to support these processes, the applications required to manage the data and automate the processes, and the hardware needed to support the applications. Thus, the entire EA becomes driven by business requirements.

The major advantages of business process modeling are as follows:

- It identifies business requirements.
- It leads to an understanding of exactly what processes the business performs.
- It provides the ability to analyze existing processes and identify ways to gain efficiencies.

Technology Element

If data is the foundation upon which a component-based application rests, technology is the infrastructure upon which applications ride, making data available to both users and decision makers. Technology can be viewed as the hardware and operating systems allowing applications to function. The proper integration of business processes, applications, and infrastructure is critical to successful information resource management (IRM). For example, analysis of the current BEA and indications of target BEA requirements indicate a growing business need to integrate automated Geographic Information Systems (GIS) functions within many of the BLM's business processes.

This requirement, along with the increasing demand for access to more and more data, will necessitate significantly greater bandwidth requirements in the BLM target BEA. An analysis of those requirements and a knowledge of the applications architecture are needed before specific infrastructure design specifications can be determined. If these requirements are not fully understood, the probability that the BLM's infrastructure will collapse under the weight of unanticipated demand increases.

Factors to Be Considered

There are several important factors that should be considered in making a decision to transition to a component-based applications system:

1. *Organizational impact.* Component-based applications require a greater degree of data, application, and process standardization than currently exists within the BLM.
2. *Funding impact.* Currently, most application development and maintenance is funded by individual program offices because the legacy applications they are using were developed to support specific program requirements. Under a component-based applications architecture, components and applications are more likely to become assets of the entire enterprise instead. In the future, either multiple program offices will have to fund development jointly or the BLM may want to consider centralized enterprise funding.
3. *Architectural impact.* The BLM's applications architecture will become less complex, more reliable, more flexible, and more scalable. Components will become reusable and shared and stovepipe applications will gradually become obsolete. Data quality, standardization, and accessibility will dramatically improve through use of the EIDS.
4. *Time to market impact.* Development time should be dramatically reduced. For example, the Military Traffic Management Command experienced a 25 percent reduction in software development time after adopting a component-based system.

5. *Cost impact.* Development costs should be dramatically reduced because code for a single function such as "name and address" will only have to be developed in a single component rather than in every application that needs to access names and addresses.

Summary

In conclusion, the concept of a component-based applications architecture provides a vision for the future of the BLM's architecture development. Adoption of the concept will provide strategic direction for years to come, enabling the BEA effort to progress with its design of a more detailed target environment. It will also provide a focus for information resource management efforts regarding data, applications, business processes, and technology. Finally, it will provide an opportunity for evolutionary, controlled, and purposeful transition to an environment in which information technology becomes a more responsive and efficient tool for supporting the BLM's business requirements.

D. COMPONENT-BASED APPLICATIONS—SUCCESS STORIES

The BLM is not an "early adapter" in the area of component-based applications. Therefore, it can benefit from the real world "lessons learned" by other organizations that have already had experience with reuse, reengineering, and COTS integration. Our challenge is to apply this knowledge to the unique BLM environment. Here are some examples:

- Honeywell successfully implemented an award-winning effort on the shop floor of its plant in Rocky Mount, North Carolina. A web-based COTS application tracks defects and corrective actions. It has not only reduced software costs by 98 percent but also improved response times sevenfold. The application also has enabled Honeywell to distribute software updates centrally, improving version control.
- NASA's Jet Propulsion Laboratory successfully built a fully automated, miniaturized antenna station using COTS components. As a result, NASA has significantly reduced the cost of tracking low-earth-orbit satellites. While no specific cost savings have been provided, the NASA research team has emphasized the importance of COTS in not only reducing costs but also increasing reliability.
- Hewlett Packard's software reuse guru, Martin Griss, has led several corporate, system-wide engineering efforts related to software reuse. While monetary successes have not been calculated, forward endeavors have identified the importance of these applications in creating a consistent, enterprise-wide methodology. Interestingly, Mr. Griss has not proposed a corporate reuse library, given what he identifies as HP's culture and process maturity, but rather, common libraries within unique domains.

All of our research into "lessons learned" points to several important conclusions:

- Cost benefits from new, custom applications may not be realized for as long as four years, emphasizing the need to explore alternative COTS solutions.
- NASA and Hewlett-Packard, as well as Toshiba, have found that as a rule of thumb, the breakeven point is three reuses.
- The support of upper management is critical to the success of the effort.

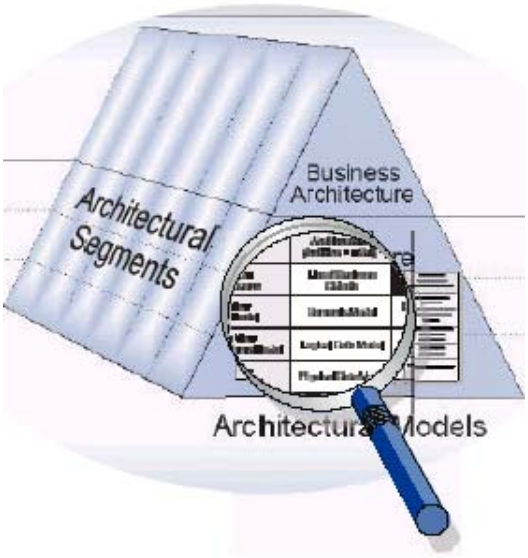
- Resources available as a result of development/maintenance can be reallocated, resulting in enhanced productivity through division of labor.
- The organization's best developers can work on multiple projects simultaneously.
- Knowledge assets are sometimes difficult to value because they are not reflected on accounting balance sheets.

V. Findings and Recommendations

A. General Findings and Recommendations

The Federal Enterprise Architecture Framework, 1999, identifies three approaches to developing architecture:

Conventional Approach—Requires a substantial initial investment in time and dollars. First, a framework must be developed showing how to prepare an architecture description. Second, the current baseline must be described. Finally, a target architecture must be described. The implementation of needed architecture changes through design, development, and systems acquisition cannot begin until these activities have been completed. Although this approach appears to be sound, it may result in "paralysis by analysis," due to the complexity of the federal effort.



Segment Approach—Promotes the incremental development of architecture segments within a structured enterprise architecture framework. This approach focuses on major business areas (e.g., grants or common financial systems) and is more likely to succeed because the effort is limited to common functions or specific enterprises.

Status Quo Approach—Represents "business as usual," resulting in continued failure to share information and cope with the rapidly changing environment. This approach would result in business rework, decreased productivity, and lost and missed opportunities, as well as failure to comply with Clinger-Cohen Act requirements.

The following two general findings and recommendations relate to the enterprise as a whole and are incorporated in lower-level specific recommendations presented in Section V:

- **Architecture Approach**
  - **Finding:** The BLM has predominately used the conventional approach to architecture development. This has provided a needed framework to identify processes, data, and applications.
  - **Recommendation:** The BLM should build on this framework, consistent with the requirements of the Federal EA Framework. Beginning in FY02, the BEA should focus on a subset of specific architecture segments, such as LUP, APD, and ROW, for incremental, tangible improvements and results.

    The BEA models are corporate assets that can be used, further refined, and decomposed by process owners throughout the BLM. They should be encouraged to use these models as starting points for their process improvement and reengineering efforts. Modeling

efforts beyond the component areas addressed by the BEA should be integrated into the enterprise models to foster the definition and understanding of the BLM's business.

As previously mentioned, the BLM has used the Activity-based Costing (ABC) model, which consists of nine "cross-cutting" business subject areas. These areas were modeled in detail by various subject-matter expert (SME) teams during fiscal years 2000 and 2001. As these modeling efforts progressed, commonalties across the nine "cross-cutting" business subject areas became apparent. At lower layers of detail, similar processes appeared across the nine areas, indicating the processes could be restructured to expedite analysis from an information architecture perspective. These observations do not negate the validity of the ABC model. There will be different perspectives (e.g., cost management, information management, customer service, etc.) for analyzing the BLM's business processes. Some models may be more effective than others, depending on the viewpoint examined.

We also found many of the processes across the nine subject areas involved collecting and managing information. Planning, Assessment, and Manage Work each had subprocesses for collecting and managing information common to each subject area. SME participants and BEA team members found another cross-cutting subject area was emerging. Thus a new model was defined realigning the nine subject areas into six. This model also defined "Collect and Manage Information" as a new business subject area. This model has been cross-walked to the ABC model for consistency and traceability. Table V.A-1 shows this new subject area in detail.

2	**Collect and Manage Information**
2.1	**Conduct Information Collection**
2.1.1	Determine Information Needs
2.1.2	Determine Information Sources, Interested Parties
2.1.3	Implement Information Collection Plan
2.1.4	Assemble Information
2.2	**Implement Data Management Plan**
2.2.1	**Develop Data Standard**
2.2.1.1	Develop Proposed Standard
2.2.1.2	Evaluate Draft Report
2.2.1.3	Adopt Standard

2.2.2	**Implement Data Standard**
2.2.2.1	**Determine Implementation Approach**
2.2.2.2	Execute Implementation Plan
2.2.3	**Maintain Data Standard**
2.2.3.1	Evaluate Change Requests
2.2.3.2	Evaluate Change Recommendations
2.2.3.3	Revise Data Standard
2.2.3.4	Review Revision of Data Standard
2.2.4	Maintain Metadata Repository
2.2.5	Maintain Data Quality
2.3	**Conduct Document Management**
2.3.1	**Create Document**

Table V.A-1. The "Collect and Manage Information" Subject Area.

- **Revised Process Model**
  - **Finding:** Common processes were identified among the nine "cross-cutting" business subject areas of the ABC model.
  - **Recommendation:** Use the revised model for future information architecture analyses. This model will support a more streamlined view of the BLM's business processes from an information management perspective and facilitate business process improvement and redesign.

B. INDUSTRY/GOVERNMENT EXPERIENCE

With one exception, all of the recommendations in this report focus on attaining three objectives: streamlining processes, improving data quality, and achieving efficiencies in application software. As the BLM advances in meeting these objectives, industry and government agencies are on the same path—some ahead and some behind. The following section provides a thumbnail sketch of organizations that have made significant strides in these areas. They are a source of encouragement that BLM is "on the right track" and making wise investments. Additionally, they provide a fertile source of proven approaches and lessons-learned.

Streamlined Processes

BULL HN Information Systems (Groupe BULL) experienced the following results after implementing process improvements:

- Cost savings of at least $1.2 million per year by using inspection software techniques and design documentation.
- A 50 percent reduction in code test cycles times.
- A seven- to ten-percent reduction per year in code defects from customers.
- A 4:1 return on investment in the Operating System Development organization by implementing Software Process Improvement (SPI) practices.

(Source: http://www.sei.cmu.edu/pub/documents/94.reports/pdf/tr13.94.pdf)

Schlumberger experienced the following results after implementing process improvements:

- A 30 percent increase in overall productivity.
- A nearly 100 percent increase during each six-month period in projects meeting scheduled completion because of its process improvement program.
- Dramatically improved quality of process procedures through decreasing defects per thousand lines of code by 33 percent.
- A business value factor of 8.8:1 return on investment by implementing software process improvements.

(Source: http://www.sei.cmu.edu/pub/documents/94.reports/pdf/tr13.94.pdf.)

The Oklahoma City Air Logistics Center at Tinker Air Force Base experienced the following results after implementing process improvements. This enabled them to avoid rework and duplication in their software maintenance evaluation process and maintenance tracking system:

- Estimated savings of more than $4.8 million because of its process improvement activities.
- A business value return ratio of 6.27:1 on the investment in process improvement.

(Source: http://www.sei.cmu.edu/pub/documents/94.reports/pdf/tr13.94.pdf.)

Improved Data Quality

The following testimonials speak to the improved data quality enjoyed by other organizations:

- **1999 Best Practices in Data Warehousing Awards: Architected Data Mart.** Vision Service Plan's challenge was to "provide its customers, comprised of more than 15,000 groups, with accurate reports of their monthly claims activity" generated from "legacy claims systems which had inherent data discrepancies." The solution was to "implement a group-centric claims data warehouse with one view for all its standard claims and an easy-to-use front-end reporting tool." (Source: http://www.dw-institute.com/bp99.htm)
- **1999 Best Practices in Data Warehousing Awards: Corporate Data Warehouse.** "For 25 years, data at 3M was fed into 50 business units, while each business unit developed and protected its own disparate data mart system and operated as its own company. …3M could not get one view of a customer to understand its purchases across business units …" Their solution was to "realign itself from 50 business units into seven marketing groups, while one central repository manages all information globally. 3M eliminated the redundancy of leading and managing local and business unit specific DSS systems." (Source: http://www.dw-institute.com/bp99.htm)
- **1999 Best Practices in Data Warehousing Awards: Data Extraction.** "The IRS required a data warehouse that would perform research; provide decision support; and profile and provide projections, forecasts, quantitative analysis and modeling in support of IRS's business strategies. The IRS used small development teams of one to two people to implement nine subject areas/data sets on short development deadlines." The IRS "developed an application architecture to facilitate code generation, handle data conversions and handle hierarchical to relational mapping." The new automated process "now gives the team the capability to add three simple last minute data sets and still meet deadlines." (Source: http://www.dw-institute.com/bp99.htm)
- **1999 Best Practices in Data Warehousing Awards: Data Quality.** The Ohio Department of Health (ODH) created a data warehouse in May 1998 that gives easy access to state and county summary level public health statistics via the Internet. The ODH has become a much better steward of the data they keep as a result of building its data warehouse. The most important reason for this was the data standards process that occurred during the implementation of the warehouse. (Source: http://www.dw-institute.com/bp99.htm)
- The **US Fish and Wildlife Service** is "using data standards to increase the quality and compatibility of its data. This approach will increase opportunities to share data and reduce incidents of redundant data development. Standards are being developed, reviewed, and adopted according to a formal process." (Source: http://www.fws.gov/stand/)
- **Environmental Protection Agency (EPA) Reinventing Environmental Information Initiative:** "The goals of this initiative are to provide a shared data registry for use by all environmental stakeholders, to provide a means for EPA's partners to participate in establishing data standards, and to promote use of data standards throughout the environmental protection community. These goals, part of EPA's overall data management program, are critical to supporting effective environmental protection across the U.S. and worldwide." (Source: http://www.epa.gov/rei/about/edr.htm)

- **USDA. USDA Data Repository Working Group Report:** The mission of this organization is "to build a base of information about data repositories that will help frame alternatives for a USDA data repository and potential transition scenarios." (Source: http://www.usda.gov/da/infores/dataman/dmreport.htm)

Efficiencies in Application Software

The following examples provide proof of the efficiencies in application software:

- **The component approach delivers a system for one-fifth the cost in one-half the time.** The U.S. Air Force Space and Warning Systems Center (SWSC) delivered its ATAMS in 11 months rather than the two years anticipated if conventional development techniques had been used. Only one post-delivery software error was detected during OT&E. Finally, the system was developed by a team of 11 for a total cost of about $2 million, or one fifth of the amount estimated if conventional techniques had been used.

  (Source: http://stsc.hill.af.mil/crosstalk/1996/aug/product.asp)
- **The component approach improves reuse.** Motorola used a component-based approach for FLEXworks, a family of one-way pagers. They have shown a four times cycle improvement with 80 percent reuse.

  (Source: http://sei.cmu.edu/publications/documents/98.reports/98tr007/98tr007chap02.html)
- **The component approach improves productivity.** Industry standards for code productivity range from 200 to 500 standard lines of code (SLOC) per labor-month. The high levels of reuse in some experiences with component software can lead to higher levels of productivity ranging from 40 to 400 percent.

  (Source: http://home.stny.rr.com/jeffreypoulin/Papers/CBDchapter01.html)
- **The component approach reduces development time.** HomeComings Financial Network, a subsidiary of GMAC-RFC, used Microsoft's Component Object Model (COM) to develop a loan management and reporting capability system. New components can now be built in 203 weeks. It is estimated they have reduced staff involvement in the process by 20 percent. (Source: http://microsoft.com/com/com/cstudy/hcoming.asp)

C. SPECIFIC FINDINGS AND RECOMMENDATIONS

This section of the Summary Report presents specific findings and recommendations stemming from the analysis of information collected over the past fiscal year. Information collection focused on business processes, data, applications, and technology as discrete entities. Each of our 20 recommendations is supported by Findings, Recommendations, and Benefits. Table V.C-1 is a summary of the BEA Core Team's recommendations.

Target Architecture Element	Recommendations
EIDS	1. Construct EIDS
	2. Continue Development of Enterprise Logical Information Model
	3. Perform Data Analysis
	4. Determine Data Costs
	5. Establish Data Standards
	6. Enforce Data Requirements
Components	7. Implement Legal Entity Component
	8. Develop Business Case for Request Management Component
Applications	9. Investigate Benefit of a Customer Service Application
Processes	10. Continue Development of Target Business Process Architecture
	11. Develop the Collect and Manage Information Area
	12. Integrate Geospatial Processing into the BLM Business
	13. Improve Information Sharing in Perform Planning Process
	14. Provide BEA Support to IT-LUP
	15. Implement Corporate Library & Standard Core Process for Assessment
	16. Develop Expression of Interest (EOI) (Authorize Use) Checklists
	17. Coordinate Enterprise Document Management Efforts
	18. Business Process Improvement/Transformation
Technology	19. Plan for Enterprise Infrastructure Upgrades
Consolidated Architecture	20. Develop BEA Target Enterprise Architecture

Table V.C-1. Summary of the BEA Core Team's Recommendations.

These 20 individual recommendations are presented within the context of the vision for a component-based applications architecture. Each should be considered a stepping-stone or building block toward that larger enterprise goal. Attainment of the goal to achieve a component-based applications architecture is a multi-year effort, but recommendations implemented over the next year will move the BLM closer to it. Some recommendations also are designed to enable the BLM to integrate its BEA efforts more tightly with strategic and capital planning. In addition, initiatives stemming from this report will influence the development of capital investment plans.

The specific recommendations that follow focus on enhancements in three program areas—Land Use Planning (LUP), Application for Permit Drilling (APD), and Rights of Way (ROW). One cross-program area, Expression of Interest (EOI), is the focus of another recommendation. This is a segmented approach. The selected program areas closely align with the BLM's focus on energy and minerals and land use plans in the FY02 budget. The BEA Core Team intends to establish a close working partnership with the appropriate program offices to provide them with extensive assistance in their efforts to improve information technology support in the four program areas. Recommendations suggesting improvements in business processes; data quality, standardization, and accessibility (through creation of the EIDS); and development of appropriate application components relate to all four areas.

Enterprise Information Data Store: Findings and Recommendations

1. Construct Enterprise Information Data Store (EIDS)

Findings

- Analysis of both the BLM Corporate Metadata Repository (CMR) and a data model reverse-engineered from national applications indicates a lack of consistency in naming standards for data attributes, entities, tables, and columns.
- Quality of data within the BLM is often suspect and content ownership is difficult to determine.
- In many cases, data does not match its intended use, meaning, or reliability.
- There are numerous occurrences of redundant data.
- Based on CRUD analysis, there are many instances of the same or similar data being created in more than one place (application/process). For example, 64 processes create Case Action data and 17 processes create Human Resources data. These are contributing to the problem of redundant and segregated data.
- Data is not managed as an enterprise asset. Design principles have not included common use and reuse.

Recommendations

- Begin construction of the EIDS, a common BLM data repository.
- Standardize and cleanse data to ensure data quality and eliminate data redundancy. Give priority to establishing national data standards supporting the Collect and Manage Information and Perform Assessment/Analysis business processes (both alphanumeric and spatial) and Land Use Planning. Migrate existing data to corporate enterprise information data stores.
- Partner closely with national data stewards responsible for data supporting LUP, APD, EOI, ROW, and Request Management to support their efforts to prepare that data for migration to the EIDS.

Benefits

- There will be an incremental reduction in data redundancy and segregation.
- Common types of information will be shared and reused.
- Data cleansing and standardization will improve data quality.
- Management, protection, accessibility, and use of the data will become an enterprise activity.
- A key element for the component-based applications architecture (including E-GIS Goal), a common data repository, will be established.

2. Continue Development of Enterprise Logical Information Model

Findings

- In examining existing models (for example, the 1989 Enterprise Data Model, 1991 Enterprise Data Model, and ALMRS model), we found data was modeled as defined in each specific application. To support a component-based target architecture, a logical data model is necessary.
- There are currently several development projects planned or already underway in which databases are being designed and/or implemented (e.g., NILS, LUP, and Fire). Opportunities exist to partner with the program organizations currently sponsoring these separate data modeling efforts, support them, and incorporate their models into the Enterprise Data Model.
- Data is not currently managed as an enterprise asset designed to be shared and reused.

Recommendations

- Continue expansion of the Enterprise Logical Data Model (including geospatial objects) based on business priorities to include all logical data
- Incorporate other data models, independently developed within the BLM, into the Enterprise Logical Data Model.
- Develop a close working partnership with staff performing independent data modeling efforts. Establish standard modeling techniques within the BLM and enable independent modeling efforts to take advantage of the work already accomplished in the Enterprise Logical Data model.

Benefits

- Data redundancy and segregation will be minimized.
- The model will provide guidance and standards to determine the architecture appropriate for development of future components and applications.
- Quality of data will begin to improve as a result of the consistent application of business rules regarding data.
- Independent modeling efforts will benefit from the work done on the Enterprise Logical Data Model. At the same time, the Enterprise Logical Data Model will grow faster from the integration of independent modeling efforts of specific functional areas.
- The model will provide the basis for construction of the EIDS.

3. Perform Data Analysis

Findings

- Determination of aspects of data in new projects (Investment Proposals and Business Cases) has not been considered in past BLM projects.

Recommendations

- As part of its review of Investment Proposals and Business Cases, the System Coordination Office (SCO) should routinely work with the Project Proponent or Project Manager to produce a custom data impact analysis using the CMR tool. The analysis report will tell the Project Manager what types of data are already in use, what is available for reuse, what functions can be linked, and what information will have to be collected or acquired.

Benefits

- The data analysis will place the coordination of identifying data requirements with the SCO, an organization specifically intended to perform this function, thus ensuring architectural appropriateness.
- The identification of possible duplication early in the process will reduce data redundancy.
- The cost of development efforts related to designing databases and applications will be reduced.
- The analysis will encourage the use of the CMR.
- The analysis will help to ensure that any new data design adheres to standards implemented using the products of the Data Management Plan.
- The analysis will facilitate the design and use of the Enterprise Information Data Store.
- The analysis will enhance the design of the Enterprise Logical Information Model by allowing new data elements to be included quickly.

4. Determine Data Costs

Findings
♦ Actual data costs for projects have never been determined within the BLM. Data costs could include the costs to acquire or collect data, convert data from another platform, maintain data, and ensure data quality.
Recommendations
♦ Create a methodology to determine the data costs and benefits. Incorporate the costs and benefits into the Return on Investment portion of the Business Case.
Benefits
♦ Focuses attention on the up-front and ongoing costs of designing, acquiring, storing, and maintaining data. ♦ Aids decision-makers such as the Information Technology Investment Board (ITIB) and the Budget Committee in being better informed regarding the costs associated with the proposed Business Case. ♦ Encourages reuse of existing data and applications by requiring Business Case proponents to justify the creation of new data and applications.

5. Establish Data Standards

Findings

- The BLM has few Common Data Elements documented or in use. (Common Data Elements are those elements that would be used in more than one, and usually in many, applications. They have a standard definition, format, and domain set.) Because there are so few documented national standards, every existing application uses its own "flavor" of standards and data elements. This results in redundant applications, both functionally and with regard to data.

Recommendations

- Currently, the standardization of two common elements—postal addressing and organizational codes—is being pursued. The common elements in the postal area are undergoing final review and the standardization of organizational codes has just begun. The BLM has initiated a national task force to officially declare the standard and determine the impact on existing applications.
- Many more common elements are needed to promote data reuse and eliminate redundancy. Other areas to be targeted soon include land-related elements and elements covering common administrative functions. Common Elements will be posted in the Enterprise portion of the CMR.
- New projects should be required to use the standard common elements. An impact analysis on existing applications would determine the value of converting to the common element or waiting for the processes in the existing application to be re-modeled.

Benefits

- Ensures data standards are followed, as described in the Data Management Plan (DMP).
- Facilitates the migration process to the new Enterprise Information Data Store.
- Promotes data reuse to eliminate redundancy.
- Enhances the Enterprise Logical Information Model (ELIM) by identifying candidates for common data elements.
- Supports faster implementation of new business initiatives as the portfolio of common data elements designed and/or in use grows.

6. Enforce Data Requirements

Findings

- Many automated projects in the BLM have not followed data requirements for the life cycle of the project.

Recommendations

- SCO Data Management has invested a great deal of effort in determining data requirements throughout the life cycle. These requirements have been incorporated into a *Best Management Practices for Data in Projects* document, and State Data Administrators and the Bureau Data Administrator have concurred with them. Currently, however, these best management practices are not enforced after the Business Case stage of the life cycle. The BLM should be allowed to enforce project management discipline in IT development projects.

Benefits

- Ensures new data requirements conform to the BEA.
- Facilitates coordination of data requirements both within and across program lines.
- Encourages project managers to take advantage of "best practices" to deliver robust, business-driven solutions.
- Facilitates the collection and publication of valuable metadata in the CMR by allowing the CMR team to require specific metadata for new projects.
- Facilitates the development and use of improved project management skills within the BLM.
- Initiates a formal process (discipline/methodology) for developing business solutions.
- Supports faster implementation of data solutions because "best practices" templates will be in place already.
- Augments "best practices" themselves, promoting continuous process improvement.

Components: Findings and Recommendations

7. Implement Legal Entity Component

Findings

- Reliance on private data storage in the current legacy applications leads to redundant data entry and makes it costly to either understand the "big picture" needs of a single BLM customer, vendor, or interested party, or to generalize the needs of customer groups.
  - Thirteen national applications write customer data, seven of which write to private data stores.
  - Six national applications write employee data, five of which write to private data stores.
  - Several more national applications write organization and public data to private data stores.
  - The number of state applications writing customer data is unknown.

Recommendations

- Implement a legal entity component that draws on the legal entity data (information about individuals and organizations) in the BEA Enterprise Logical Data Model, along with the business rules associated with that data. This component is intended for use by the Customer Service Application recommended elsewhere in this document, as well as other applications using legal entity data for customers, interested parties, and vendors. It should be similar to the Name and Address investment proposal of the past, but should be scoped and defined in the context of a component-based application architecture, and should also provide additional scope and guidance from an architectural perspective.
- Ensure the component is sharable and conforms to the Target Architecture.
- Form a partnership with appropriate National Data Stewards to develop Name and Address data standards and define the business processes and rules for inclusion in the Legal Entity Component. This will help to ensure all requirements are captured.

Benefits

- Improves customer satisfaction.
- Improves management of vendors and interested party contacts.
- Reduces risk of litigation due to failure to protect private data.
- Reduces software development and maintenance costs by consolidating legal entity data and data management.
- Reduces the time and cost for meeting business objectives through automation. Business objectives may include elimination of APD backlog and improved tracking and management of public comments.

8. Develop Business Case for Request Management Component

Findings

- The limited automation of business processes in the Provide Customer Service area results in higher costs for customer care and insufficiently accurate tracking and management of customer requests.
- Reliance on private data stores in legacy applications leads to redundant data entry and makes it costly to understand the "big picture" needs of a single BLM customer or to generalize the needs of customer groups.
  - Five national applications write incoming request data, three of which write to private data stores.
  - Five national applications write response out data, four of which write to private data stores.

Recommendations

- Build a business case to implement a Request Management Component that supports requests, along with the business rules associated with requests, request tracking, and request management. Requests may include: customer requests that may eventually become cases or authorizations (e.g., APDs), customer inquiries for information and status, and internal requests including those for planning activities and gathering information about land and/or resources. This component would be used by the Customer Service Application recommended elsewhere in this document, as well other applications creating or processing requests or providing request status.
- Focus initially on one or two process areas supporting customer requests, with possible expansion later.
- Ensure this component is sharable and conforms to the architecture.
- Form a partnership with concerned program area managers to define those business and data requirements needed to develop the Request Management Component. This will help to ensure all requirements are captured.

Benefits

- Offers greater flexibility in managing workloads at the State, regional, and national levels for tasks that can be performed outside of the field office. This will allow operating efficiencies not otherwise available.
- Reduces the risk of violating regulations and policies related to timely response to requests.
- Improves customer satisfaction and makes the customer experience more-consistent.
- Reduces software development and maintenance costs by consolidating request data and request management.
- Reduces time and costs for meeting business objectives through automation. Business objectives may include elimination of APD backlog and improved tracking and management of public comments.

Applications: Findings and Recommendations

9. Develop Business Case for Customer Service Application

Findings

- No single application exists to support customer care. This increases processing costs and hampers the BLM's ability to provide prompt, consistent service.
- An excessive number of applications (11) currently support a single process—Process 1.2.2 Research Response—within the Provide Customer Service area.
- Three processes from Provide Customer Service have potentially redundant automation.
- Thirteen applications write customer data, seven of which write to private data stores.
- Some processes still use manual methods to service customers. This results in higher costs for customer care and insufficiently accurate tracking and management of customer requests.
- Process modeling sessions show a recurring theme regarding the need for procedures and automation supporting customer contact management. In general, the BLM is unable to provide basic metrics on, or tracking of, customer requests from start to finish. There also is a lack of consistency in completing and managing requests from customers and information about them.

Recommendations

- Develop a business case for implementing an application that automates processes and business rules associated with providing customer service at the BLM. The application should provide for both self-service, via the Internet and Public Room access, and full service, in which BLM staff talk directly to customers.
- The application should be scoped to include all forms of customer service, from answering simple questions and providing documents and forms to checking the status of permits, submitting EOIs of various forms, and initiating more substantial requests.
- The application should use sharable components fitting the application architecture, including recommendations 2 and 3 on pages 36 and 37.
- The application should meet the customer service needs of the enterprise rather than being limited to a specific geographic or program area.

Benefits

- Improves customer satisfaction.
- Reduces the risk of litigation due to inconsistent responses to customers.
- Reduces the risk of violating regulations and policies related to customer service.
- Reduces time and costs for meeting business objectives and customer expectations through automation.
- Reduces software life cycle costs.

Processes: Findings and Recommendations

10. Continue Development of Target Business Process Architecture

Findings

- More than two years ago, the BLM decided to use the high-level business processes from the ABC model as the basis for the BEA business process model. The primary purpose of the ABC model is to account for the cost of performing all work associated with producing a type of product. This results in an emphasis on cost accounting processes that overshadows the importance of business functions.
- The ABC model introduces numerous situations in which the same work processes are being performed in several ABC areas.
- Core BLM business processes such as "Records Management" and "Collect and Manage Land/Resource Information" are not clearly identified in the ABC model and are components of many activities.
- The ABC model tends to represent the management and funding of major programs almost as if they were separate, and sometimes competing, lines of business. This stove-piping precludes a more logical organization of work around common business processes shared by the programs, thereby forcing a high degree of process duplication among the programs. Stove-piping of funding strongly encourages stove-piping of applications development and duplication of data sets to support the stovepiped applications.

Recommendations

- Use a Business Process Model emphasizing the information structure and common processes rather than the cost structure.
- Realignment of the ABC-based model processes has already begun. Processes and definitions have been drafted but the new model should be reviewed throughout the BLM.
- Future work on the target business process model for the BLM should ensure it is comprehensive and captures all of the information learned in the earlier work. It will then serve as the basis for identifying future business process improvement requirements and for defining the data, applications, and technology required to support the requirements.
- In the future, all architecture business process modeling efforts should be coordinated with the Activity-based Costing and Management and Strategic Planning models. This will help to ensure the BLM will be able to integrate, or at least cross-connect, these three management views of its business.

Benefits

- Reduces multiple representations of the same work process (as found in the ABC-based modeling done to date).
- Establishes the foundation for target business processes, from which component architecture recommendations can be identified.
- Fully integrates the ABC "Sustain Organization" functions, such as IRM and HRM, with basic Line of Business work processes.
- Captures the business requirement to Collect and Manage Information.

11. Develop the Collect and Manage Information Area

Findings

- A major portion of the BLM's business is collecting and managing information related to land, resources, and land use.
- The ABC-based process model does not contain a separate business process area that addresses how the BLM collects and manages information.
- Analysis of the existing business process model indicates the absence of enterprise-level standard procedures, methods, or organization structure to collect and manage information.
- The absence of Bureau-wide preferred formats and an organization-wide structure for collecting, managing, and sharing data leads to lost time and unnecessary expense.

Recommendations

- Focus further business analysis and modeling on specific business needs and opportunities for the Collect and Manage Information component(s).

Benefits

- Provides a common reference to establish clarity and uniformity across information to be collected.
- Provides a common mechanism for documenting, understanding, and approving information processing.
- Establishes a common repository to ascertain conditions and status information.
- Provides an infrastructure to establish and provide a common set of tools, utilities, and procedures for capturing, manipulating, storing, querying, and displaying information.
- Provides the ability to recognize duplicate information collection requests.
- Serves as an effective mechanism for identifying redundant cost and resource expenditures.

12. Integrate Geospatial Processing into the BLM Business

Findings

- Since the advent of functional GIS technology, geospatial display, query, and analysis have been automated and incorporated into many BLM projects and planning tasks. The benefits of project-based geospatial support are significant, but the results tend to be localized within the project and data are not standardized. The challenge now is to advance from purely project-based geospatial use to the enterprise-wide integration of geospatial tools and data into the work activities of BLM's resource specialists. This should be done in a way that simplifies the sharing of data and geospatial applications and expands that sharing into each business process that can benefit from it. Primary responsibility for the task has been assigned to the Enterprise GIS Project, with an additional burden assumed by the IT-LUP Project.
- The Enterprise GIS (E-GIS) project was established to address these issues, with a focus on making GIS technology and spatial data available to resource specialists throughout the BLM. E-GIS is charged with creating a geospatial architecture that fits into the overall BEA, while also providing special guidance regarding unique geospatial issues for Process, Data, Applications, and Technology (PDAT). The E-GIS Project Manager has requested the active assistance of the BEA Team to help his core team: (1) examine the BEA business process models and identify geospatial analysis needs and opportunities, and (2) delineate the implications of meeting such needs and opportunities with respect to the BEA Enterprise Data Model, Applications Architecture, and Technology environment. In this way, E-GIS will begin to identify and integrate geospatial functions into the BEA, while also generating specific business support opportunities.

Recommendations

- Integrate Geospatial Processing into the BLM business.
- The BEA efforts directly assist the Enterprise GIS (E-GIS) project to achieve full integration of geospatial information processing into the BLM's business processes.
- The BEA Team should assist the E-GIS Core Team in analyzing existing fifth-level BEA business process models to identify specific opportunities for integrating geospatial display, query, and analysis into critical work tasks. The BEA Team should also assist the E-GIS Core Team in assessing and anticipating the associated requirements for data (Enterprise Information Data Store), applications (NILS, IT-LUP), and technology (the Enterprise Architecture Infrastructure Project, with a BEA recommendation concerning bandwidth). Finally, the BEA Team should work with E-GIS to define a geospatial architecture comprised of fully integrated elements of the Bureau Enterprise Architecture.

Benefits

- Reduces labor requirements for a large majority of the BLM's business processes by delivering geospatial and tabular data, in the form of accurate maps, directly to the desktops of resource specialists.
- Helps to ensure that conflicting uses of public lands are not authorized where they would overlap geographically and that proposed activities are compliant with LUPs and relevant stipulations.
- Supports geospatial analysis and the visualization of results that support better, and easily defended, decisions. Integrates geospatial display, query, and analysis into the automated systems used by resource specialists.
- Produces documentation with tables, charts, pictures, video, and maps for resource decisions.
- Promotes standardization and accessibility of geospatial data and metadata in support of the IT-LUP project. Supports E-Government by providing map-based access to BLM resource data and plans.

13. Improve Information Sharing in Perform Planning Process

Findings

- Processes for implementing and monitoring approved land use plans vary within the BLM.
- Information associated with developing and tracking the LUP varies and is typically stored at the State or field level. This results in inefficient reporting at the national level.
- Planning is performed in virtually every organization and within virtually every high-level business process that was modeled.
- There was little consensus on planning activities among participating SMEs or in known documentation regarding long-term management responsibility and overall performance/effectiveness of the BLM's multi-year plans (specifically LUP and Facilities plans per modeling to date.)

Recommendations

- Establish national business processes and rules for managing, updating, and tracking land use plans, so the LUP becomes a living document. See recommendation 1 on page 35 for standardizing planning data in support of LUP.
- Identify automated tools for supporting information sharing. This would include review and support of the current business cases relating to LUP as appropriate.
- Focus on planning efforts related to Authorize Use areas, such as Application for Permit to Drill and right-of-way activities.

Benefits

- Improves information sharing capability throughout the entire planning life cycle, enabling managers to make better business decisions.
- Improves the capability for "what-if" and "changing business conditions" analyses.
- Supports public relations management activities with customers, interested parties, and staff.
- Defines out-year budget and workload requirements.

14. Provide BEA Support to IT-LUP

Findings

- Geospatial processing remains a semi-independent technical support activity in the BLM and has not achieved its full potential for streamlining and improving business operations. GIS teams operate mostly as a separate group of expert consultants who analyze geospatial data and convert resource data to maps, in response to requests from resource specialists. The GIS functionality is not fully integrated into the LUP activity.
- The Enterprise GIS (E-GIS) project was established to address issues of this type, with a focus on making GIS technology and spatial data available to resource specialists throughout the BLM. E-GIS is charged with creating a geospatial architecture that fits into the overall BEA, while also providing special guidance regarding unique geospatial issues for Process, Data, Applications, and Technology. The need of the LUP IT Support Business Case is similar in that the first area of focus for integration should be the LUP effort currently underway.
- The Business Case for the IT LUP states: "If the Bureau is to be successful in its current LUP efforts, resource specialists must acquire, organize, document, maintain, and professionally analyze information on widely ranging topics and then effectively communicate this knowledge to our customers via cutting-edge communications and visualization techniques. The BLM's new planning era, starting in FY 2001, gives us both the opportunity and responsibility to evaluate new and existing tools for LUP. Included in this are the state-of-the-art geospatial tools needed to implement data standards within the LUP effort."
- Within the Perform Planning process, 17 fourth-level processes involve interfaces with NEPA constituent contacts.

Recommendations

- Develop a showcase BEA solution of a business need by direct BEA support of the IT-LUP project. Integrate this project with other projects and applications in the selection, control, or evaluation phases.
- This recommendation focuses on improving the ability to share information within the planning process and providing a mechanism to treat all planning decisions as long-term assets always available to the BLM and interested parties. As a part of this recommendation, the potentially automated tools for supporting information sharing will/should be identified as defined in the Business Case. This would include review and support (as appropriate) to the current business case relating to IT-LUP. The specific role of the BEA Team is to communicate and coordinate multiple planning-related project groups, as well as to assist in, and provide resources for, process and data modeling efforts. In addition, FY02 efforts should be focused on LUP planning efforts related to support Authorize Use areas such as APD and ROW activities.
- Because of the high degree of repetition within a specific subject area, such as the interface with NEPA constituents, these processes should be examined for standardization, potential streamlining, and automation support (e.g., support from a document management system).

Benefits

- Improves information access and sharing capability throughout the entire planning life cycle. This results in a living LUP instead of one that sits on a shelf.
- Improves the ability to manage expectations and relations with customers, interested parties, and BLM staff.

15. Implement Corporate Library & Standard Core Process for Assessment

Findings

- Data used in the assessment process is collected multiple times, in multiple ways and places. In addition, there is concern a large amount of other raw data is collected and never included in the assessment process.
- Some assessment objectives and questions are not clear. This results in too much data—or the wrong type of data—being assessed in some cases.
- Several different processes are used to make assessments, primarily because of variances in the questions being asked.
- Assessments are not performed as efficiently as possible. This is due to a lack of automated tools connected to the data needed to support the process (e.g., GIS and statistical packages).
- Data from prior assessments is not readily available to support current and future assessments. There is no central repository, or library, for completed assessments.
- Accurate trend analysis of collected data relative to assessments cannot be performed because of the absence of both an adequate assessment information repository and the tools to perform trend analysis.
- An increasing number of knowledgeable BLM personnel who define assessment information requirements are nearing retirement. Their knowledge will be irretrievably lost if it is not formally documented very soon.

Recommendations

- Investigate the feasibility of an enterprise-wide assessment library providing content management and easy information retrieval. The focus should start with a specific assessment focus (e.g., LUP assessments).
- Implement a core assessment process for all assessment processes and modify it as required for unique assessment requirements in different functional areas. Part of the core process should be the implementation of standard assessment information needs checklists for various types of assessments.
- Design the core process to include the ability to access, retrieve, and store initial, derived, and assessment results data in order to facilitate trend analysis of the stored data.
- Identify potential areas for the reuse and sharing of data that might be included in an assessment component in the future.
- Focus FY02 efforts on completing and implementing assessment questions and information checklists related to APD, LUP, and ROW.

Benefits

- Increases the accessibility of assessment information for BLM employees, customers, and decision makers.
- Provides a common set of core assessment questions and information requirements. This will lead to consistency in the answers and information provided to similar assessment questions, thereby improving customer satisfaction.
- Enhances trend analysis capability. This will further augment customer management services by allowing the BLM to anticipate customer requests for information and by providing accurate trend analysis to customers.
- Standardizes assessment information formats and storage. This will enable the BLM to use the information more than once and realize favorable returns on its investment in data collection and maintenance.

16. Develop Expression of Interest (EOI) (Authorize Use) Checklists

Findings

- Current EOI processes lack standardization and adequate automation. Consequently, proponents are not always familiar with the types of questions that will be asked or the level of detail and preferred format. Standard checklists for each type of EOI are needed.
- The lack of standard checklists can potentially result in inconsistent outcomes, litigation, and customer dissatisfaction.

Recommendations

- Develop and implement checklists by EOI type. Make them available to proponents to help them provide appropriate information to the BLM. We recommend two types of checklists at a minimum:
  - What is expected from the proponent.
  - What will be considered by the BLM during the EOI decision process.
- Focus FY02 efforts on completing and implementing checklists for EOIs related to APD and ROW.
- Apply data quality and standards, as outlined in the Data Management Plan, to data on the EOI checklists for APD and ROW and migrate that data to the EIDS.
- Develop and implement functionality for supporting Frequently Asked Questions (FAQs) and BLM responses relating to the EOI checklists.
- The BEA Core Team should partner with and support the recently approved project "Enhanced AFMSS E-Commerce Capabilities for Well Permit and Report Processing" in this endeavor.

Benefits

- Makes EOI processing faster and more efficient.
- Reduces staff and funding requirements for EOI processing. The will reduce the BLM staff time spent on explaining to proponents what is needed and requesting additional basic information and documents required for an EOI submission.
- Reduces staff and cost requirements for data transformation activities when data storage standards (EIDS) are established and provided to proponents.
- Improves the satisfaction of EOI proponents.
- Improves the consistency and defensibility of EOI decisions.

17. Coordinate Enterprise Document Management Efforts

Findings

- There is a current DOI initiative to evaluate Department requirements for a Document Management System within the department. However, the Bureaus within the DOI may be allowed to implement their own Document Management Systems.
- There are currently several projects assessing Document Management Systems within the BLM. Those identified, to date, are:
  - National Integrated Land System (NILS)—for looking at documents for "land-related" documents such as surveys, titles, and case parcels.
  - Cadastral Survey Field Note System.
  - The GLO Project.
  - CACHE & Safety Proposal.
  - IT Support for Land-Use Planning.
  - Enterprise Information (EI) portal.
  - AFMSS.
  - Bond & Surety.
- The BLM needs a bureau-level document management system that will: (1) allow efficient management of document creation, receipt, review, sharing, storing, and archiving across the enterprise, and (2) standardize forms and data collection methods. In modeling the various types of documents managed by the BLM, we found documents and records are managed in many different ways, limiting the ability to share documents and records across the BLM.

Recommendations

- Coordinate and consolidate the various document management efforts currently underway within the BLM through the System Coordination Office (SCO) and the Architecture Governance process. Ensure the final solution is compatible with the component-based architecture.
- Initiate an effort to define the requirements for a BLM Automated Document Management System.

Benefits

- Reduces costs of document management within the BLM by having one system instead of many.
- Improves productivity and interoperability across the BLM from a single system.
- Enhances ability to store and retrieve documents and records.
- Provides the ability to store documents and records electronically.

18. Business Process Improvement/Transformation

Findings
♦ The capability of the BEA Team is not being used to its full extent in supporting the BLM decision-making process.
Recommendations
♦ Offer the BEA Team's process improvement expertise to the Project Manager/Process Improvement proponent to assist both in the selection phase and as part of the SCO review and feedback.
Benefits
♦ Ensures a comprehensive review of all process improvements in three areas: ♦ Other process improvements under consideration. ♦ Alternate process options. ♦ Application to other similar processes.

Technology: Findings and Recommendations

19. Plan for Enterprise Infrastructure Upgrades

Findings

- Both trends in applications architecture and the recommendations of the Technical Reference Model strongly point toward regional and national sharing of data and applications via web-based architectures. The E-Government mandate and projects such as NILS GeoCommunicator, IT Support for Land Use Planning, the Enterprise Information Portal, and Enterprise GIS are expecting to add significant, but unknown, new demands to the BLM's Wide Area Network (WAN).
- Implementation of BEA recommendations depends on the timely availability of adequate data capacity to both BLM offices and external customers. Currently, year-by-year future bandwidth requirements are not known and the impact of new proposals is not measured in terms of their cumulative impact on WAN capacity.
- Existing IT architecture guidance presumes that adequate capacity will be obtained. However, new decisions, projects, and initiatives are increasing the demand on capacity.
- If adequate bandwidth cannot be provided, for any reason, then the BLM will be compelled to delay or reverse present architectural trends. Even if the necessary bandwidth can be provided, the issue nevertheless demands urgent attention.

Recommendations

- Plan for adequate enterprise bandwidth.
- Assist project managers in evaluating the bandwidth limits and tradeoffs between bandwidth capacity and central/distributed processing.
- Monitor bandwidth usage and make policy recommendations to the Chief Information Officer to ensure the proper and efficient use of the available bandwidth.
- Leverage the existing and approved Enterprise Architecture Infrastructure project in concert with the National Operations Center to undertake a BLM-wide bandwidth requirements analysis as soon as possible. The analysis should include requirements from all sources, among all organizational tiers, for the next five years. The completed requirements analysis should then be included in capital investment planning.

Benefits

- Ensures the information pathways are in place, when needed, to get the full benefit of data sharing, applications sharing, remote system management, and the target component architecture.
- Prevents episodic shortfalls of communications capacity.
- Permits E-Government to expand while providing a consistently high level of service to the public.

Consolidated Architecture: Findings and Recommendations

20. Develop BEA Target Enterprise Architecture

Findings

- Thus far, the BEA effort has been concentrated on the analysis and articulation of the current Enterprise Architecture. Specific recommendations are being made in the BEA Version 2.0 Report for changes that will begin to shape the target architecture. Future projects should be recommended and implemented only within the context of an integrated target enterprise architecture, as stipulated by the Federal Enterprise Architecture Framework. Currently only a concept for a target environment has been developed.
- As the BEA evolves and matures, it will become an important asset to assist the BLM in proactively guiding and coordinating continuous improvement in the organization.
- Within the current organizational structure of the BLM, there is no enterprise-wide organization responsible for managing the planning, development, implementation, and maintenance of business processes, data, and applications.
- Currently, the BLM is staffing EA tasks as collateral duties for its senior personnel. This limits the speed at which EA efforts can progress and be completed.
- The current funding model for information resource investments does not include mechanisms for funding, acquiring, and managing shared data, components, and applications. If it is not corrected, this shortcoming will be magnified in an architectural environment structured around a component-based applications architecture. The BLM will need an enterprise-level organization to manage the development, implementation, and maintenance of enterprise components and applications.
- Adequate BEA governance is currently lacking.

Recommendations

- Continue the development of the BEA target enterprise architecture. A concept for the target BEA has been presented in this document. Now it is time to add detail and refine that concept. The target BEA should fully integrate the process, data, applications, and technology architectures and depict the desired vision of the future.
- Identify reusable and shareable components in the target architecture and evaluate proposed projects in light of it.
- Formalize the concept of a BEA Core Team by giving it the responsibility for planning, developing, implementing, maintaining, and managing the BEA. Provide it with permanent, full-time equivalent staffing. The purpose of such an organization should be to provide enterprise-level coordination and integration for all EA activities currently being performed at the program level.

Benefits

- Provides a blueprint for evolution to an environment in which IT will be able to support the BLM's business requirements more efficiently.
- Provide the basis for recommending future IT projects to the ITIB for approval.
- Define future Capital Planning and Investment Control requirements for the BLM as required by the Clinger-Cohen Act of 1996.
- Greatly strengthen BEA efforts, speeds the BEA development process, and provides dedicated professional staff capable of carrying out the increasingly complex and technical task of integrating all aspects of BEA development, implementation, maintenance, and management.

VI. Transition to a Component-Based Architecture

A. TRANSITION STRATEGY

The path to a target architecture is one of evolution, requiring a clear understanding of the following:

- *Stated Objective:* The design and implementation of a target architecture characterized by a component-based applications architecture.
- *Required Resources:* Approved funding for FY02 BEA projects; applicable business cases approved by the ITIB; and human resources such as the BEA Core Team, the SCO, the ITIB, project managers and their staffs, and National Data Stewards.
- *Implementation Approach:* Presented in schedule format in Section VIII.

These elements are key success factors in ensuring the fruition of the BLM's vision for a component-based applications architecture that will provide automated support for the BLM's business processes.

B. COMPONENT INTEGRATION

Smooth transition to a component-based applications architecture will initially require small, well-defined steps as the BLM learns the culture of that new environment. Larger, more complex and aggressive steps can be taken later, after the transition has achieved initial success and everyone is comfortable with the process.

Figure VI.B-1 graphically depicts most of the recommendations in Section V and their relationships to one another. It is not necessary to attempt to implement all of the indicated projects or steps during FY02.

The chart shows the vision for a component-based applications architecture drives the development of the Target BEA. While the Target BEA continues to be developed (see the dashed line emanating from "Target BEA"), the concept will drive more immediate projects that start the development of the initial components and applications.

The graphic further illustrates that before a component can be implemented, the business processes supported by that component must be transformed to maximize process efficiency. Likewise, the data required to support that business process must be modeled according to agreed-upon standards and the EIDS must be constructed so the data can then be migrated to the EIDS. Once the processes are understood and transformed, as required, to achieve maximum efficiency, and the data is migrated to the EIDS, the selected component(s) can be developed.

Five recommended components are identified. However, it is not necessary to develop them simultaneously. Component development will, in turn, lead to the development of new applications or the reengineering of legacy applications to take advantage of the new components.

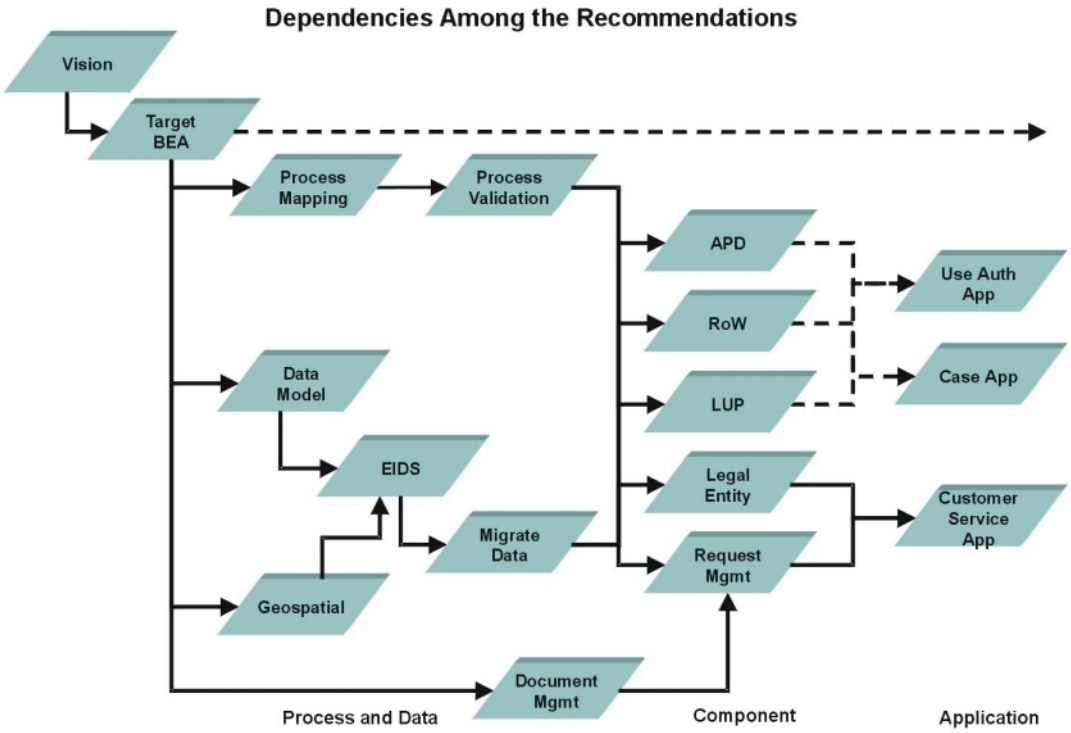


Figure VI.B-1. Dependencies Among the Recommendations.

The BLM should anticipate the transition to a component-based applications architecture will be a long process, but also keep in mind the operation of legacy applications can continue uninterrupted. Corporations in private industry have found it advantageous to employ COTS transitional middleware translators, such as Informatica or PostalSoft, to facilitate the transition. Figure VI.B-2 shows how these translators are used.

Legacy applications may continue to operate with their existing private data stores. On the other hand, bringing new components on line can enhance legacy applications. If reengineered, legacy applications can benefit from the same new standardized, quality, accessible data that new applications will use. The translator simply makes the new data in the evolving EIDS available to the legacy applications. Over time, the EIDS expands, more and more components are deployed, and more and more legacy applications are reengineered to use the components. This adds flexibility to the applications architecture, reduces development and maintenance costs, and greatly increases access to enterprise data. In addition, the translation is transparent to the customer.

The process can be accomplished in the following three phases:

- Phase 1: Database triggers and/or stored procedures are used to pass data through the Translation Layer to cleanse and standardize the data and place it into the EIDS. The cleansed data is also stored in the legacy database (planned redundancy). Other applications are not yet addressed. (Database Integrity Rules will only permit a single occurrence of the name and address to exist in the EIDS. Individual applications are unaware they are using the EIDS version.)

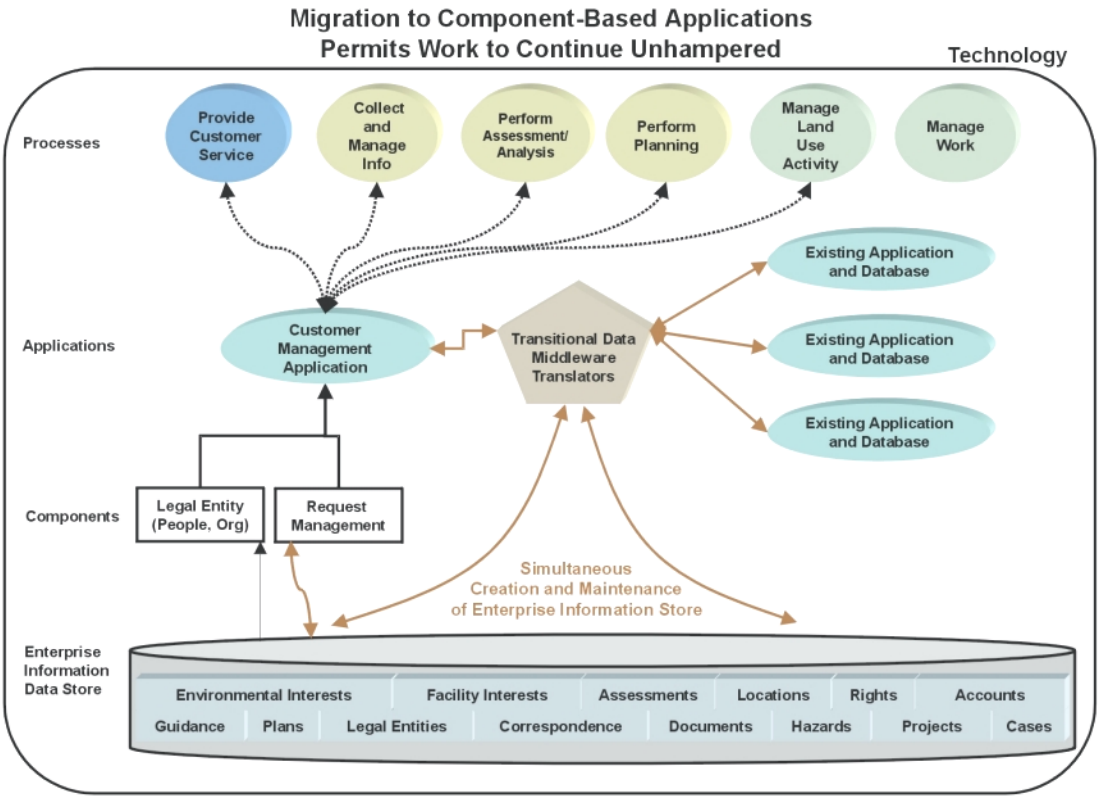


Figure VI.B-2. Migration to Components with Middleware.

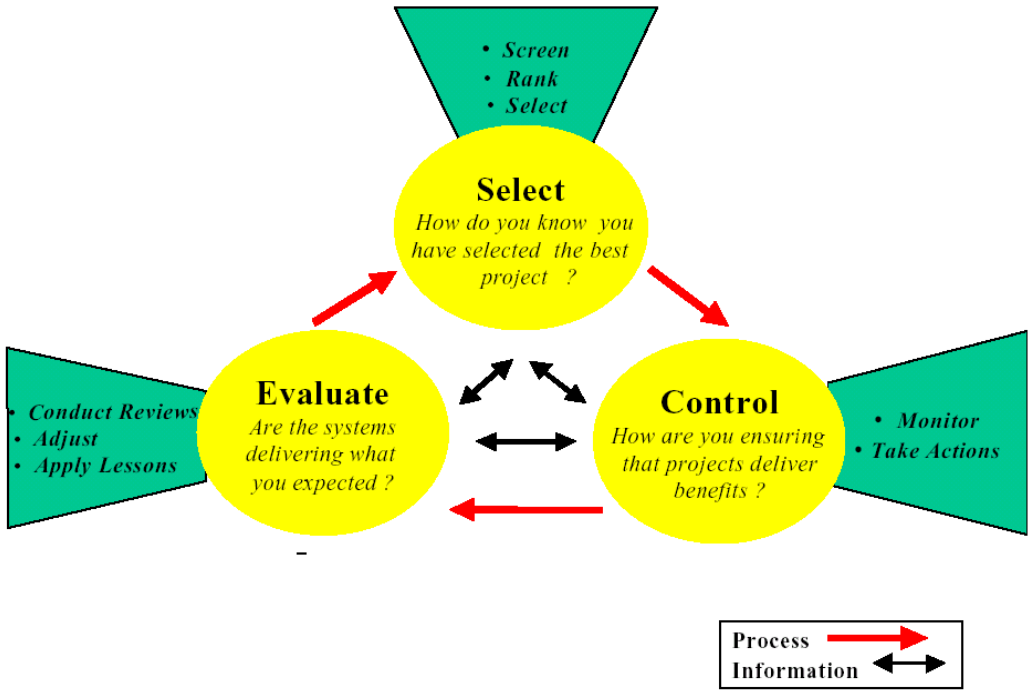
- Phase 2: The legacy applications that have completed Phase 1 are modified (one by one) to use new components. Other applications begin the migration path described in Phase 1. Eventually, all legacy applications use the new component. Application-based private data stores cease to exist and the EIDS becomes the primary source of data. The Translation Layer will most likely remain necessary to help the architecture evolve as new components are developed and applications are reengineered. This approach also facilitates COTS solutions.
- Phase 3: As new component-based applications are developed, legacy applications are either modified to use them or retired when they are no longer needed.

Adequate architectural governance (the development and implementation of policies and procedures to evaluate projects for architecture conformance) enhances the transition to a target environment. For example, during the past year, the BEA Team developed criteria that are now used to evaluate all business cases for conformance with the BEA. Based on the evaluation, the Lead Architect makes an approval/non-approval recommendation to the ITIB. The BEA team also integrates its efforts with the SCO's Select-Control-Evaluate Process for IT projects. Implementation of the Data Management Plan is another form of architecture governance.

Additional requirements for architectural governance will be needed in the future to develop policies and procedures related to the efficient development of components for enterprise-wide use and the proper integration of data, components, applications, and technology in support of business requirements. (See the discussion of Architectural Governance in Section VII.)

VII. Architecture Governance

For the BEA to improve information management, it must be used as a decision support and communication tool to guide IT projects and investments. The BEA facilitates systematic change by continually aligning technology investments and projects with the BLM's mission needs and strategic goals. To achieve this end, the BEA is integrated into the BLM's Information Technology Investment Management (ITIM) process via architectural reviews at critical decision points. The BLM's ITIM process is based on the General Accounting Office's (GAO's) "Select—Control—Evaluate" (SCE) methodology. Figure VII-1 illustrates the information and process flow methodology. As projects move through each phase, they are evaluated for architecture alignment and conformance. The System Coordination Office (SCO) oversees national IT projects and investments to ensure adherence with the BLM's Select, Control, Evaluation criteria.



Source: Assessing Risks and Returns: A Guide for Evaluating Federal Agencies' IT Investement Decision-making; U.S. General Accounting Office; GAO/AIMD-10.31.13; February 1997.

Figure VII-1. Information and Process Flow Methodology.

Table VII-1 identifies the types of enterprise architecture reviews that should be conducted as referenced in *A Practical Guide to Federal Enterprise Architecture, February 2001*. The BLM has established architecture alignment criteria that are used to evaluate proposed business cases in the Select phase. Business cases are evaluated against the criteria for all BEA layers (e.g., process, data, applications, and technology) to ensure the proposed project adheres to the applicable principles, conceptual target, technical reference model, and other architecture factors. For example, to minimize data redundancy and improve or enforce data standardization, available data models are reviewed for proposed projects. Systems requiring data already housed in existing data stores may be modified to access this data rather than to create redundant data.

Type of EA Reviews	Review Purpose/Goal
Business alignment	Determine if the proposed project aligns with agency strategic plans, goals, and objectives. The goal of the review is to ensure the expected business outcomes of the project are aligned to concept and high-level project requirements.
Business case solution	Examine the proposed solution, at a high level, to determine the impact introduced into the organization's IT environment. The goal of the review is to ensure the proposed solution supports both the business and technical architecture.
Sequencing plan	Determine whether the proposed investment is consistent with the sequence and priorities in the plan. The goal of the review is to ensure progress toward the target architecture.
Technical compliance	Determine whether the architecture of the proposed solution complies with the enterprise standards, the various architecture levels, and methodologies. The goal of this review is to ensure technical compliance of IT projects.

Source: A Practical Guide to Federal Enterprise Architecture

Table VII-1. EA Review Goals.

The results of these reviews are provided to the SCO and the respective project manager or proponent. Architecture review results, along with results from other reviews (e.g., financial, strategic alignment, and project management), are consolidated and presented to the ITIB for consideration in evaluating projects. The ITIB is the BLM executive decision-making body that approves or disapproves proposed and ongoing projects and determines whether corrective actions should be taken during any of the three SCE phases.

Projects are evaluated for compliance with the Technical Reference Model (TRM) during the Control Phase. These reviews ensure the projects are proceeding along the technical direction established by the BLM. Program and Project Leaders should refer to the BEA for guidance and constraints on systems architecture and design. A primary goal of the project proponent and manager should be to ensure the proposed solution supports the BEA. Figure VII-2 shows that the BEA is an iterative process. Standards and technologies are constantly retired, revised, or introduced into the architecture for various components (e.g., network or desktop systems).

The TRM is updated regularly; however, it is a static document. Project reviews must consider that although the TRM is static, technology changes are extremely dynamic. A waiver process must be established to adequately respond to these situations. Information Management issues policy on TRM adherence and provides a waiver process. Non-compliant initiatives may be approved for research, concept development, prototyping, and other purposes. These efforts may challenge assumptions currently accepted in the EA and may lead to breakthroughs that could significantly improve the EA. (See *IM 2001-204, Approval and Use of the Information Technology TRM*, Volume 2.)

To further architectural governance efforts, the BLM recently established a Technical Review Board (TRB). The TRB is chartered to be the governing BLM entity that facilities the ongoing development of the Information Technology Architecture (ITA) and determines technical conformance to the ITA as defined in the TRM.

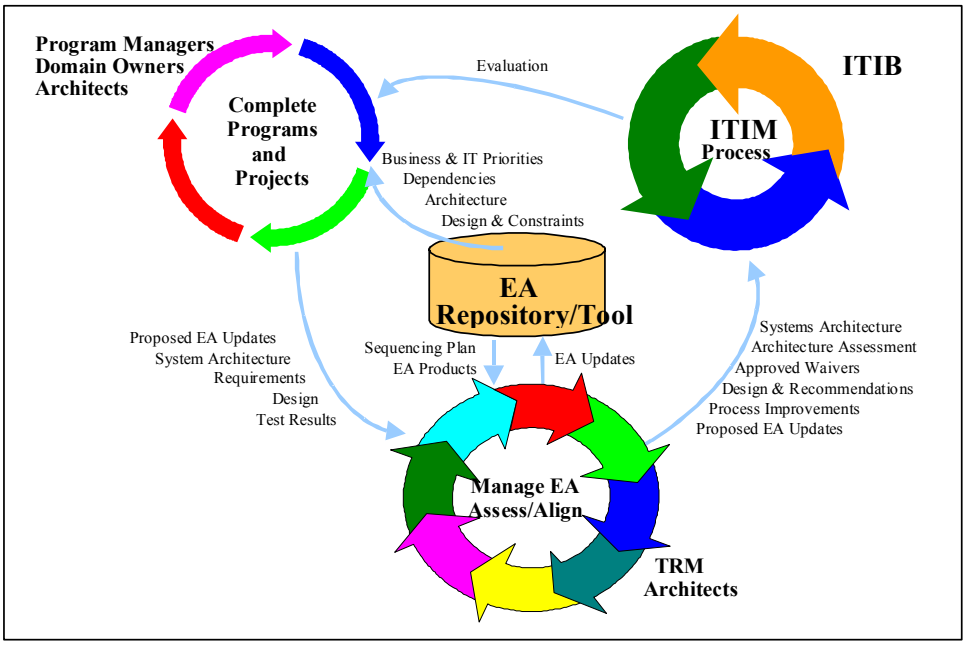


Figure VII-2. Program/Project Evaluation.

VIII. Next Steps

FOCUS AREAS

Table VIII-1 highlights the four functional areas in which recommendations are focused—Collect and Manage Information, Assessments, Planning, and Customer Service. It also shows the relationship of each of the four areas to the process, data, and application layers of the enterprise architecture. For any of the functional areas to evolve to the target environment, processes, data, and applications, along with their relationships to each other, must be analyzed and restructured. This tables graphically depicts the next set of interdependent activities that are the key to the BLM's success from a business perspective.

Business Subject Area	Process	Data	Application
Collect and Manage Information	Develop new process model	Model data	Recommend component
Assessments	Develop core assessment process Modify core for unique processes Fully decompose APD and ROW models Develop SOP checklist for APD, ROW, and LUP	Build EIDS for assessments emphasizing APD and ROW Develop data model Ensure data quality Migrate data to EIDS Identify the data necessary for trend analysis	Recommend Components for: APD ROW
Planning	Develop standard processes for implementing and tracking approved LUPs.	Build EIDS for LUP Develop Enterprise Information Model Ensure data quality Migrate data to EIDS Identify shareable planning data	Develop Request Management Component Incorporate Request Management Component into Customer Service Application Recommend component for LUP
Customer Service	Validate Customer Service process model	Build EIDS for Legal Entity and Request Management Request data model Ensure data quality model Migrate data to EIDS	Develop Legal Entity Component Consider Acquiring Customer Service Application Incorporate Legal Entity and Request Management Components Identify potential new components

Table VIII-1. Detailed Focus Area Plan.

INITIAL PLANNING

Initial-level scheduling considerations for implementing the recommendations presented in Section V are depicted in Figure VIII-1. The chart lists the recommendations presented in Section V and shows an ideal high-level estimated timeline for completion of each recommended project. One major consideration for project commencement is the date on which it is approved by the ITIB. Some projects require preliminary staff work on activities such as estimating process transformation or data standardization before a business case can be developed and submitted to the ITIB for approval. Consequently, the ability of project managers to prepare business cases in time for consideration at periodic ITIB meetings is critical.

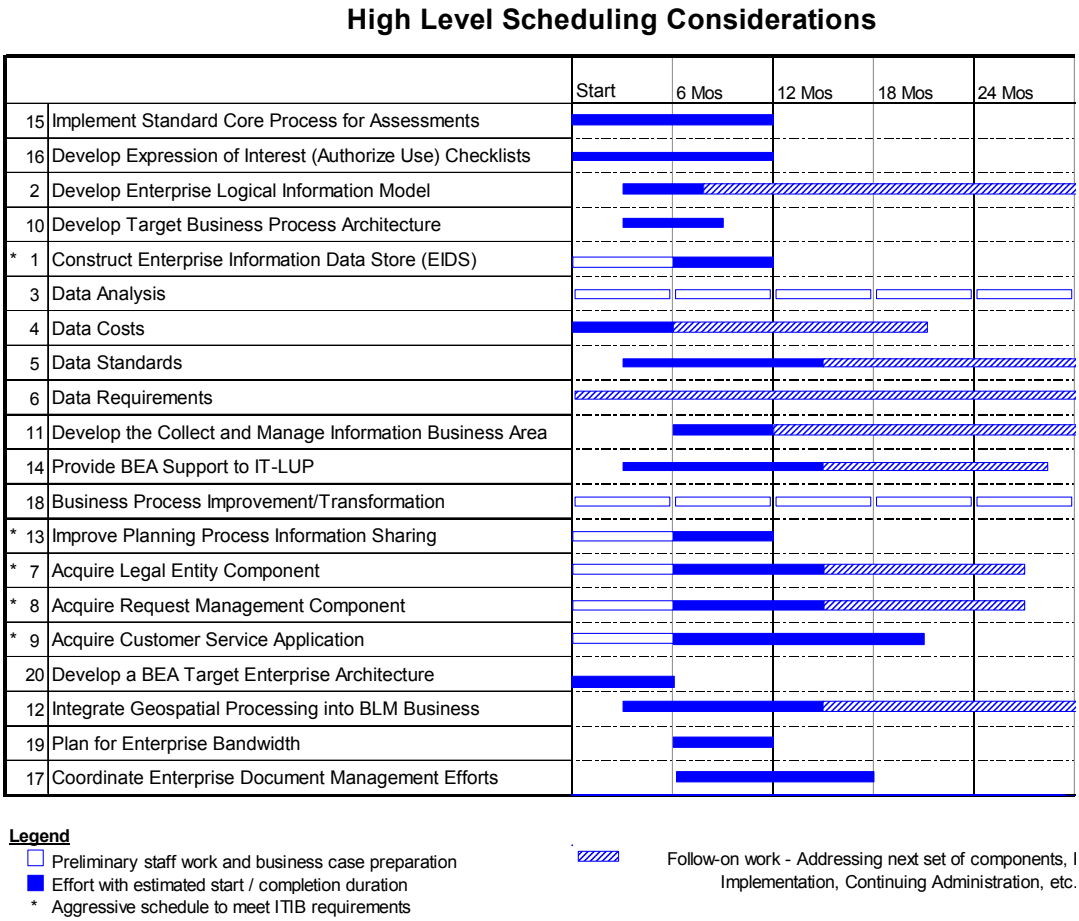


Figure VIII-1. High-Level Scheduling Considerations.

BUILDING PARTNERSHIPS

The BEA team is prepared to support program directors and project managers in any way possible to facilitate the preparation of appropriate business cases and the implementation of approved projects. The BEA team offers particular expertise in process and data analysis and modeling, preparation of data standards, database development, requirements analysis, and application analysis. In addition, the BEA team will work with project managers to evaluate the implications of BEA requirements and standards for projects and to assist in identifying the most expeditious means of meeting those requirements and standards. Efforts over the past two years to collect information and establish a baseline current BEA have produced a wealth of knowledge about the BLM, its business, and how IT is used to support business requirements. The BEA team is eager to share that knowledge and assist program area efforts to more efficiently conduct the BLM's business and share information with its customers.

IX. Summary

This Summary Report has provided an overview of the current BEA and its value to the BLM, both as a tool for capital investment planning and for legislative compliance. BLM FY01 initiatives and their accomplishments have been presented here.

Perhaps the most significant element of this project is its focus on the evolution of the BLM Target Architecture. This report presented a Conceptual Target Architecture that will be refined with further detail in the coming year. BLM's Target Architecture will promote robust data repositories, also termed enterprise information data stores (EIDS), and will leverage reusable application components where practical that are designed to support redefined and streamlined business processes. As a first step in this evolution, 20 specific recommendations supporting this objective have been identified and an initial implementation schedule has been provided.

Throughout this report, there is an underlying theme of partnership and teamwork. The ability of the Core Team, the BEA Team, and various BLM personnel to come together and produce an EA is a testimony to their commitment to this project. This cooperative spirit will, of necessity, be a key success factor as enterprise-level decisions are made in following years.

Glossary

Many of the definitions in this glossary have been adapted from *The Computer Desktop Encyclopedia*, Second Edition, by Alan Freedman. New York: AMACOM, 1999.

Acronym/Term	Full Name/Definition
ABC	*Activity-based Costing.*
AFMSS	*Automated Fluid Minerals Support System.*
ALIS	*Alaska Land Information System.*
ALMRS	*Automated Land and Mineral Record System.*
AM	*Automated Fleet Management System.*
APD	*Application for Permit to Drill.*
application	A specific use of a computer, such as for payroll, inventory, or billing.
backbone	The part of a communications network that handles the major traffic. It generally is the fastest transmission path in the network and often covers the longest distance of any path as well.
bandwidth	The transmission capability of a communications network.
BEA	*BLM Enterprise Architecture.*
BLM	*Bureau of Land Management.*
BSS	*Bond and Surety System.*
CBS	*Collection and Billing System.*
change management	See *configuration management*.
CIO	*Chief Information Officer.* The CIO is generally in charge of all information processing within an organization.
CMR	*Corporate Metadata Repository.*
component	In a component-based architecture, the term means a reusable element of an applications architecture that can be used by any application, running on any processor in the technology infrastructure, using data available from anywhere in the enterprise.
component-based applications architecture	A system for designing application software that incorporates protocols and interfaces for interacting with other programs and providing for flexibility and expandability to meet future needs. The architecture includes small program modules, or components, that are designed to work together with each other when an application that uses them is run and that allow new applications to be built and customized quickly.
configuration management	A system for keeping track of large software development projects. A full-featured system automatically documents all of the components used in an application and is able to maintain previous versions of the application.
COTS	*Commercial-Off-The-Shelf.* Ready-made computer hardware or software that is available for sale.
CRUD	*Create, Read, Update, or Delete.*
CRV	*Common Requirements Vision.* A document that provides the basis for the development of the Department of the Interior's Enterprise Architecture.
CSFN	*Cadastral Survey Field Notes Index System.*

Data	Any form of information. In the Information Technology area, the term includes such items as spreadsheets, databases, text documents, images, and digital voice or video recordings.
data element	The fundamental data structure in a data processing system. Data elements are stored in fields. In a customer database, for example, data elements might include the customer's name, address, and city.
data management	The management of all data within an organization. This function typically includes administering the data as well as setting the standards for how data is defined, perceived, and used.
data mining	Exploring detailed business transactions to uncover patterns and relationships within the business activity and history.
data model	A description of a database's organization, often created as a diagram that shows the relationships between entities.
data processing	Using machines to process data. Now called *Information Technology.*
data repository	A database of information about applications software. It may contain such fields as author, data elements, inputs, processes, outputs, and interrelationships. A repository can also be used to identify software components and the business rules for their reuse.
data storage	A permanent or semi-permanent media for storing digital data. Examples include magnetic and optical media such as discs and tapes. Not to be confused with random access memory, which provides a temporary workspace for executing software instructions and processing data.
data structure	The physical layout of data. Examples include data, memo, fixed-length, and variable-length fields; database records, files, and indexes; text documents, and spreadsheets.
DOI	*Department of the Interior.*
DSA	*Data subject area.*
E-GIS	*Enterprise GIS.* See *GIS.*
EA	*Enterprise Architecture.* An Enterprise Architecture is comprised of four subordinate architectures: process, data, applications, and technology (sometimes called the infrastructure). When fully integrated, they represent the EA and describe what the organization does, the information required to perform the enterprise's business, the applications used to automate business processes, and the hardware and operating systems used to support the applications.
EI	*Enterprise Information.*
EIDS	*Enterprise Information Data Store.*
enterprise	An entire organization.
enterprise model	A depiction of how an organization conducts its business. The design of the organization's information systems is based on this model.
environment	In the case of the BEA, an environment is either the current or target state of the EA. The environment describes the status of the processes, data, applications, and technology of the EA.
EOI	*Expression of interest.*

extensibility	As applied to a hardware or software system, the term means the capability of being easily expanded or customized. See also *scalability*..
FAQ	*Frequently Asked Questions.* An FAQ is a group of commonly asked questions about a subject, along with the answers. FAQs are used extensively on the Internet. Vendors use them to reduce the need for telephone-based customer support.
FY	*Fiscal Year.*
GAO	*General Accounting Office.*
GIS	*Geographic Information System.* GIS is a digital mapping system used for exploration, demographics, dispatching, and tracking.
GLO Project	*General Land Office Records Automation Project.*
HR	*Human Resources.*
HRM	*Human Resources Management.*
IM	*Information Management.*
interoperability	The ability of one system to communicate or work with another system.
IRM	*Information Resource Management.* This discipline analyses an organization's information resources. It covers the definitions, uses, value, and distribution of all data and information within an organization, and evaluates the kinds of data and information an organization requires to function and progress effectively.
IT	*Information Technology.* IT is a broad term covering all aspects of the use of computers to process information. Previously known as *data processing*.
ITIB	*Information Technology Investment Board.*
LAN	*Local Area Network.* A LAN is a communications network serving users within a closely-defined geographic area, such as a single office building. It consists of servers, workstations, a network operating system, and communications links that tie everything together.
legacy application	An application that has been in existence for some time.
legacy system	A mainframe- or minicomputer-based information system that has been in use for a long time.
life cycle	The useful life of an application or information system. The length of the cycle depends on both the nature of the work being done and the software development tools used to create it. A large number of patches eventually undermines the structural integrity of the system to the point where it can no longer be expanded.
LUP	*Land Use Planning.*
MAN	*Metropolitan Area Network.* A MAN is a communications network that covers a medium-sized geographic area, such as a city or suburb.
metadata	Data that describes other data. A data repository is one example. The term may also refer to any file or database that holds information about another database's structure, attributes, processing, or changes.
migration strategy	A series of steps allowing an organization to evolve smoothly to a new architecture. Also called a *migration path.*

network operating system	A network operating system manages networks as well as the computer on which it is installed. It processes multiple requests simultaneously and provides the security necessary in a multi-user environment.
NILS	*National Integrated Land System.*
OIG	*Office of the Inspector General.*
operating system	The master control program that runs a computer. The operating system sets the standards for all of the applications that run on the computer.
PDAT	*Process, Data, Applications, and Technology.*
plug and play	In the context of software development, the term means the ability to add a new component and have it work without having to perform any technical analysis or procedure.
program logic	A sequence of instructions in a program. There are three classes of instructions: sequential processing, selection, and iteration.
reengineering	The use of Information Technology to improve performance and cut costs. The technique is used to examine the goals of an organization and to redesign its work and business processes from the ground up.
reusable	An existing software component that can be used in building new applications.
ROW	*Right-of-way.*
scalability	As applied to a hardware or software system, the term means the capability of being easily changed in size and configuration. See also *extensibility*.
SCO	*Systems Coordination Office.*
SDE	*Spatial Database Engine.*
sharable	The ability of a software component to be used by more than one application. One example is the spell checker in an office applications suite, which can be used by all of the applications in the suite.
SME	*Subject matter expert.*
stovepipe application	A standalone application that does not integrate with, or share data or resources with, other applications.
TCO	*Total Cost of Ownership.* The total cost of using a computer, including the hardware, software, upgrades, training, and technical support.
TRB	*Technical Review Board.*
TRM	*Technical Reference Model.*
WAN	*Wide Area Network.* A WAN is a communications network that covers a very large geographic area, such as a state or country.

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