



**BUREAU OF LAND MANAGEMENT**

**Initial Bureau Architecture**  
(Version 1.0)

*Summary Report*  
of the Bureau Architecture Team

March 31, 2000

With Contracted Support from: **SOZA**



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## SECTION 1—OVERVIEW

### What is in This Report?

This report presents the Bureau Architecture (BA) Team's findings and recommendations regarding an initial (Version 1.0) Bureau of Land Management (BLM) Architecture. These results are discussed with only a minimal description of the analytical methods and the data that were used to develop them.

The recommendations concern the following areas:

- < Immediate implementation strategies for information technology (IT) and business investments to both improve the current architecture and begin the migration to the future architecture.
- < Recommended architectural criteria to be used by the IT Investment Board (ITIB) to judge whether both existing and proposed IT projects fit the future architecture.
- < Structures to use and maintain the architecture into the future.
- < A suggested order of implementation.
- < A description of what additional work remains to be done to build out the rest of the BA.

The findings and recommendations about the current and desired future state of business processes and IT management are based on an analysis of BLM's:

- < Work processes,
- < Data and information,
- < Automated applications, and
- < The computer technology infrastructure to support them.

In this report, the BA Team has grouped actions into six implementations strategies, which are a mechanism to allow a relatively easy grasp of the numerous actions required to achieve the future vision. The six strategies are:

- < **Facilitating the Accomplishment of BLM Work in the Field**—*Delivery of Information Directly to the Program Specialist/Decision-maker*
- < **Improving the Utility of BLM Business Processes and Information**—*Making Sustainable Resource Decisions; Replacing Out-dated Land Use Plans*
- < **Managing BLM's Information Resource is Part of BLM's Real Work**—*Establishing Accountability, Responsibility, and Authority*
- < **Assuring and Storing High-Quality Program Information**—*Structured Data Administration and Management*
- < **Providing the Solid Foundation on Which All Technology Works**—*Technology Infrastructure, Network and Security*
- < **Getting the Return on Investment and Budget Dollars**—*Management of Information Technology Investments*

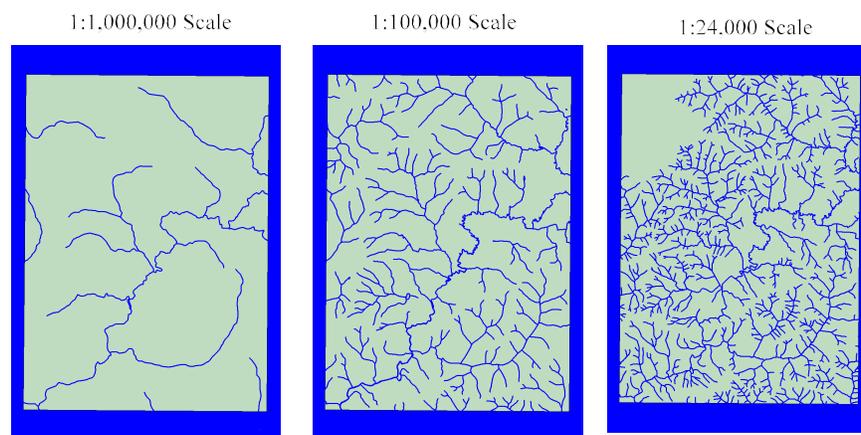
## What is an Architecture?

At its core, the BA is about the work that the BLM does and the information that we use to accomplish the work. Structurally, the BA is a management framework that describes:

- < “What” needs to happen rather than “how” it should happen;
- < The business rules and processes (including information and data) required to operate the organization that are independent of any specific organizational structure, technology, or existing systems;
- < The hardware and software needed in basic operations of the BLM.

The BA is composed of two parts—the Business Architecture and the IT Architecture. Each is dependent upon the other, and neither can succeed without the success of the other.

One way to understand the initial BA is to think of topographic maps at different scales. A map at the scale of 1:1,000,000 shows the landscape and major, easily recognizable features. As one looks at maps of the same area of higher resolution (i.e., 1:100,000 and 1:24,000) one sees more detailed features, yet the overall landscape remains visible. The same is true of the BA. The Initial BA shows the overall view of BLM as well as major areas of opportunity for improvement and integration of business and IT. Later work on the BA will produce increasing detail in high priority areas, corresponding to higher map resolutions in this analogy.



**Figure 1-1. One Landscape—Multiple Scales**

## Why Do We Need an Architecture?

There are some very good reasons:

- < It gives BLM a means of providing managers and employees with the tools they need to make the best possible decisions in any arena;
- < It provides BLM with a means to defend the decisions that are made; and an efficient process to implement the decisions made;

- < It provides BLM with accountability for technical IT decisions to the Business Process owners;
- < It will allow BLM to be more competitive for new budget resources by providing a sharper focus on BLM's business lines.
- < It helps BLM get the support needed from the Department, Office of Management and Budget (OMB), General Accounting Office (GAO), and the Congress;
- < BLM will not get the budget resources needed to accomplish program work or to acquire needed technological tools without the BA;
- < Laws and executive directions, the Clinger-Cohen Act, GAO and OMB directives, require us to have it.

## What is the Business Case for the BA?

BLM managers need to realize that architecture is not a one-time job. In the words of Neil Armstrong, this is "One small step for man, one giant leap for mankind." The initial BA represents only the "first small step" in relation to the overall effort needed.

Since BLM has not done much in horizontal work process analysis previously (past analysis has been mostly programmatic), we will need to enhance and further build out the BA process descriptions as lessons are learned in using the BA to support the BLM's business and IT investment decisions.

Some people may believe that the actions proposed in this document are not necessary and that business process reengineering as well as automation are luxuries—not a necessity. The BA Team specifically rejects this belief. We simply cannot afford to—either in terms of available staff, budget resources, or credibility—operate redundant work processes, collect the same data time and time again, or haphazardly implement new technology.

How many times have we collected data for a planning effort and not reused it when needed for an Environmental Assessment (EA)? Or conversely, if data had been captured at the EA level and kept current in the normal course of an employee's work, could it have been reused in either a planning effort or other work process?

In a different light, given the potential turnover in BLM's resource expertise over the near term due to retirements, etc., how much investment in on-the-ground resource knowledge will depart without any means of capturing that knowledge so it can be reused by new/other employees? How many times have different BLM offices implemented different solutions to enterprise-wide business needs?

The BA Team estimates that within the seven primary BLM mission-oriented work processes—there is a minimum of \$27 million wasted annually due to the above data inefficiencies. The total labor cost only (not including any operations costs) in 1999 for these work processes was approximately \$271.7 million. The \$27 million wasted is derived from an estimate of at least ten percent inefficiency (a very conservative estimate) resulting from

duplication, re-work, and redundant operations. The BA provides the blueprint for building a better future.

## What are the Mission Benefits of the Architecture?

The mission of the BLM is to “sustain the health, diversity and productivity of the public lands for the use and enjoyment of present and future generations.” We organize our work to perform this mission around three major strategic goals, which are further broken down to more detailed business (“mission”) goals. The business processes of the BLM are designed to produce program outputs to meet those goals. Data automation, computer applications, and IT infrastructure all must be focused on supporting those business processes efficiently.

The most important purpose of the BA is to ensure that all available resources are focused on carrying out BLM mandates, including in what order and over what time period these actions need to be performed. For this reason, the BA is structured in the same way—business processes determine data needs, which together determine applications needs, application needs then determine IT infrastructure needs.

In achieving the above objectives, the ELT has approved and we have agreed to use the following business principles in meeting both our mission and the subsequent objectives of the BA. These principles are that BLM will:

- < Manage natural resources for multiple-use and long-term value.
- < Be customer focused and responsive.
- < Adhere to applicable laws.
- < Work in partnerships.
- < Make sound business decisions
- < Provide broad access to public information.
- < Be an adaptive organization.

Having a BA that aligns IT management with the business of the BLM ensures that IT investments are managed in the most efficient and constructive means to perform BLM’s work. But, before new automation is integrated into work processes, enterprise-wide, high quality data are required. Otherwise, one cannot achieve efficiencies that are being sought. Today, we collect a lot of data, but most of which is collected to different standards. Also, new business-focused applications will improve the BLM’s efficiencies and quality of work accomplished.

The BA is just one part of a bigger effort to improve IT investment management in the BLM. These other efforts include re-definition of the ITIB, use of established project evaluation criteria, capital asset planning and management, and adherence to an agency BA in IT decision making.

To conform to the BLM principles, we must provide to our employees:

- < More efficient, re-engineered work processes that can effectively use today's and the future's technology tools,
- < The best scientific, economic, and social information—and public input,
- < A method of setting priorities (both in the business and IT architectures) and an order of implementing investments,
  - Including natural resources costs, program alternatives, or other business needs,
  - BLM organizationally can be proactive rather than reactive,
- < Value added for our IT investment versus the perception of value lost from IT investments,
  - Brings IT decisions into the same decision space as in all other BLM decision processes, e.g., resource decisions.

These changes will help BLM managers to see where IT investments can be consolidated, streamlined, shared, simplified, and improved. Also, it will show where IT development, maintenance, and staff costs could be reduced while at the same time that the quality of service to IT users will be improved. Finally, the BA effort helps BLM to meet requirements of laws and directives.

## What are the “Down” Sides?

Simply stated, the BA is not a replacement for common sense nor is it a silver bullet. It is not a magic formula to apply. We will need to resist the tendency to seek an immediate solution. Answers may not appear easily nor quickly. It will require further—and sometimes painful—work as BLM moves itself from a vertically oriented (‘stovepipe’) organization to a horizontally oriented process-based organization. This will include determining the appropriate balance between the need for local flexibility and for uniform customer service and business processes across BLM’s jurisdictions.

In addition, this report represents a set of findings and recommendations that span the full spectrum of BLM’s business lines. The actions described in this document are rooted in the BLM’s Strategic Plan and subsequent analysis done in support of the ABC process. Therefore, because of this previous, foundational work, we believe the decision space on this recommended course of action is relatively simple—a vote “up” or “down”—on the approach. We recognize that resources and funding are limited. However, the more complex decision space lies in determining the priority of implementation actions, the sequence of steps, and the level of efforts to be devoted to achieving the various pieces of the BA.

In deciding on the recommended approach (regardless of any timing decisions), the following will need to happen:

- < A high degree of executive commitment, leadership, and involvement.
- < A development of and adherence to formal data management policies and standards.
- < Program areas and states will need to sacrifice some perceived ownership for the good of the organization as a whole.
- < Required use of model-based system planning and design (blueprints).

- < Active implementation/migration planning.
- < An effective organization structure recognizing the horizontal view of the work processes rather than the traditional vertical view.
- < Recognition that there is a business side to the BA that may be larger than the IT side.
- < Use of state of the art analytical techniques and tools.
- < Availability of an appropriate skill base.

## Who Developed the Initial BA and This Report?

The BLM's Initial BA and this report were developed by a multi-disciplinary BLM team, with contracted support from Soza & Company, Ltd. (SOZA). The current BA Team was formed in December, 1999 by combining two parallel BA efforts and teams: an enterprise BA team and an BA team for Land and Resource Information Systems. Data and analysis completed by those teams was carried forward into the combined BA project. The work is planned to extend through fiscal year 2000, so this report provides the findings and recommendations from the initial analysis work only—what is referred to here as the Initial BA.

Members of the BLM BA Core Team and the BA Oversight Board are listed in **Appendix A**.

## General Guide to the Report Sections

The content of the following sections of this report is as follows:

- < **Section 2** provides quick descriptions of the architectural analysis methods used, and a summary of the nature of the resulting Initial BA.
- < **Section 3** groups the most important recommendations from the Initial BA analysis into six immediate implementation strategies that BLM can move forward.
- < **Section 3** also discusses the relationship between the BA and the management of the BLM's IT investment portfolio. It recommends the investment decision criteria that measure how well an existing or proposed project fits into the BA.
- < **Section 4** contains the summary description of the Initial Bureau BA and the Team's findings and recommendations for processes, data, applications, and technology; and a roll-up of these into a consolidated picture.
- < Finally, a complete description of the BA, as it currently exists, the full set of business process models for all BLM processes (down to level 3), and specific recommendations for the technical BA are presented in a series of back-up volumes, separate from, but related to this Summary Report. All of the supporting material is retained in a very limited number of hard-copy reference sets in the BLM Washington Office and Denver IRM office locations. More importantly, a significant portion of the BA analysis is incorporated into the BA electronic repository software tool, where it can be refined, extended, and accessed as a key element of the BA. Some of these files will also be made available for use by posting to the Bureau's BA website.

## SECTION 2—DEFINITION OF THE INITIAL BUREAU ARCHITECTURE

This section explains the methods and background activities used to develop the BLM’s Initial BA (Version 1.0), and describes at a high level the components and products that now make up the Initial BA.

### 2.1 Methodology

This section focuses on the methods used to create the initial BA. The equally important methods for using and maintaining the BA that cover project selection criteria and the resources that will be needed to keep the BA up to date are described in **Section 3.3** of this report. No pre-existing approach existed for building an enterprise BA that met BLM’s needs, so the team developed a customized blend of three standard industry approaches.

#### 2.1.1 The Zachman Framework

First, the BA Team started with the Zachman Framework for architectural modeling. The Zachman Framework has been used to organize and store information about key architectural topics, grouped together by level of detail. It is primarily a method to categorize all the kinds of business goals, policies, plans, business needs and elements of IT into one large matrix. When all critical elements of the enterprise have been assigned to the proper cells of the Framework, it is possible to identify strengths, gaps, and opportunities for improvement. The Zachman Framework is used almost universally in architectural analysis, and reference to it therefore helps the BLM in communicating its BA to other agencies and businesses. For this reason, the Zachman Framework is discussed in more detail in **Appendix B**.

#### 2.1.2 Ten-Step Method (Spewak Model)

Second, the BA Team used a step-by-step method, the “Ten-Step Method” provided by SOZA. The Ten-Step Method provided a sequence of project steps similar to the Steven Spewak model. The basic idea of the Ten-Step Method is to analyze business processes and needs, then look at how current information systems components serve those needs. A preferred future suite of information systems components is developed, and the gaps between current and future are identified. Then an implementation plan is created to show a logical path from current to preferred future.

**The ten steps are:**

1. Plan the effort
2. Analyze business strategy
3. Identify business activities that support the business strategy
4. Identify information needed to run the business
5. Assess current systems and databases
6. Assess current technology
7. Analyze gaps

8. Identify future information systems and databases
9. Identify future technology infrastructure
10. Lay out Implementation Migration Plan

These steps were converted to Gantt chart form, scheduled, assigned, and tracked to completion. The listing indicates the general order of steps, but most of the steps run in parallel, and are repeated within each architectural focus area. The Ten-Step Method was used largely in planning, scheduling, and managing the project work efforts.

### 2.1.3 Architectural Focus Areas Method

Third, the BA Team used the “architectural focus areas” method, which looks at an enterprise architecture from the separate viewpoints of business processes, business information and data, computer applications, and IT support infrastructure. The four focus areas relate to each other in a specific way in developing the BA that is determined by the following fundamental principles. These principles are as follows: mission goals must drive business processes; business processes must drive data requirements; the combination of process requirements and data requirements must drive requirements for applications; and the requirements of process, data and applications must drive the technology infrastructure that hosts those applications.

The architectural focus method has worked very well to organize the detailed analysis work of the BA team. It will carry forward into the permanent method for managing BA recommendations and on how to evaluate IT project proposals.

#### The four focus areas in abbreviated form (“PDAT”) are:

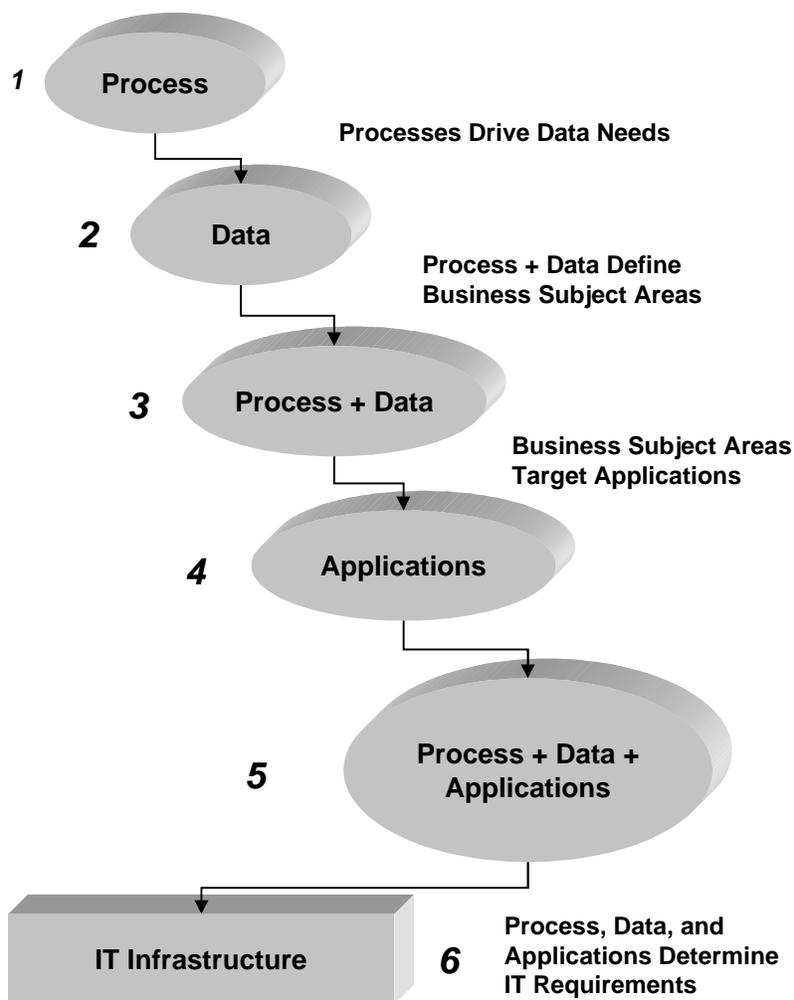
- < The BLM mission defines Process,
- < Process defines Data,
- < Process and Data define Applications, and
- < Process, Data, and Applications define Technology.

Finally in this method, the Architectural Management category provides a roll-up mechanism for the PDAT analyses. This hierarchy is defined in the **Table 2-1** and is illustrated in **Figure 2-2**.

Focus Area	
Process	Process is the work or actions performed in BLM to accomplish its mission. At the highest level, “process” represents the “What” of the BLM’s business.
Data	Data are the raw facts and business rules about people, objects, and events that are important to conduct the BLM’s business.

Focus Area	Description of Contents
Applications	Applications are the computerized software tools that operate on data to execute the BLM's business.
Technology Infrastructure	Technology infrastructure includes all installations and facilities that support computerized applications for information processing and communications needed to conduct BLM's business.
Architectural Management	Management is about the methods, information and tools used to administer each of the above focus areas. It includes the process of creating and managing the consolidation of analysis of those four focus areas into an integrated picture and plan.

**Table 2-1. Hierarchy Definition**



**Figure 2-2. Sequence of Analysis for Architectural Focus Areas**

## 2.1.4 The Integrated Method Used in Developing the Initial BA

This customized BA method incorporates into its procedures the BLM's commitment to putting the efficient execution of missions first. For this reason, the BA is structured according to the PDAT method: business processes determine data needs, which together determine applications needs, application needs then determine IT infrastructure needs.

The BA has been constructed from a variety of best available, current sources and analysis activities performed upon the knowledge collected. The project work plan was divided by the architectural focus areas, so that the steps for current, future, gap, and recommendations were repeated separately for process, data, applications, and technology infrastructure, and integrated for the architectural management focus area.

The BA contains numerous types and forms of models and representations of PDAT for the current (existing) environment, the desired future environment, and a comparison or gap analysis between the current and desired future environment. Work Teams were organized to address the Process, Data, Applications, and Technology Infrastructure (PDAT) focus areas separately. Each of the PDAT work teams analyzed current, future, and gaps for their focus area, and derived findings and recommendations from that unique viewpoint. Then, representatives of each team participated in the roll-up from these focus groups to the consolidated PDAT recommendations. These separate sets of findings and recommendations then were consolidated by the entire BA Team into architecture-level findings and recommendations.

As enterprise BA information was collected by the BA team, it was also assigned to the appropriate Zachman Framework cell, and added to the status summary for that cell. The information then can be accessed through the appropriate cell of the Zachman framework for comparison, evaluation, and further development.

## 2.2 Definition of the Initial BA

It is noteworthy to point out that as of March 31, 2000 the BLM now owns a new and very significant asset, namely, a well documented, enterprise-wide Initial BA.

### 2.2.1 What is the BA?

At its core, the BA is about the work that BLM does and the information that BLM uses to accomplish the work.

The BA is NOT:

- < A document.
- < Totally contained within a single tool (automated or otherwise).
- < Totally completed ever.

The BA will be useful and worthwhile, if it is:

- < Managed as an asset.
- < Always consulted as a key guidance for decision making.
- < Utilized for the design and construction/purchase of automated solutions.
- < Updated as new or changed knowledge becomes known or available.

## 2.2.2 The Contents of the BA

Structurally, the BA is a management framework that describes the business rules and processes (including information and data) required to operate the organization that are independent of organizational structure, technology, or existing systems; and the hardware and software needed in basic operations of the BLM. The BA is comprised of two major components—the Business BA and the Information Technology (IT) BA. Each is dependent upon the other, and neither can succeed without the success of the other.

The BA also includes knowledge about BLM processes, information, applications, technology and the relationships among them. It contains numerous types and forms of models and representations of these PDAT elements for the existing situation, the desired future state, and a comparison or gap analysis between the existing and desired environments. The contents of the BA have primarily been organized to support the PDAT viewing perspective, however, since this information is in a repository it can be organized for viewing from other perspectives, such as the BLM's Activity Based Costing (ABC) perspective, or the Zachman Framework, depending upon the needs of the viewer.

Also, the BA is in itself a process involving an approach and discipline that, if consistently utilized and adhered to, will ensure that the collection, organization, analysis and use of PDAT knowledge continues to grow and mature over time. This will increase the value and usefulness of the BA as a Bureau asset over time.

## 2.2.3 BLM Mission and Strategic Plan

The mission of the BLM is to: “sustain the health, diversity and productivity of the public lands for the use and enjoyment of present and future generations.” The most important purpose of the BA is to ensure that all available resources are focused on carrying out this mandate.

The BLM organizes its work to perform its mission around three major strategic goals, which are further broken down to more detailed business (“mission”) goals.

## 2.2.4 Business Principles

The BA Team with the BA Oversight Board, using the BLM Strategic Plan and other initiatives that BLM has implemented over the past several years, developed a list of “Business Principles” that would provide a touchstone of key concepts around which BLM business activities were conducted and IT systems and applications should recognize. These principles were presented to and discussed with the BLM Executive Leadership Team during their September, 1999 meeting.

The ELT members had no objections to and endorsed the following list of BLM Business Principles:

- < Manage natural resources for multiple-use and long-term value
- < Be customer focused and responsive
- < Adhere to applicable laws
- < Work in partnerships
- < Make sound business decisions
- < Provide broad access to public information
- < Be an adaptive organization

The BA Team used this list in considering the primary features of modeling and presenting work processes, data needs, application needs, and technology infrastructure recommendations.

### **2.2.5 Business Processes**

The business processes of the BLM are designed to produce program outputs to meet those goals. Data automation, computer applications, and IT infrastructure all must be focused on supporting those business processes efficiently. Because of this mission focus, emphasis was placed on modeling the BLM's business processes. Teams of subject matter experts from every program and most BLM states were convened during February and March, 2000 to help diagram key business processes and the data that moves between them.

Teams addressed the following business process areas (which are the same high-level work process categories used in the BLM's cost management (ABC) system):

- 1.0 Provide Customer Service
- 2.0 Assess Condition/Status
- 3.0 Perform Planning
- 4.0 Authorize Use
- 5.0 Implement BLM-initiated Actions
- 6.0 Perform Monitoring
- 7.0 Manage Compliance
- 8.0 Manage Work
- 9.0 Sustain Organization (partial)

These 9 major categories represent the major functional process categories that correspond directly to the strategic and mission goals of the BLM. Note that these categories do not correspond to the BLM's organization chart. Grouping processes in this way permits the BLM to identify functions shared across organizational boundaries, where economies of scale may be possible. In this effort, the BA teams concentrated on identifying and modeling "What" BLM did, not "Who" did it or "How" it was done, which are issues suitable for later stages of architectural development.

### ***Work Process Decomposition***

For purposes of this activity, the nine business processes were defined as “Level 1” work processes. The BA teams broke down eight of these nine components into two more levels, to “Level 3” diagrams. A number of workshops were conducted with subject matter experts to help define level 3 for business process areas 1.0 through 8.0 (see list above), and for the human resources management portion of business process area 9.0, Sustain the Organization.

The process diagrams show the relationships of work and information flows among the various levels of each business process, and between each process and the other BLM business processes as well as with external entities. Level 3 breakouts provide just enough detail for the processes and information flows to support BLM-wide architectural analysis and recommendations. Breakouts to Levels 4, 5 and 6 will be needed later, when particular high-priority business process areas are examined for possible process re-engineering and IT enhancements. The results of these future analyses will be added into the permanent BA repository, and the inventory of process models will gradually grow in breadth and depth.

An example of a Work Process Decomposition and Work Flow Diagram is provided in **Appendix C** to this report.



## SECTION 3—PROPOSED IMPLEMENTATION STRATEGY

This section is organized into three subsections:

- < **3.1 BA Implementation Strategies**, which presents six groups of high priority recommendations that have emerged as a result of developing the Initial BA.
- < **3.2 Investment Portfolio Management**, which provides a high level explanation of how the BA should be used to provide architectural guidance to the evaluation and management of automation proposals and existing investments.
- < **3.3 Refining, Maintaining and Using the BA**, which discusses steps necessary to implement and to improve the BA through providing permanent organizational support and staffing, and taking specific actions.

### 3.1 BA Implementation Strategies

Work processes are at the core of everything that the BLM does. To be most useful, work processes must be re-evaluated and updated at intervals, and current models of the BLM's work processes must be readily available to BLM staff and others who look to them for guidance. The second critical item at the core of everything the BLM does is a body of essential, critical information entities.

At present, work processes, information and data entities, methods, and tools tend to be isolated into individual programmatic compartments. As new work processes are required or existing work processes need updating, the BLM typically starts over almost from scratch. As BLM seeks to move from a vertically oriented ('stovepipe') organization to a horizontally oriented process-based organization, there are numerous opportunities to re-assess work processes for improvements, to make them more effective, and less costly.

The same is true for critical, corporate information entities and coverages. Information used in work processes usually is not maintained consistently, nor is it accessible to all users who need it. Great efficiencies can be achieved by automating the creation, maintenance, and sharing of key information elements needed to do BLM work and make BLM decisions, and by making the information available on-line to BLM staff.

At its core, the BA is about the work that the BLM does and about the information that BLM uses to accomplish the work. The BA includes knowledge about BLM processes, information (data), applications, technology, and the relationships between them.

The BA Team recognizes that the lengthy and diverse list of findings and recommendations from the BA is difficult to absorb and to implement separately. The team also has seen that many of the most important findings and recommendations fall into categories, and can therefore be grouped into a manageable number of implementation strategies. These strategies need to be discussed and approved by the ITIB and ELT, and then aggressively and consistently pursued across BLM.

The first two implementation strategies directly focus on improving IT support to the primary business functions of the BLM. The other four strategies represent critical actions required to accomplish the first two strategies. They also are fundamental to implementing the entire BA.

These six strategies are as follows:

**Facilitating the Accomplishment of BLM Work in the Field—Delivery of Information Directly to the Program Specialist/Decision-maker**

**Improving the Utility of BLM Business Processes and Information—Making Sustainable Resource Decisions; Replacing Out-dated Land Use Plans**

**Management of BLM’s Information Resource is Part of BLM’s Real Work—Establishing Accountability, Responsibility, and Authority**

**Assuring and Storing High-Quality Program Information—Structured Data Administration and Management**

**Providing the Solid Foundation on Which All Technology Works—Infrastructure, Network and Security**

**Getting the Return on Investment and Budget Dollars—Management of Information Technology Investments**

Each strategy is described in more detail in the following pages. These strategies should be used by the ITIB to identify, solicit and fund project proposals and other tasks to begin using the BA. The ITIB also should use these strategies in its evaluation of project proposals and funding requests, as discussed in section 3.2 below.

### **3.1.1 Implementation Strategy 1: Facilitating the Accomplishment of BLM Work in the Field—Delivery of Information Directly to the Program Specialist/Decision-maker**

#### ***Objective***

To re-focus the development, acquisition, and deployment of information technology assets within the BLM to delivering the information and tools needed by each employee “on the firing line,” in the field or in the office to conduct the BLM’s work in the most efficient, effective and productive manner possible.

#### ***Rationale***

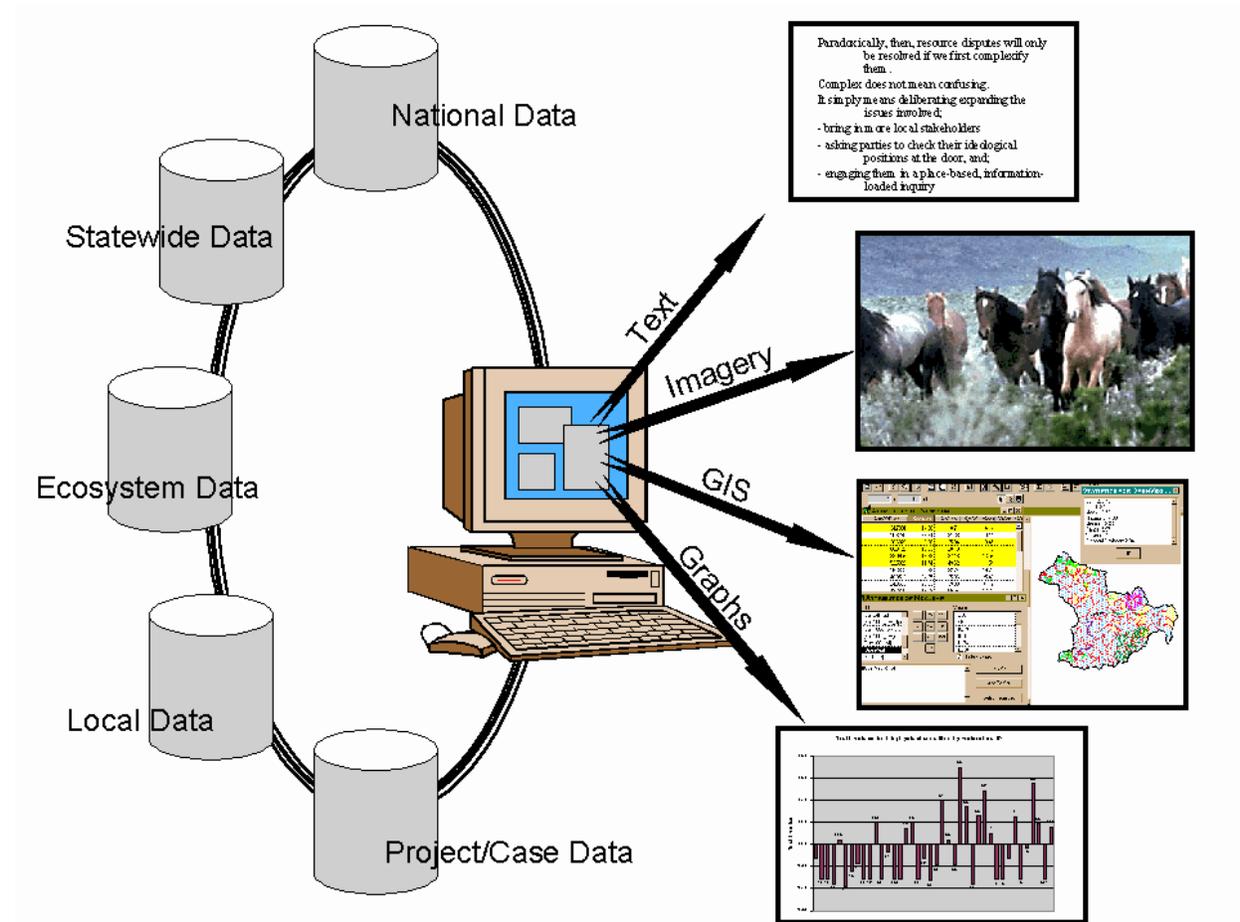
The guiding vision of the BA is that quality, reliable, and accurate information is mission-critical, and that the required suite of information management tools, data resources, and documents need to be made accessible to every BLM employee or manager who needs them to do their work anyplace at anytime. Significant efficiencies and long-term cost savings can be achieved by automating the creation, maintenance, and sharing of key information elements needed to do BLM work and make BLM decisions, and by making the information available on-line to BLM staff.

Business processes must drive information management decisions, set the priorities of, and maintain oversight of information management actions. Information management assets must be organized around putting the right information, in the right format (spatial displays and analyses, tables of data, legal documents of record, scientific models and applications), in front of each BLM employee where and when that person is performing the BLM’s work.

To evaluate a permit application, for example, BLM staff may require map overlays, tabular data, site photographs, and other forms of data to be accessed readily on a desktop computer or a portable device. That information currently may be located in many separate computers, in varied forms, and may be inaccessible to many of the BLM staff people, for practical purposes. Data, applications, and IT infrastructure development should be prioritized according to the necessity to channel all required information to that BLM staff person in such a manner as to most effectively reduce program administration costs and errors. This means that the primary metric for IT effectiveness will be its contribution to the achievement of BLM program (business process) goals, at reduced cost.

A corollary to the delivery of the right information is the need to provide efficient task-oriented user interfaces. Such interfaces will: (1) simplify getting to the right data (spatial, alphanumeric, graphical, and other types), (2) combine data entry with database maintenance, form generation, and record-keeping, and (3) use COTS software that supports interactive query, spatial analysis and visualization, and reporting of results. Such interfaces adhere to the principle that data is entered once, for all purposes, and is made available to all functions and users who may require it. These interfaces must provide for display and query of spatial data, since the nearly all of the

“business” conducted by field office personnel entails the use, analysis and visualization of geospatial data. The vision can be illustrated as follows:



**Figure 3-1. Bringing Information to the End User**

### **Implementation Steps**

Implementation would include the following steps:

- < Determine what the various categories of BLM employees need for “on the screen” access to information and tools for finding, displaying, analyzing, maintaining, and reporting information, especially for field operations.
- < Develop a base set of end-user requirements, to be provided universally, or nearly universally, and additional types of interface capabilities that are required by major categories of BLM employees.
- < Make initial determinations of what capabilities should be further customized to business processes, and in what priority order. For example, providing generalized ad hoc query capability for all BLM employees performing use authorization is non-customized, as it requires the employees to know and seek out information required in each business process step.

- < Initiate modeling of the coverages, databases, applications, and technologies necessary to support the objective of providing readily accessible and reliable data on the BLM employees desktop (and other) computer screens, starting with the Business Subject Area of Land Status/Resource Condition Determination (see **Section 4.1.3.** of this report).
- < Initiate efforts to determine desktop needs for the Business Subject Areas of Records Management, Name and Address Management, and Work Management (see **Section 4.1.3.** of this report), including doing the necessary additional work process modeling beyond Level 3, data entity definition, data modeling, and data store development work.
- < Seek active support from all levels of BLM management for achieving this vision, and plan the staging of individual projects to advance the BLM step-by-step toward it via obtaining project approvals from the ITIB for implementation.

### **3.1.2 Implementation Strategy 2: Improving the Utility of BLM Business Processes and Information—Making Sustainable Resource Decisions; Replacing Outdated Land Use Plans**

#### ***Objective***

To address a real-time, substantive issue that is facing BLM, namely updating the base of plans through an automated planning process

To deliver tangible, useful products to the BLM employees that they can use in doing their jobs better.

#### ***Rationale***

The work processes “Perform Planning” and “Assess Condition/Status” were determined by the BA analysis to be fundamental to everything else that the BLM does. When coupled with the critical information elements used by most work processes, two major Business Process Areas emerged as significant opportunities for substantial progress. These were: Land Use Planning and Land Status/Resource Condition Determination (see **Section 4.1.3.** of this report). Consequently, business process improvement and technology investments should be targeted and prioritized to support the creation and sharing of critical, foundation data, assessments, and planning decisions, so that it will become easier, quicker, and cheaper to have that critical information available throughout the BLM.

An immediate opportunity to begin moving in the direction of the desired future BA vision exists right now. In the FY 2001 Budget, the BLM is seeking an increase of \$19 million specifically to update land use plans. The requested increase in funding will allow the BLM to achieve its strategic goal of “understanding the condition of public lands” by evaluating and updating existing land use plans and associated National Environmental Policy Act (NEPA) documents.

Recently, the development of the Grand Staircase-Escalante National Monument (GSENM) management plan required the BLM to acquire geospatial data across the affected landscape to provide assessments for the issues identified in the plan. With completion of a management plan, the Monument will need to transition from a static planning database to maintaining a dynamic information system that will support defending and implementing planning decisions. The automated data used for the GSENM plan has the potential to become a “Living Plan” where maintaining up-to-date data allows periodic plan reviews and updates to grow the plan without requiring major data acquisition efforts.

This implementation strategy provides the vision needed to support those new planning efforts with up-to-date information technology and techniques so that plans can be completed more effectively, and that the decisions made will support implementation of those plans more quickly and for a lower unit cost. The focus of this strategy is to automate the geospatial data for the various forms and levels of land and resource plans. Further, the new planning emphasis offers the opportunity to introduce the advantages of automated support to planning into the many

major new plans that will be created. If this strategy is implemented, these plans will be the first wave of easily-maintained, easily-accessible BLM planning documents.

This strategy can also be used to prototype support to the development of major resource assessment efforts (such as the “Sage Grouse” Assessment), in order to test and demonstrate the feasibility of applying reusable data management techniques to these assessments.

### ***Implementation Steps***

Implementation includes the following steps:

- < Review previous large-scale plan development efforts that used automated processes and technologies to produce guidance for other planning projects on methods and tools that are most effective.
- < Perform more detailed business process modeling and data modeling for the Business Process Areas of: Land Use Planning and Land Status/Resource Condition Determination, starting from the reference point of the process models of the Initial BA, and identify the best strategies for applying technology tools to them.
- < Put in place policies to ensure that maximum feasible progress toward the vision of providing accessible electronic plans is made in the ordinary course of the planning.
- < Define stages in plan automation that provide for an immediate start on creating reusable and accessible planning data, followed by progressive, modular movement toward a new vision. Prioritize according to the priorities of the planners to meet their FY 2001 challenge.
- < Strive to implement the goal of universal access to the geospatial (GIS) information and tabular information relating to a location or issue.
- < Establish a strategy to acquire the necessary geospatial data, in the form of fixed coverages of mission critical data across the landscape, that are already available from sources outside of the BLM.
- < Develop a long-term strategy to transition the static planning and assessment data into an Enterprise GIS that is composed of corporate coverages that represent standard data that is maintained in the field but accessible to all, for implementation of the resulting plans.
- < Determine the technical IT architecture that will most efficiently support the future vision for electronic planning, and implementation to define stages and priorities, and reconcile with the BA.

### **3.1.3 Implementation Strategy 3: Management of the Information Resource is Part of BLM's Real Work—Establishing Accountability, Responsibility, and Authority**

#### ***Objective***

To establish the principle that management of the highly valuable information resource assets that BLM has are an inherent part of every manager's and employee's "real" job in each "program" or function of the BLM.

To establish clear roles, responsibilities, accountability, and authority for doing this job. The information management responsibility includes the work processes, systems and applications, databases, data sets, spatial coverages, knowledge, skills, training, staffing, and infrastructure management components.

#### ***Rationale***

Each work process, data category, system, and infrastructure component should have a designated manager, who has the authority and who bears personal responsibility and accountability for the successful operation and performance of that component within the BLM BA. Responsibility in this total operational sense is not now assigned to a specific individual who is both empowered, and held accountable, to succeed.

The concepts of managerial responsibility, sponsorship, stewardship and accountability at logical organizational levels are not defined sufficiently for this purpose, and will require management decisions and intervention. Establishing a "component manager" for each major or critical component will focus both authority and responsibility on a person who will plan, lead, coordinate, measure, advocate, and represent that particular entity, and who will be responsible for understanding the national and local business needs it must satisfy.

Since the BA is developed to support the BLM's primary "business lines" and "customer service" components, specific responsibility should be assigned within each of those "business lines" for every major information management process. It should be assigned at the organizational level, or "tier", that provides the greatest BLM-wide or programmatic uniformity, consistent with legitimate sub-program or regional differences. Sponsorship and managerial responsibility must be seen as a responsibility of the programs.

Success in this implementation strategy will remove all ambiguity concerning responsibility for BA components, and will contribute to the achievement of fewer, more widely available, useable systems that do not duplicate or overlap one another.

### ***Implementation Steps***

- < Establish definitions and (possibly) categories of specific managerial authority and responsibility suitable for the range of BA components including: work processes, data and business information, applications, and technology infrastructure.
- < Define the practical meaning of accountability in respect to personal responsibility, liabilities, and rewards.
- < Provide guidance and training on sponsorship responsibilities.
- < Review existing state models of data managerial responsibility and stewardship, database management and update management for examples that could work at the National and State level to derive principles to govern assignment of managerial responsibility to these tiers.
- < Define and obtain necessary concurrence on logical tiers suitable for cost-effective assignment of managerial responsibility of processes, data sets, applications, and IT technology components.
- < Assign managerial responsibility of components to logical tiers, in a BA priority-driven sequence, and assign managerial responsibility of each specific component to an individual.
- < Establish a standing, permanent BLM organizational and staffing capability and assign specific responsibilities and authorities to manage the various components of both the Business BA and the technical IT BA.

### **3.1.4 Implementation Strategy 4: Assuring and Storing High-Quality Program Information—Structured Data Administration and Management**

#### ***Objective***

To consistently apply accepted business data standards, so that the value of the BLM's information assets are enhanced by improving their reliability, accuracy, utility, and capability for the widest possible use.

#### ***Rationale***

Active data management has quantifiable benefits. Reliable, consistent data results in reduced resource costs (enter once, re-use many times, and accessible to all). Consistent data is also more defensible in legal proceedings. Mission critical information is often scattered, incomplete, or unreliable, despite the vigorous efforts by some BLM personnel. BLM staffs expend time and effort working around these deficiencies, which in the end increase both program costs and time expended. A more diligent effort in applying consistent data standards should be instituted to accomplish the BLM's mission.

The BLM's body of business information about the public lands and resources comprises a major asset of the BLM. Additionally, the BLM uses its data/information to make thousands of business decisions each year. The adherence to established and consistently applied data management guidelines will ensure that this mission-critical business information is complete, correct, and current. BLM managers and employees, our partners, and the public will have valued data that they can do their planning, make decisions, and implement those decisions.

Data/information are gathered for many different projects independent of each other. The alignment of the data with business processes should employ a set of standards and structures to facilitate data sharing across multiple applications and BLM staffs. The usefulness of most IT investments depends on having consistent data. There are currently few mechanisms for data sharing between or among projects and/or programs, and there are very few efficient mechanisms for data storage and maintenance. Establishing BLM-wide data standards that are consistently applied and interpreted will save the BLM money by reducing multiple data entry of the same information. This strategy should address data and database management responsibility and authority while separating the data as a resource from the applications that use it.

#### ***Implementation Steps***

Implementation would include the following steps:

- < Review existing State models for data stewardship and management to modify for use at the National and State level.
- < Characterize and size the data management/administration opportunities using the repository, previous assessments, expert knowledge from the field office BLM staffs.

- < Identify, develop or modify policies and documentation to meet the objectives of data administration and management as presented in the BA.
- < Support development of the corporate metadata repository and/or other method to index, track and plan for easy access to reliable data in directly-useable format.
- < Address the following data administration and management issues: standards, re-engineering, prioritization, simplification guidelines; security; authentication, training, and BLM staffing needs.

### **3.1.5 Implementation Strategy 5: Providing the Solid Foundation on Which All Technology Works—Infrastructure, Network and Security**

#### ***Objective***

To establish a cost effective, technical infrastructure environment that satisfies a wide range of potentially conflicting objectives relating to security and accessibility needs for managing BLM information.

#### ***Rationale***

There are significant limitations in the current Technology BA that do not allow BLM to effectively address and implement electronic mechanisms for various business needs relating to information collection and dissemination for large user populations. These business needs relate to expanding the concept of items such as “public rooms”; flexible/timely support to implementing future business processes; and increasingly sophisticated types, formats and volumes of information delivered to a wide variety of stationary and mobile locations.

There is a clear need to substantially reduce the overall effort and expense currently being incurred by BLM for network and security management, while simultaneously improving the overall security environment and supporting numerous regulations such as FOIA, the Privacy Act, Paperwork Reduction Act, etc. Significant security risks that exists in the current environment need to be addressed. Security strategies and policies need to be geared toward minimizing exceptions.

Major components of the Technology BA, such as, large servers and transmission lines need to be viewed from a best use, multi-purpose perspective that must be flexible and support numerous changes over time, configuration must be administered with this in mind. This does not appear to be approach that has always been used in the current environment.

The BLM must first determine the critical technology infrastructure it needs to support its mission critical and essential applications. Without this list it is impossible to determine, budget for, implement or manage the minimum levels of technology infrastructure required to provide for appropriate day-to-day operational support and business continuity/recovery capability.

The technology infrastructure should move as much functionality as possible towards Internet/Web-based information delivery mechanisms, E-Business, etc.

There is a significant opportunity to leverage the upcoming, mandatory BLM network adjustments, necessitated by the imminent, fall 2000, DOI-NET change, as an opportunity to re-configure the overall BLM network to address several basic issues relating to infrastructure, security and contingency/business continuity issues, particularly for mission critical applications.

### ***Implementation Steps***

- < Provide sufficient capability within the BLM to perform the detailed level analysis, implementation activities and subsequent support for the resulting technology infrastructure from this initiative.
- < Implement a 'Security in Depth' network infrastructure that cleanly separates the four basic levels of business activity and information access/authority from one another. (Namely: Public (Untrusted User), Trusted Business User (BLM and other agencies as appropriate), IT Factory, and Legal Records.
- < Establish a formal management mechanism and the associated automated toolsets to establish, maintain and enforce that an accurate inventory of all hardware, operating systems and major application components that reside on the BLM network exists on a near real-time basis.
- < In conjunction with other recommendations relating to the management of IT investments, implement formal tracking and reporting mechanisms once formal SLAs (Service Level Agreements) performance expectations have been established between the Process Owners and the IT function for all essential and mission critical BLM Applications.
- < A comprehensive Technical Reference Guide needs to be developed, maintained and implemented as part of the guidance and review process for all changes to the existing Technology BA and new proposals.

### 3.1.6 Implementation Strategy 6: Getting the Return on Investment and Budget Dollars—Management of Information Technology Investments

#### **Objective**

To achieve Capability and IT Management Maturity Stage 3 within BLM by FY 2002.

#### **Rationale**

The General Accounting Office (GAO) draft report “Information Technology Investment Management: A Framework for Assessing and Improving Process Maturity” (January 2000) sets out a straightforward, step-by-step procedure to improve agency information management. This strategy will implement that procedure through Stage 3 (of 5). Achieving Stage 3 will include creation of the policy, management, and technical infrastructure necessary to manage the BLM’s IT investment portfolio effectively. This will be blended with work to attain certain elements of the Software Engineering Institute’s Capability Maturity Model.

This strategy requires creation and adequate funding of a BLM organizational structure to: (1) maintain the BA; (2) improve project management; (3) assist in aligning investments with existing and re-engineered business process needs; and (4) provide technical support to the Information Technology Investment Board (ITIB) for all its evaluations. This structure within the BLM needs to have the authority to manage and update the information technology vision and to manage the transition strategy to the future desired state, while improving information technology support for dealing with the ongoing issues and business processes inherent in the BLM.

However, to achieve the BLM’s collective goals, it will be the role of the ITIB to actively solicit projects and activities that collectively fill the gap between the information system that exists today versus that of the future system. Achievement of Stage 3 maturity will mean that IT investment decisions are closely aligned with high-priority needs of the business side of the BLM, as approved by the BLM executive leadership and that individual projects will have a high likelihood of success.

#### **Implementation Steps**

Implementation would include the following steps:

- < Develop and adopt an implementation work plan that customizes the GAO maturity process to the BLM. [A draft of this plan is already in preparation.] This plan should include assignment of individual leads for each new policy, process, and product that must be created. Overall leadership and responsibility should be lodged with the BLM CIO, however, active participation as corporate information management champions rests with all members of the ELT.
- < Commit funding and staffing adequate to support this initiative.

- < Execute the plan under frequent scrutiny by the IT Investment Board and Executive Leadership Team, with continuing review by the IRM Advisory Committee and others whose responsibilities are affected.
- < Complete the design of evaluation criteria and procedures to govern the ITIB's decisions and adopt them for use.
- < Integrate IT investment decision making with capital assets planning.
- < Train project managers in successful project management methods.
- < Develop a comprehensive inventory of the investment portfolio, which is the collection of assets that the ITIB is charged to manage by the terms of the Clinger-Cohen Act.

## 3.2 Investment Portfolio Management

This section describes how decisions to invest money in IT anywhere in the BLM will be evaluated in light of the BA's findings and recommendations. Other elements of this approach are being developed separately, by and for the ITIB, in close consultation with the BA effort. Therefore, this section focuses only on those aspects of investment portfolio management that should be governed by architectural considerations.

BLM is using the BA and parallel efforts to improve its planning and execution of IT projects, so that the most cost-effective blend of IT investments can be identified and achieved over a reasonable period. This BLM effort aligns with the requirements of the Clinger-Cohen Act of 1996, related OMB guidance, and guidance from the General Accounting Office, all of which are intended to assist Federal agencies to succeed in IT management. The concept of the IT investment portfolio, and of managing additions and subtractions from that portfolio to yield the biggest bang for the buck, was contributed by OMB, and is an important element of the BLM investment management process.

### 3.2.1 Purpose and Linkage to the BA

The BA provides a comprehensive blueprint for improving how BLM IT investments support business processes. To follow this blueprint, the BLM needs practical methods to manage all its IT investments—existing and new—to evolve in the desired directions. In the future, every decision to spend money on IT maintenance, development, or training will be made in light of the need to evolve the entire portfolio of IT investments toward the long-term BA goals.

The ITIB is responsible for managing the IT portfolio. Efforts outside the BA are developing the ITIB's procedures, method of tracking the inventory of installed IT investments, proposal evaluation process, money-tracking tools, and other components that the ITIB requires in order to make sound business decisions.

To guide its decisions, the ITIB will adopt a set of objective evaluation criteria. Several of these criteria will, almost certainly, measure the degree to which an existing or proposed IT investment conforms to the BA and promotes its long-term objectives. A project that will help move the BA toward a desirable future state will be scored higher by the ITIB, for these architecture-related criteria. Review of existing and proposed IT investments in respect to these criteria will provide the most direct tool for maintaining and implementing the BA throughout the BLM. The architecture-based evaluation criteria are presented in the following section.

### 3.2.2 Project Selection Criteria Relative to the BA

The following Initial BA criteria are recommended for use in reviewing new projects and proposals, as well as the periodic assessment of existing systems as deemed appropriate by the ITIB. As explained above, these criteria address only the issue of conformity with the BA. Other criteria will be applied by the ITIB along with these in order to make the best investment decisions. The architectural criteria are as follows:

### **1. Module Building Toward the Desired Future BA.**

Existing and proposed IT investments or continued support of in-progress projects must demonstrate that they contribute modules that align clearly with the authorized BA and contribute directly toward attaining the desired future BA concepts. Those projects that deal with the “crisis of the month” must be made to migrate toward the desired future BA. In this context, the ITIB is responsible for making the “keep-toss-acquire” decision in evaluating new proposals or in reviewing the IT BA. As used here, the term ‘acquire’ is defined as the full spectrum of acquisition—from developing in-house to full out-sourcing.

### **2. Attaining the Process-Based Orientation.**

Existing and proposed IT investments that are “stovepipe” will not be deemed as architecturally compliant and new applications must seek to address “cross-cutting” process functionality as defined in the current authorized version of the BA. Support for the BA will be accomplished by further defining and detailing (to levels 4 and 5) the initial BA version of work processes and information flows. Then, proposals for utilizing, augmenting or replacing existing process-oriented applications and/or buying/building new process oriented application(s) if not already existing can be evaluated. Proposals will be supported by specified PDAT information, which is directly relatable to the PDAT elements of the BA.

### **3. Enhance Operational Efficiency—Store Data Once.**

Databases will be owned and maintained as resources distinct from the applications that use them. New projects (including acquisition of purchased applications) will not build or create redundant primary store data entities when there is an existing primary data store that already contains that entity. Secondary data stores may be appropriate in some situations for performance and security reasons; however they may not be used as a redundant mechanism for storage of identical data. Data will be created, updated, maintained, and retired only once through the primary data store. New projects must either utilize the existing primary data store, or seek to fully replace the existing primary data store and support all other existing applications that rely upon it.

### **4. Preference for Use of Established BLM Technology**

Existing and proposed IT investments or in-progress projects must not require the introduction of new types of technology infrastructure (including standards and protocols) beyond those identified in the future (desired) portion of the current approved version of the BA. Any requirement for new technology must first be incorporated into the BA, through an orderly process, before being introduced into new or existing applications. (This includes both strategic existing and missing strategic technology components.) Also, projects and proposals for new applications or in-progress projects will not be architecturally acceptable if they require significant investment in augmenting or modifying technology infrastructure components that have been designated for retirement or replacement.

## **3.3 Refining, Maintaining and Using the BA**

### **3.3.1 Refining and Maintaining the BA—Anticipated Future Effort**

The BA is a dynamic framework for describing and organizing the BLM's work processes, how those processes determine our information and data needs, and subsequent impacts on applications and technology. This framework requires further refinement and long term maintenance. At the same time the BLM will take additional responsibility for the BA from the contractor. In particular, the Assistant Directors must commit staff and other resources to the maintenance of the BA. It is anticipated that some long term contract support may be required to provide specialized skills and knowledge on an as-needed basis.

### ***Further Analyze High Level Data Entities and Primary Business Subject Areas***

The BA has identified over 30 high level data entities or groups of related information. Some of these entities, for example Land Status and Customer, are used by a many different processes throughout the BLM. These areas are defined to the third level business processes with closely related high-level data entities. Based on the priorities identified earlier in this document, the process BA will need to be further defined to the appropriate level to support data modeling and system development. The benefit of this effort would be to provide a common business understanding for the applications and databases required to support the business subject areas.

### ***Work with Project Teams to Ensure Maintenance of the BA***

As project teams develop new applications and databases, and enhance and modify existing applications and databases, they will provide additional information about process, data, applications and technology. This information should be incorporated into the BA so that it accurately reflects the BLM's current status and future vision. The benefit of doing this would be to have one central place that captures the BLM's processes, data, applications, and technology, both current and future. This process is essential to maintaining the BA and guiding investment decisions.

### ***Develop BLM's Current Application Inventory***

Twelve of the BLM's applications were analyzed as part of the BA effort. This is a small sample of the total applications that the BLM uses. The purpose of developing BLM's current application inventory would be to assess the applications that the BLM uses in terms of their usefulness to the business community, how easy the system is to run and maintain for the IT community, and how well the application fits into the BA. The benefit of this effort would be that the BLM would have a better understanding of its application inventory, would be able to identify systems that need to be replaced because they don't meet user needs or are hard to maintain, and would be able to identify redundant and best-in-class systems. The level of assessment required will be a judgement call based on how the application does or does not support the current business needs. Implementation of an Enterprise Management System (EMS) would facilitate the process.

### ***Interface the BA Components into BLM's Corporate Meta-Data Repository***

Currently, most of the BA is represented in the form of business models in Cool:Biz®. However, within NIRMC, there is a Corporate Meta-Data Repository (CMR) that serves as the repository of information about the business processes, data, systems, databases, etc. that support BLM. The information currently in the Cool:Biz® repository should be available to the CMR. The benefit of this effort would be to make all information about the BLM that has been gathered about BLM available in from single source—the CMR. However, since the CMR does not support all of the information and functionality contained within the Cool:Biz® repository, the information currently in the Cool:Biz® repository will be maintained there as well.

### ***Update the BLM BA Internet/Intranet Site***

The information contained in many of the diagrams and reports that make up the BA is only available in hard copy and on LAN-based files. The intent of this effort would be to make the information contained in the BA available to anyone who wants to look at it through the Internet/Intranet. This would reduce the amount of effort needed to respond to people wanting copies of all or part of the BA.

### ***Determine the Current Status of Technologies within the BLM***

A more pro-active examination of the rapidly changing technologies, including Internet, database design, and GIS needs to occur to provide guidance in the future build out of the BA. The BA has a snapshot of the technologies currently in use by the BLM, including hardware, networking, and fundamental IT services that support data and applications. We also need a more comprehensive understanding of the availability and use of technology in the BLM. For example, throughout the analysis it was clear that Geographic Information Systems (GIS) can provide support to the business processes and information needs of the BLM. Some offices use GIS extensively; others use it infrequently. The purpose of this effort would be to find out how GIS is being used throughout the BLM. By doing this, best practices for the use of GIS could be identified. Further, rather than reinvent the wheel, perhaps some of the GIS software already available could be used to meet the needs of other BLM offices.

### **3.3.2 Continuing Benefits of the BA**

When implemented, the BA will serve the following functions, which together will help BLM invest its IT dollars where they will best support the business of the BLM:

1. Provide a model of the business processes of BLM, initially at a high level of detail, but incorporating greater detail as provided by later projects.
2. Facilitate priority ranking of business process areas for new automation investment.
3. Provide an enterprise data model, also increasing in detail over time.
4. Maintain a detailed inventory and descriptions of computer applications in the BLM, mapped to business process, business program, managerial responsibility, and characterized by consistency with the long-term direction of the BA.
5. Maintain a detailed inventory and descriptions of information technology infrastructure components, characterized by consistency with the long-term direction of the BA.

6. Provide architecturally sound guidelines for management of data throughout BLM.
7. Maintain a list of high-priority infrastructure and applications investments based on BA findings.
8. Identify key opportunities in process re-engineering, data management, applications development, and IT infrastructure improvement.
9. Provide specific architecture-based criteria for selecting/evaluating proposed projects within the ITIB's area of responsibility.
10. Provide an organized compendium of related documents, policies, briefings, templates, guidelines, and other aids to improve project management and investment planning.
11. Supply a clear record of progress toward improved IT support to BLM's business processes.

These functions all support BLM compliance with the Clinger-Cohen Act of 1996, which aims at improving IT investment management in Federal agencies.

### **3.3.3 Incorporate the BA into the BLM's Decision Processes—Establish a Full-Time Capability to Manage the BA**

The approach to maintaining and using the BA is likely to evolve with increasing experience. Since the BA is business driven, the BLM needs to establish a permanent BA management staff (with representation similar to the current Core Team) that will be responsible for maintaining the BA. There is also a need for full-time capability for maintaining the BA repositories, building out the rest of the BA features, providing business process analysis and re-design support, providing BA related recommendations to the ITIB, and providing BA support to proposals, ongoing projects, and existing systems. There needs to be a base of resources (either BLM staff or contractors) to provide these functions with additional staff brought in on an as needed basis for special studies or projects.

#### ***Establish a BLM Entity to Manage and Facilitate the Use of the BA***

A Business Architecture Office (BAO) should be established, as proposed by the BA Team, to report to the BLM Deputy Director and the mission Assistant Directors (200, 300, 800). It would be responsible for the refinement, enhancement and maintenance of the BA, and especially the Business BA components. The BAO would work with BLM managers and program specialists to define BLM business needs, conduct associated business process analysis, support the development of data standards, and support improvement of data quality. The BAO would also provide BA support to project sponsors, analyze, and review proposals and approved projects, similar to the CIO's staff, but more from a business viewpoint.

The CIO has a proposed IT Coordination Office to provide the principal support to the ITIB, supporting and coordinating with the BAO and NIRMC. The IT Office would also support the BA by maintaining the BA repositories (e.g., Cool:Biz®, CMR, etc.), leading data modeling and derivation of application and infrastructure requirements, and providing contractor support for the BA. Working with the BAO, the CIO's staffs would then derive data models, application functional requirements, and determine impacts on technology requirements to implement the

BA. The IT Office will provide managers of IT projects with management standards, guidance, and support on project proposals and approved projects.

### ***Institutionalize BA as Part of BLM***

Now that the BA has been developed, it is important that it be made part of the BLM's decision-making and system development processes. This requires training and educational steps that work to ensure that the ELT, ITIB, senior management, and staff of the BLM understand the BA and are connected to using it as a decision support tool.

### ***Ensure that All Applications Being Implemented Conform to the BLM BA***

The BA describes the desired future for our business processes, data, applications, and technology and a path to get there. Only those applications that conform to this path should be built or acquired.

**Table 3-2** provides more detailed suggestions concerning the nature of these roles.

<b>ASSIGNMENT OF BA FUNCTIONAL RESPONSIBILITIES</b>							
	<b>Organization</b>						
<b>Function</b>	<b>ELT</b>	<b>ADs</b>	<b>CIO</b>	<b>BAO</b>	<b>ITIB</b>	<b>ITC Office</b>	<b>NIRMC</b>
Specify business needs and priorities	A	L		S		S	
Maintain BA	A		A	L	S	S	S
Business process analysis & requirements		S		L		S	
Data analysis & requirements		L		S		S	
Data modeling		S		S		L	
Application functional requirements		S		S		L	S
Technical infrastructure requirements				S		L	S
Maintain BA repositories				S		L	S
Manage projects	A	L	S	S	A	S	S
Manage data	A	L	S	S		S	S
Standards	A		S	L	S	S	
Content & Quality		L	S	S		S	
Data repositories			A	S		L	
Maintain technical infrastructure			A	S		S	L
Project development assistance & review			L	S	A	L	
Support ITIB				S		L	S
A=Approve, L=Lead, S=Support							

**Table 3-2. Assignment of BA Functional Responsibilities**

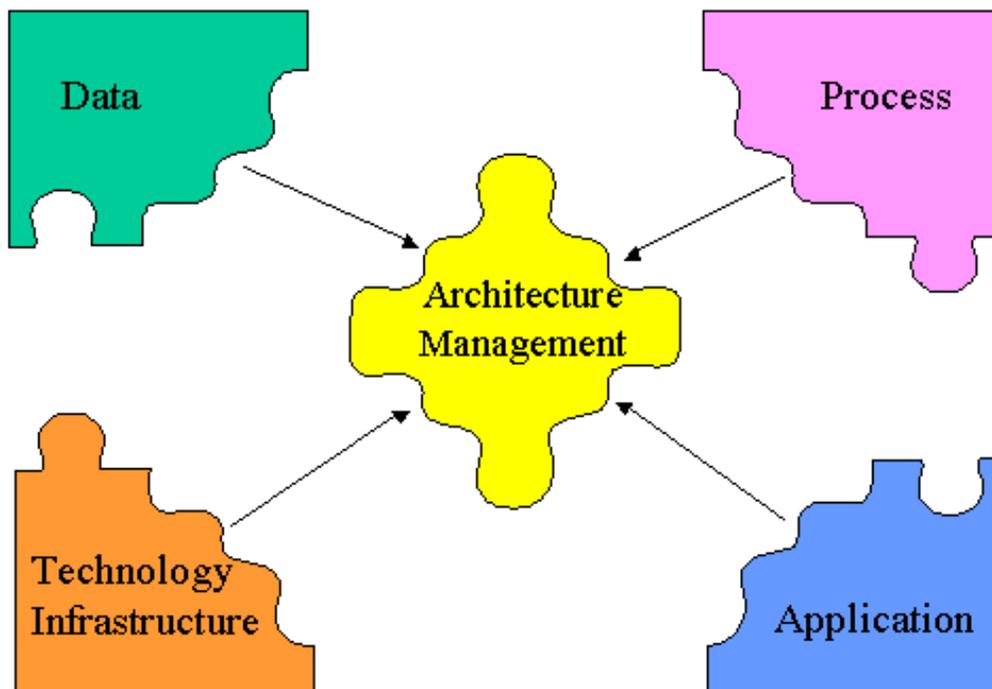
## SECTION 4—THE INITIAL BUREAU ARCHITECTURE (VERSION 1.0)

**Section 4** looks at the BLM BA from the separate viewpoints of business processes, business information and data, computer applications, and IT support infrastructure (“PDAT”). The four focus areas relate to each other in a specific way that is determined by the following fundamental principles: mission goals must drive business processes; business processes must drive data requirements; the combination of process requirements and data requirements must drive requirements for applications; and the requirements of process, data and applications must drive the technology infrastructure that hosts those applications.

### 4.1 PDAT Consolidation

#### 4.1.1 Overview

This sub-section presents a consolidated view of the major findings and recommendations from the specific analyses of process, data, applications, and technology infrastructure. This consolidation is not simply a regrouping of those findings and recommendations.



**Figure 4-1. PDAT Consolidation**

Within the following separate sub-sections on process, data, applications and technology infrastructure, findings and recommendations were derived solely from the unique viewpoint offered by that topic. Certain recommendations and priorities that make sense from these separate perspectives may be less important, or may require restatement, when considered together in the

overall PDAT context. This section, therefore, presents the results of a cross-walk of the PDAT analyses, in the form of a consolidated list of major findings and a consolidated implementation plan.

The consolidation of PDAT implementation plans was accomplished by (1) combining similar recommendations across the topics; (2) determining, to the extent now feasible, any dependencies between recommendations, within and across the PDAT topics; (3) ordering the recommendations according to dependencies; and (4) grouping the recommendations into stages by apparent similarities.

The BA implementation strategies presented in **Section 3** above wrap many of the detailed, staged PDAT findings and recommendations from this section of the report into more easily understood and managed “packages” of implementation strategies. (See the table at sub-section 4.1.4. below for the linkages between specific recommendations and the six implementation strategies.)

#### 4.1.2 Major Findings

Most of the major findings from the consolidated and integrated PDAT analysis contribute to this overall, general finding: *the BLM has not been organized, managed, or apparently highly committed to achieving many of the measures necessary to attain the goal of fewer, simpler, more efficient work processes, databases, computer applications, and technology infrastructure components.* In particular, the high degree to which decision authority is decentralized for land and natural resources management purposes is mirrored by a parallel preference for the same kind of decentralization in all other types of decision-making in the BLM.

However in the realm of IT, the only way to achieve economies of scale and improved support to the business processes is to standardize certain PDAT components at the corporate or regional level, and to require compliance with those standards. The BLM’s goals for IT improvement will not be achieved until the BLM accepts this need and makes it stick. The success of the BA depends on it.

The following findings are the most important emerging from the PDAT analyses.

- < The BLM has no effective assignment of ownership of business processes, data, applications, or technology infrastructure. Consequently, there is no clear accountability for successes or failures. Commonly, there are competing and uncoordinated deviations from, and modifications to “standards” across the BLM. “Effective ownership” must include assignment of each BA component to one named individual; granting that individual undivided control of that component; providing real rewards and sanctions for performance by the individual; and providing sanctions against any infringements of that owner’s prerogatives by any other BLM personnel. *Single-point ownership does not necessarily imply centralization at the national level.* BA components should be “owned” at whatever level of the organization is most appropriate—taking into account legitimate differences among jurisdictions.

- < There is no complete, up-to-date, and reliable inventory of business processes, data sets, computer applications, or IT infrastructure components (including standards and protocols). There is consequently no current basis for the “IT Investment Inventory” required by the ITIB to evaluate investment decisions, and thus BA implementation is handicapped. Configuration control and IT contract management are likewise inhibited.
- < There is not yet in place a complete IT investment management system, consistent with the Clinger-Cohen Act and OMB guidance, by which all further IT investments made anywhere in the BLM are to be evaluated by objective criteria and procedures. This includes prioritizing investments in relation to priorities of the BA. At present, program funds are routinely applied to IT investments, out of view and out of the control of any collective IT decision process. Investment procedures are not, strictly speaking, part of the BA, but must be in place for it to succeed. Steps are underway to fill this gap.
- < Powerful structural influences have encouraged “stove-piping” of business processes, data sets and computer applications. The BLM manages and funds major programs almost as if they were separate, and sometimes competing, lines of business. This stove-piping of programs (the “vertical” or “org chart” view of the organization) inhibits more logical organization of work around common business processes shared by the programs—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 stove-piped applications.
- < A very high percentage of all BLM business processes involve, or should involve, access to tabular documents and geospatial information, on the same screen, easily accessed, reliable, and internally consistent. The current BLM approach to GIS and geospatial data tends to isolate GIS in small groups of GIS specialists, who provide map-making and analysis support to the program staff on a pay-for-service basis. This approach separates the end user from the tools, data, and skills they need in order to use geospatial information as an integral, routine step within their daily business processes. This approach to GIS as a separate business process in its own right is also an impediment to proper technology infrastructure planning, since geospatial technologies require major accommodation for storage and data transfer.
- < Data design and management practices, whether viewed at the detailed technical level or the corporate management level, are highly inconsistent, and do not typically conform to industry best practices. The BLM’s data resource is commonly understood to be critical to its business, but that resource is a very long way from being complete, controlled, up-to-date, reliable, or even inventoried.

### 4.1.3 Findings from Process/Data Association Matrix

The data requirements associated with the business processes were combined into a CRUD (Create, Read, Update, Delete) Association Matrix. The results were subsequently grouped/clustered into natural business subject areas. The CRUD diagrams used in this analysis are included in the PDAT backup (detail) volume.

A Business Subject Area is a grouping of business processes and high-level entities that are closely interrelated and, therefore, should be analyzed as a unit. Business Subject Areas serve as a guide to subsequent application development—one or more applications and one or more databases are typically built to support one Business Subject Area. A single application should support one (and only one) Business Subject Area. However, a database can support multiple applications and multiple Business Subject Areas.

The analysis of the BLM's processes and information requirements resulted in the identification of the following Business Subject Areas:

<b>Guidance</b>	The activities and information required to provide strategy and direction to BLM staff
<b>Land Use Planning</b>	The activities and information required to develop a plan for the use of BLM lands
<b>Authorization and Enforcement</b>	The activities and information required to allow certain uses to be made of BLM lands and to take whatever course of action is necessary should the land not be used appropriately.
<b>Compliance and Monitoring</b>	The activities and information required to determine if BLM lands are being used appropriately.
<b>Land Status/Resource Condition Determination</b>	The activities and information required to analyze the condition and status of BLM lands.
<b>Records Management</b>	The activities required to support the capture and maintenance of and the information required about the documentation captured and produced as part of the BLM's business processes
<b>Name and Address Management</b>	The activities required to support the capture and maintenance of and the information required about the persons and organizations with whom the BLM has a business relationship (e.g., employees, customers, members of the public, regulatory authorities, etc.)

**Work Management**

The activities required to support the capture and maintenance of and the information required about the work processes of the BLM

**Administration**

The activities and information required to support the infrastructure of the BLM, including human resources, finance, contracting, information technology, etc.

In addition, the “Administration” Business Subject Area will be broken down after additional analysis of the business process and information requirements of “Sustaining the Organization” is completed.

The next step will be the prioritization of these business subject areas to determine where automation investments should be focused.

#### 4.1.4 Implementation Plan and Staging

The following table presents the consolidated PDAT implementation steps and stages resulting from this analysis to date.

Stage	All Components	Process	Data	Applications	Technology
1	<p>Create/maintain accurate inventories of PDAT [6, BA]</p> <p>Define, then assign ownership to each PDAT component [3]</p> <p>Improve IT investment management practices. Ensure all proposals (changes to existing and new) are aligned to the BA. [6]</p> <p>Refine and maintain BA PDAT and priorities [BA]</p>	<p>Refine future business process model [BA]</p> <p>Place models under strict configuration control [BA]</p>	<p>Implement technical data management improvements (see <b>Section 4.3</b>) [1, 2, 4]</p> <p>Employ relational database technology tools to enforce business rules[1, 2, 4]</p> <p>Separate data from applications [1, 2, 4]</p> <p>Place the data resource under comprehensive management control [1, 2, 4]</p>	<p>Name an enterprise-wide applications coordinator [3]</p> <p>Implement technical applications design recommendations (see <b>Section 4.4</b>) [BA]</p> <p>Establish single BLM-wide accepted list of mission critical and essential applications. [6]</p>	<p>Implement 'Security in Depth' Technology BA as part of BLM response to DOI-NET FY2000 network reconfiguration effort. [5]</p>
2		<p>Implement BP change management process [6]</p> <p>Begin to incorporate GIS into business processes [1, 2]</p>	<p>Complete logical data models for all existing systems and perform a gap analysis against the enterprise data model [4]</p> <p>Integrate enterprise data model with Corporate Metadata Repository [4]</p>	<p>Refine process and information flow requirements into clearly defined production environment performance metrics. Establish corresponding Service Level Agreement (SLA) for all production applications, and, as part of the proposal for all new applications. Start with mission critical first. [1, 5, 6]</p>	<p>Reconfigure and deploy existing/new technology components to support multi- purpose use and augment contingency/ business continuity. [5]</p>

Stage	All Components	Process	Data	Applications	Technology
3		Extend process models to level 5-6, as required, as part of specific proposals and initiatives [1, 2]  Apply business process modeling lessons in future organizational re-alignments [6]	Manage data as a corporate resource; create enforceable management structures and apply resources to ensure that data are accessible, current, reliable, and secure [3, 4, 5]	Coordinate geospatial projects above state office level as appropriate to the topic. [1, 2, 3, 4, 5]	Develop/Implement robust monitoring mechanisms to track and report to Process Owners actual performance relative to SLA desired metrics. Use performance information to develop trends and overall Technology Infrastructure investment requirements. [5]
<b>[ ] Key:</b>		BA Required for BA Implementation 1 Delivery of Information to the End User 2 Planning Automation 3 Accountability, Responsibility, Authority	4 Data Management 5 Technology Infrastructure 6 IT Investment Management		

**Table 4-2. Consolidation of Implementation Plan and Staging**

## 4.2 Business Processes

### 4.2.1 Overview

As stated throughout this document, a basic tenet of the BA is that the business requirements of the BLM will control investments and management decisions concerning data resources, computer applications, and IT infrastructure. If business requirements are to drive intelligent decisions, then it follows that BLM must have a clear and logically-organized view of its business processes, how they interrelate, and how they are themselves managed. Business process analysis has therefore occupied a central place in the BA development efforts to date.

Business process analysis clearly defines what work the enterprise performs, grouping like work together regardless of how it is performed, or where in the organization it is performed. By identifying and linking together what work is done, it is possible to establish what information is required to support each business process. Understanding the work and the information needed to do it leads to an understanding of the computer applications and IT infrastructure that are needed to support the processing and transfer of this information among users or storage locations.

Modeling and analysis were done for both the current situation and the future, desired situation (what the BLM would prefer to do in the future). The main steps taken in this process analysis were as follows:

#### ***Current Processes***

- < Existing results from past process modeling efforts were inventoried, extracted, and assessed for applicability to the BA.
- < A detailed analysis was conducted of the work process structure that is embodied in the Activity Based Costing (ABC) model. While not a true process model, the ABC structure provided a useful surrogate for current process breakouts in the BLM.

#### ***Future Processes***

- < A future desired process model was developed to the second level of breakout, beginning with the nine high-level business process categories defined by the ABC model. These nine were first broken down one more level, and these sub-processes were analyzed to define information flows between them, and between sub-processes in others of the nine process categories.
- < Subject matter experts (SMEs) drawn from the BLM programs at field office, state office, and Washington office levels, met in intensive workshops to (1) confirm the second-level process breakouts, and (2) break out each second-level process to the third level of detail.
- < The Core Team reviewed the complete third-level business process model and reconciled inconsistencies in naming, process modeling assumptions, and information flows.

## ***Current and Future Processes***

Although intuitive to many in BLM, one of the results is that many of BLM's business processes may require some level of geospatial data analysis, typically requiring GIS and/or visualization software tools and special accommodation for data storage, data communication, output, and training. The future business process model was analyzed at level three to determine where each type (level of technical sophistication) of geospatial analysis may be required in each process. This was accompanied by an analysis of geospatial data types that are implicit in the information flows among business processes.

The current business process situation was assessed by intensive analysis of the ABC activity model, completed in mid-1999. Functional hierarchy diagrams were developed, which revealed that the BLM's current environment consists of 40 or more (major) "stove-piped" program processes. The following analysis steps were then taken:

1. All processes described in the ABC study were identified. Level one processes represent the nine major process categories used in all BA analysis.
2. Processes were further broken out in further detail, based on the narrative descriptions of each process element.
3. A process decomposition model was developed within the process modeling software tool (COOL:Biz®).
4. Six technical criteria for evaluation of the current process model were defined, as follows:
  - < *Level of Aggregation*: The process is too detailed or specific for the level in the analysis at which it appears.
  - < *Single Child (sub-process)*: A process has only one child, implying that the parent and the child are the same.
  - < *Rule of 7*: A process should break down into no more than seven child processes.
  - < *Compound Process*: The process name implies that more than one action is being taken as part of the process
  - < *Naming Standards*: Processes should be named using a verb-object construct, e.g., "Take Order" or "Evaluate Employee."
  - < *Duplicate Processes*: The same process is appears many times in the analysis.
5. The business processes down to level three were evaluated separately against these technical criteria.
6. A cross-cutting analysis then was performed at level one.
7. Findings were derived and recommendations formulated (see **Section 4.2.2**).

## ***Location of Detailed Materials***

The full set of business process models for all BLM processes is included in the separate Process Analysis Volume Binder, provided as part of the detailed supporting materials for this summary report. More importantly, the models are incorporated into the electronic repository of the BA modeling software tool, where they can be refined, extended, and accessed as a key element of the BA. All results are captured in a specialized process modeling software tool (COOL:Biz®), which permits the results to be analyzed, visualized, corrected and maintained efficiently.

## 4.2.2 Findings and Recommendations

### **Current Situation**

A review of the current environment (based on ABC) revealed that there are an excessive number of redundant processes. For example, the first level process “Use Authorization” consists of a total of 167 subordinate processes. Of those 167, there are 20 different sets of processes with the same name. This accounts for 66 of the 167 processes in the model. For example, five of the program elements within “Use Authorization” have the same set of children or sub-processes. Given this duplication, opportunities exist for consolidation and streamlining of processes.

The table below presents the nine level one processes, the number of duplicate processes in each, and the percent of processes within each that are duplicated elsewhere within that same level one process. Across the enterprise 37% of all processes appear to be duplicated in separate program elements.

<b>Level One Process</b>	<b>Total # processes</b>	<b># Duplicate Processes</b>	<b>% Duplicate Processes</b>
Public/Customer Service	27	0	0
Inventory and Assessment	121	36	29.7
Planning and Analysis	63	46	73.0
Use Authorization	167	66	39.5
Implementation	270	103	38.1
Monitoring and Evaluation	99	51	51.5
Compliance and Enforcement	134	75	55.9
Program Management	17	8	47.0
Sustaining the Organization	175	15	8.5

**Table 4-3. Level One Process Duplicates**

This duplication is a symptom of the stove-piping of business activities between program elements that are now thought of, managed, staffed, and funded as separate functions. This is the natural result of the historical development of BLM exacerbated by new mandates and targeted funding allocations. The BLM probably cannot eliminate all duplication of business processes among programs, but the potential is clear for savings from consolidations according to an improved model (the preferred future model) of the BLM's business processes.

## ***Future State Objectives***

The future process model contains 9 level one processes (ABC business areas), 34 level two processes, 82 level three processes, and a total of 240 information/data flows. Analysis of the process models revealed the following general findings:

As with most knowledge-driven enterprises, BLM's processes demonstrate an emphasis on the planning of data collection, actual data collection, and analysis and compilation of collected data. Of the 82 Level Three processes in the model, 26, or nearly one-third, center on these data management processes. Duplicate processes within the above areas may represent the lowest level of detail and may indicate opportunities for single process definition and work streamlining. Given that these processes represent a large percentage of the process model, it is likely that they also represent a large percentage of BLM's actual work, expressed in full-time equivalents (FTEs) or cost of doing business. There are undoubtedly opportunities across the processes to leverage resources, employ technology, and streamline and improve processes.

The review of the Business Processes has shown an overwhelming potential for using geospatial data. Two conclusions may be drawn from this review. The first is that geospatial analysis is needed to support multiple Business Processes. The second is that there are a number of report generating activities that would benefit from geospatial support.

The Business Process labels and definitions were reviewed to determine whether the processes could use some form of geospatial analysis to accomplish the task. The geospatial analysis types were grouped into three tiers or levels; Read/View, Compile/Prepare, and Analyze Content. There were many processes that take advantage of geospatial data for analysis.

High quality geospatial and relational information about the lands and resources the BLM administers should be seen as a valuable asset. The many professionals in the field collecting information, the visualization of that information, and its distribution should be seen as key elements of the BLM's business.

## ***Recommendations***

### **Stage 1:**

**Continue analysis of the future business model:** This should be done by applying the same criteria used for analysis of both the current and future environment models contained in this report.

**Assign ownership/stewardship:** This is necessary for control and accountability of business process re-engineering and automation. It is particularly important to ensure that such stewardship is not ambiguous, for example, shared between program and state administrations or other organizational components.

### **Stage 2:**

**Implement business process change management:** This will require a change control methodology that promotes transition from current to the future desired business process model, in actual everyday practice. The change management system must be flexible enough to foster desirable change, yet sufficiently strict to prevent unauthorized changes not approved by the business process owner and BLM management.

**Focus initial re-engineering on data management process:** Improvements made to data collection, storage, and access will have a positive, cascading effect upon all other processes.

**Fully integrate the use of technology into business processes:** In all business process re-engineering activities, include a fully integrated analysis of the role of technology, such as geospatial visualization and analysis, in the identification of business processes and information flows.

### Stage 3:

**Complete process modeling to level 4, 5 or 6:** This level of detail is required to reveal reusable process modules and enterprise information requirements. Refinement should occur as part of continuing assessment of new initiatives or project proposals.

**Identify and document business rules:** These support business processes and must resided within a software tool to make maintenance and user access readily available. The BLM has documented many of its business rules in detail for previous projects, but they are not in a practical repository to promote widespread reuse. This is needed to thoroughly understand the interrelationship between data and its utility within a process. Business rule documentation can be accomplished as part of developing new initiatives and projects in high-priority business areas.

## 4.3 Data

### 4.3.1 Overview

All managers are information managers. However, this fact is not well accepted by many in BLM. Reliable data provides BLM managers and employees with the information needed to make the best possible decisions. Consequently, well documented decisions are easier to defend in legal proceedings. The Data focus area seeks to identify the data required and produced by the enterprise. The business-driven approach employed by the BA involved the following activities related to data:

1. Taking an inventory of existing data structures and producing a data model of the current data environment.
2. Assessing several aspects of the current data environment such as data standards, data oriented policy, and data management.
3. Defining a future environment that meets the information needs of the business processes and aligns with the organization's guiding principles, goals and objectives.
4. Analyzing the difference between the current environment and the future environment to determine what to retain, eliminate and acquire in order to gradually achieve the future state objectives.

Throughout this report, the term “data” includes all business information of any character or physical form that is required to perform the business processes of the BLM. Data therefore includes far more than the information contained in electronic databases. Written and unwritten business rules, data on paper, e-mail message contents, and all other sorts of business information are within the scope of the BA data analysis and strategies.

The current data situation was examined at two levels: a top-down review of data management practices and issues and a bottom-up analysis of the data component of 11 BLM-wide applications. **Table 4-4** lists the 11 applications that were studied in detail.

System Identifier	System Name/Subject
AC	Aircraft Monitoring System
AFMSS	Automated Fluid Minerals Support System
CBS	Collections and Billing System
CDD	Corporate Data Dictionary
CS	Cadastral Survey
FORVIS	Forest Vegetation Information System
H & B	Wild Horse and Burro
ID	Inventory Data
LAWNET	Interface to the DOI's Law Enforcement Incident Reporting System
LR2000	Legacy Rehost
TSIS	Timber Sales Information System

**Table 4-4. BLM National Applications Analyzed for Data Purposes**

The following steps were performed:

1. The original logical designs were recovered through reverse engineering using CASE tools.
2. An analysis of each application was published.

3. Lists of entities, attributes, keys, and business rules were developed for each application.
4. The twelve models were merged into a single model for summary analysis.

The future data focus contains an enterprise data model depicting the high-level information needs of the business processes. The data model provides an overview of the business information requirements sufficient to meet the needs of broad information systems planning, development and maintenance.

The future data focus was developed using the results of the process modeling sessions conducted with subject matter experts. Analyzing the BLM business processes and the information flows into and out of them identified high-level data types. These data types were then reviewed by the Core Team, which provided definitions.

### ***Location of Detailed Materials***

The major analytical products for the data work and for the 12 existing BLM systems are available in written form in the separate Data Architecture Volume binder, and in a separate written report on each system reviewed, provided as part of the detailed supporting materials for this summary report. Additionally, other information is available in the BA repository in electronic format.

## **4.3.2 Findings and Recommendations**

### ***Current Situation***

#### **Findings**

The analysis of current applications indicates:

- < Absence of pro-active data management
- < Potential redundancy in both processes and data
- < Limited sharing of data or cooperative efforts to obtain commonly needed data including geospatial data
- < Conformity to Federal Geographic Data Committee standards for geospatial data has been mandated and BLM is lagging behind other agencies.
- < Geospatial data is always or sometimes required in 74 percent of data flows identified in the third level business process modeling effort. Much of this currently is paper information. However, at an increasingly rapid pace, BLM may expect that these data flows will be automated, with transfer of standardized digital geospatial data between a high percentage of all BLM business processes.

The technical criteria used to evaluate the quality of the relational architectures of the current data models, and the summary findings under each criterion are in Data Architecture backup volume.

## ***Future State Objectives***

A major component of the Data BA is an Enterprise Data Model depicting the high-level information needs of the business processes. The data model provides an overview of the business information requirements sufficient to meet the needs of broad information systems planning, development and maintenance. The Data component of the Bureau BA identified 28 types of information the BLM tracks in order to execute its business processes effectively. These data types are used in combination with their affiliated business processes to identify targets for automation. The data types are:

Assessment	Facility	Response
Authorization	Land Status	Use
Budget	Mandate	Appeal
Comment	Notice	Guidance
Compliance	Organization	NEPA
Condition	Plan	Results Evaluation
Contract	Project	Strategy
Customer	Questionnaire	Work Load
Employee	Request	Work Plan
Enforcement	Resource	

These data types are defined in the Data Architecture backup volume.

## ***Recommendations***

The following list presents initial BA recommendations concerning the grouping and order of performance of recommendations concerning business data. This order is established purely from the perspective of improvements required to business data, without consideration of the competing priorities from the analyses of processes, applications, and IT infrastructure. The consolidation of these is presented in **Section 4.1**.

### **Stage 1:**

**Implement the detailed recommendations** for data management from preceding section.

**Assign accountability and control of databases and data elements**, see implementation strategy number 3 (**Section 3.1.3**.)

**Employ relational database technology** features to enforce business rules, rather than embedding business rules in application code

**Separate, for management purposes, data resources from the applications** that draw upon them. This makes it possible to manage data as a corporate resource, to consolidate redundant databases, to assign and enforce responsibility for data sets, and to minimize the costs of maintaining key data.

**Stage 2:**

**Refine and maintain the Enterprise Data Model** as the Bureau BA progresses through its next steps

**Complete logical data models** for applications as they are replaced and perform a gap analysis against the Enterprise Data Model

**Integrate** the Enterprise Data Model with the Corporate Metadata Repository

**Stage 3:**

**Manage data as a corporate resource;** create structures and apply resources needed to ensure that data are accessible, current, reliable, and secure.

## 4.4 Applications

### 4.4.1 Overview

The analysis of applications within the BA (Version 1.0) seeks to determine whether the BLM's applications are responsive to the requirements of business processes and associated information and provide the best feasible support with the fewest, simplest computer applications that can meet the needs.

Serious gaps in the information about the current applications in the BLM were identified early, and remained an impediment to accomplishing a complete analysis however, the following activities and the associated analyses were completed and resulted in the high level Application Findings and Recommendations in **Section 4.4.2**.

- < Existing information and inventories of applications at the national, state, and field level were compiled and incorporated into a single electronic tool to simplify comparison.
- < Industry application trends applicable to the BLM environment were documented and related BLM specific implications were developed.
- < Twelve national applications were analyzed for functional redundancies and certain design characteristics.

Development of a typical application BA would also include the following steps:

- < **Determine inventory of current applications and basic information** about each application. Basic information includes items such as: the designated technical and business individuals and contact information, a general description of what the application does, interfaces to other applications, level of importance to core business activities, typical transaction volumes, indication if purchased/in-house developed, the software/hardware environment it runs in/on, conformance to existing change management policies, documented user and technical performance expectations and actual performance results, etc.

- < **Determine industry application trends** applicable to the BLM environment and develop BLM specific implications for each trend relative to BLM Business principles, values, strategic objectives and goals.
- < **Assess current applications** utilizing/examining the basic information about each application, grouping/organizing the applications into various logical tiers according to the relative level of impact they have upon the organization (tiers range from the entire enterprise down to a selected work group/individual), examining their technical characteristics relative to the industry trends applicable to the BLM, etc.
- < **Assess the viability of the current applications in relation to future Business Subject Areas** (BSAs) derived from the affinity analysis/grouping of the future processes and data performed in PDAT consolidation. The gap between existing applications to serve each Business Subject Area will produce specific application development recommendations. This is a large effort and is generally accomplished in a number of smaller efforts once the BSA's have been prioritized by BLM Management.

### ***Location of Detailed Materials***

The major analytical products for the Application BA work are available in written form in the separate Applications Volume Binder, provided as part of the detailed supporting materials for this summary report. Additionally, other information is available in the BA repository in electronic format.

## **4.4.2 Findings and Recommendations**

### **Stage 1:**

**Conduct a BLM-wide inventory:** The BLM has no complete, up-to-date, or reliable inventory of applications and there are a number of different existing application inventories that are inconsistent with each other. An effort to complete the inventory for the remaining national applications should be undertaken first, then completed based upon the prioritized Business Subject Areas. A rigorous process to keep the resulting application inventory current must also be implemented. A direct result of not having a current application inventory is it is impossible to determine where scarce IRM resources are being expended in development and maintenance, except for a few key systems at the national level, thus the BLM cannot currently execute its responsibility under the Clinger-Cohen Act to ensure that new IT investments do not duplicate existing software.

**Name an enterprise applications coordinator:** As previously mentioned much of the basic information regarding current applications is either non-existent or not easily found. This situation cannot be remedied without clearly named owners/co-ordinators. Also in those situations where coordination roles, administrative titles, duties, etc. currently exist they are inconsistent across various BLM programs, geographic locations, and organizational units. These owners/co-ordinators would then be responsible for tracking the applications as significant resource investments and corporate assets.

**Implement the future state Application objectives:** The following list provides a set of overall design guidance for all major application enhancements, new application development and COTS applications acquire/purchase evaluations:

- < Applications should be designed for platform independence.
- < Applications should be modular in design, with a bias toward developing major portions of them as reusable components.
- < Applications should be designed in regards to push and pull technologies to take advantage of client/server technology, middle-ware messaging and deployment to the web environment (Intranet/Internet).
- < Applications should conform to a single graphical user interface standard.
- < Applications should be mapped to the technology tiers, future business processes and data.
- < Applications must not be designed to treat the data associated with it as being solely owned/controlled by that application.
- < Applications should be designed from the future BSA perspective. (process/data grouping). The current approach of acquiring/building applications at a specific BLM Program level results in widespread duplication of software components to support a large number of business processes that are common to many, if not all, programs.

### Stage 2:

**Define Performance Requirements for Applications:** This work will refine process and information flow requirements into clearly defined application performance metrics. These performance requirement metrics as defined by the Process owner/sponsor will result in a detailed Service Level Agreement (SLA) for each production application. These SLAs need to be developed as part of the proposal for all new applications. The work should start first with the BLM mission critical applications.

### Stage 3:

**Coordinate geospatial application efforts above the State Office Level.** In some cases the States resist this but in other cases they look for it. This would help coordinate ongoing efforts in the states and find/implement best capability/least cost solutions. This includes the Beta Testing of GIS software. The current testing situation is fragmented and lacks a mechanism for communicating the problems and bugs found in the new releases of the software. There is a real need within BLM for a larger community involvement in testing the functionality. This would also reduce the individual burdens.

## 4.5 Technology Infrastructure

### 4.5.1 Overview

Technology infrastructure is the facilities, policies, procedures, hardware, system software, protocols and other technology components that permit automated support to business processes, data and associated applications. Technology infrastructure typically includes base level mechanical and electrical installations, computing platforms, communications infrastructure, and system operational support elements.

The objective of this analysis is to align technology infrastructure, existing/current and future, with the requirements of the BLM business processes—specifically, to support in the most cost-effective and maintainable manner the automated applications and data flows that those processes require.

The major products of the technology infrastructure portion of the BA are described in a separate attached Volume “Technology Infrastructure” that is supporting material to this Summary Report on the BA.

The following major steps were taken to complete this portion of the BA.

1. Existing inventories of the types/kinds all technology infrastructure components were obtained, cross-referenced, and, to the extent feasible, supplemented by new information. Attempts to determine quantities for each type of technology were accomplished with limited success, the issue of developing and maintaining an accurate inventory for BLM technology infrastructure components needs to be addressed.
2. A team of BLM and SOZA system engineers categorized the current infrastructure components into a matrix that cross-walks existing categories of infrastructure component to the “logical tiers” of the organization. The BLM Logical tiers, which are groupings of kinds of users and maintainers, independent of where they are located in the organization was also developed.
3. Technology Characteristics for the BLM were derived from the translation of User Needs (Environmental Characteristics) based upon descriptions of the various types of work performed into the characteristics of Technology that satisfy that need. After structuring the Technology Characteristics into logical tiers they are used as input to developing the Target Environment.
4. The team developed objective criteria for selecting which infrastructure components should be retained, which should be eliminated, and which should be sought out, in order to create a streamlined future infrastructure.

5. The difference between the current technology and the desired future technology was analyzed relative to six business oriented scenarios to determine a logical staging strategy for the technology infrastructure components and derive recommendations for implementation.
6. Further analysis of capacities and numbers of required components has been deferred until that information can be obtained from the business process re-engineering effort.

### ***Location of Detailed Materials***

A significantly more detailed set of information about the specific investigation and analysis work done to create the Technology part of the BA (Version 1.0) is available in written form in the separate Technology Volume Binder, provided as part of the detailed supporting materials for this summary report. Additionally, nearly all of the Technology BA information is available in the BA repository (Cool:Biz®) in electronic format.

## **4.5.2 Findings and Recommendations**

### ***Current Situation***

- < In general, information on the various kinds of hardware and software in the field is substantial but incomplete. Information on the quantities of many infrastructure components is mostly lacking.
- < As web enabled, and 2-3-tier and thin client applications become more prevalent, the network dependence becomes an increased availability factor. Current network recovery/ provisions for continuity plans need to be instituted/augmented.
- < Current bandwidth capacity needs to increase significantly, particularly with Vendor and COTS increased adoption of n-tier BA approaches, thin-client applications, graphic intensive applications and other large file and data transfer needs on this rise.
- < Knowledge capture /Management (KM) is particularly important within the BLM, as IT and other specialists retire or leave the BLM, and incentives to join Civil Service are decreasing. Providing corporate knowledge to remaining staff members in a format that can be readily accessed and assimilated, is critical to reducing the impacts of “brain drain.”
- < IT labor shortages, as well as budget reduction trends are causing organizations to focus on core expertise, move toward outsourcing solutions to address a wide variety of technology issues such as: non-mission critical help desk operations, office automation suites, desktop platforms, etc. The current BLM IT infrastructure is not well suited to accommodate this trend.
- < The widespread (but not exclusive) use of Informix RDBMS in the BLM is a hindrance to GIS Technology progress, because currently the BLM’s standard GIS software vendor is relatively slow to release the Informix version of its new software versions.

### ***Future State Objectives***

- < Reduce unnecessary redundancy in all levels of technology infrastructure components to improve efficiency and reduce costs. Ensure major technology infrastructure components particularly those of supporting multiple purposes are treated as a corporate level assets and configured to allow for/support a wide variety of needs.
- < Support and encouragement for a wide variety of remote computing/intranet/web-based/wireless access and delivery needs must be considered early in the design phase of all future Technology infrastructure components.
- < A similar ‘look and feel’ for all technology infrastructure components directly accessible by humans must be established and maintained to reduce training costs, improve productivity, support sharing among organizations, etc.
- < Provide/augment protection from unauthorized or inadvertent access, or disasters and ensure the availability, integrity and confidentiality of information housed within the various technology infrastructure components. Significant focus must be applied to the technology components supporting data/information as it is generally an irreplaceable item.
- < XML (eXtensible Markup Language—a subset of SGML [Standard Generalized Markup Language—a system for organizing and tagging elements of a document] designed especially for Web documents) provides a direct method to share information, not through translation, but directly through XML definitions. An important aspect of future technology components, particularly those relating to Technology Methods, Staffing and Standards need to address/support this capability.
- < Public-Private key encryption mechanisms are becoming prevalent, affording a level of security to all network transfers that historically was difficult and time consuming to create.
- < Assistance from an automated Environment Management System is a necessity in large, diversified and geographically distributed environments such as the BLM in order to maintain accurate technology inventories, rapidly respond to needs for updating automated functionality through automated downloads, ensure software licensing is current, etc.
- < Formal Change/Configuration management is required to achieve the CMM level 2 objective the BLM has set for itself. All technology infrastructure components regardless of geographic placement will need to adhere to change management policies in order to reach the goal.
- < Specifying detailed hardware configurations cannot be effectively accomplished within the life cycle of much of the equipment installed. BLM should move to specifying functionality, or minimum configurations from an abstract standpoint, in order to avoid this issue.
- < IT needs to be able to support a common GIS enterprise functionality within each State Office. To support that basic level of enterprise the technology will need to provide for quick data storage and retrieval of large volumes of data.

Six business oriented, technology scenarios were developed to create smaller groupings from the 500+ technology components to provide a suggested implementation strategy to migrate from the current technology environment to one that will address the BLM user–technology interface requirements. The resulting components were grouped into “keep” and “retire” categories and “identified missing/future technology” components.

The six technology scenarios are listed below along with the related BA implementation strategy as described in **Section 3** of this report.

- < Optimize IT Service delivery and management (Strategy #1—Delivery of Information Directly to the Program Specialist/Decision-maker).
- < Field Automation enablement (Strategy #1—Delivery of Information Directly to the Program Specialist/Decision-maker).
- < Knowledge Management/Workflow (Strategy #3—Management of BLM’s Information Resource and Business Subject Area—Work Management).
- < Optimize development management for BLM custom applications (Strategy #5—Providing the Solid Foundation on Which All Technology Works—Network reconfiguration portions, and Strategy #6—Management of Information Technology Investments).
- < Legal Records (Strategy #5—Providing the Solid Foundation on Which All Technology Works—Infrastructure, Network and Security—Security in Depth, and Business Subject Area—Records Management).
- < FOIA/Privacy Act (Strategy #5—Providing the Solid Foundation on Which All Technology Works—Security in Depth, and Business Subject Area—Records Management).

### 4.5.3 Proposed Implementation Priorities and Staging

Stage	Computing Platforms	Data Communications	Data Mgmt & Structure	Development Tools	Methods, Staffing & Stds.	Enterprise Mgmt & Security
	<ul style="list-style-type: none"> <li>• <b>Infrastructure Support</b> Shared storage, and EM support infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• <b>High Security Perimeter -</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Standard database</b> supporting Distributed RDBMS (Informix)</li> <li>• <b>CA Platinum Data Repository</b> - Oracle Shared data repository for Corporate Data Dictionary, data models, etc.</li> <li>• <b>Info Dissemination</b> -Related to knowledge management, a repository of varied and diverse topics needs to be on-line and searchable by anyone in BLM. Items such as Information Management Bulletins, etc. Provides a dynamic capabilities marketing vehicle to enhance employee performance.</li> </ul>		<p>Vendor/Contractor Management</p>	<ul style="list-style-type: none"> <li>• High level network security provisions</li> <li>• <b>Security Perimeter Level 1 Environment</b> - (no end user direct access allowed, updated on a pull basis from data server environment. Effectively, a secure back end environment, supporting the legal records “data warehouse”)</li> <li>• <b>Security Perimeter Level 2 Environment</b>. -A “DMZ” style data security perimeter. Behind this Perimeter would be the R/W servers - the “data marts.” Direct R/W access allowed for authorized users, R/O access for all to published data</li> <li>• <b>Security Perimeter Level 3 desktop access</b> - All service delivery desktops would be protected by biometric or smart card technology</li> <li>• <b>Security Perimeter Level 4 Remote public access</b> - All service delivery published data would be accessible through public commodity interfaces.</li> </ul>

Stage	Computing Platforms	Data Communications	Data Mgmt & Structure	Development Tools	Methods, Staffing & Stds.	Enterprise Mgmt & Security
2	<ul style="list-style-type: none"> <li>• <b>Data Server Environment—UNIX</b> (Security Perimeter Level 2 Environment - direct R/W access allowed for authorized users, R/O access for all to published data)</li> <li>• <b>Application &amp; Logic Middleware Server Environment - Mixed Platform as appropriate</b> NT Primary, UNIX as appropriate. From this layer down, outside security perimeters, and relies on OS security.</li> <li>• <b>Presentation Server Environment</b> - Websphere based</li> </ul>		<ul style="list-style-type: none"> <li>• <b>Business Rule Abstraction</b> Database development discipline that requires that logic be segregated from the code, so that the business logic can be consistently be reused and updated, without impacting the application code</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Std. Development and test Methodology,</b> tools, and framework (A standard development process must be implemented, so engineering discipline can be incorporated into the IT development efforts. Evolutionary approaches, with small, incremental product releases, should be used.)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Data Oriented Policies</b> - Data Retention Policy Data Archive Policy Data Storage Policies, Data Backup/Restore Policies</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Security</b> -User authentication, single sign-on, data access, etc.</li> <li>• <b>Tivoli Suite of Enterprise Management tools, including software distribution, monitoring, etc.</b></li> </ul>

Stage	Computing Platforms	Data Communications	Data Mgmt & Structure	Development Tools	Methods, Staffing & Stds.	Enterprise Mgmt & Security
3	<ul style="list-style-type: none"> <li>• <b>Legal Records Repository Environment—UNIX</b> (Security Perimeter Level 1 Environment - no end user direct access allowed, updated on a pull basis from data server environment. Effectively, a data warehouse)</li> <li>• <b>Workgroup Computing</b> Notes Email, OA services, Document Management, Knowledge Management</li> <li>• “Proxy” environment of Level 2 Servers, minimizing the “holes” to manage into Level 2</li> <li>• <b>Remote Desktop</b> Configuration</li> <li>• <b>GPS</b> capable computing device</li> <li>• Commodity <b>Handheld Computing Device</b> w/proprietary enhancements Handspring Visor, Palm Pilot or Windows CE devices-</li> </ul>	<ul style="list-style-type: none"> <li>• Radio - WAN data <b>bridge</b></li> <li>• <b>ISP or dial in support</b> - Remote Access Network Connectivity</li> <li>• Remote Authentication</li> </ul>	<ul style="list-style-type: none"> <li>• <b>NOTES Knowledge and workflow management</b> forums -(Leveraging NOTES, provide the ability to knowledge base repositories to be set up, maintained, and disseminated. Capturing and publishing the human knowledge factor is probably the most important thing that IT can facilitate within the BLM environment.)</li> <li>• <b>NOTES/Domino Document Management</b> - Currently Email is the dominant tool of document management. Revision control is non-existent</li> <li>• <b>Workflow</b> Support Sequential order of completion of various work tasks</li> <li>• <b>Public Data (Base) Search</b> Capability</li> </ul>		<ul style="list-style-type: none"> <li>• <b>Handheld Device Interface Policy</b> Create an approach to handle portable and handheld computing devices</li> <li>• <b>Remote Trusted User Support Policy</b></li> <li>• <b>Credit Card Support</b> Policy consistently handle credit card transactions on-line w/appropriate fiduciary controls</li> <li>• <b>Remote Public User Support Policy</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Remote Authenticated Access</b> Dial in or ISP login support</li> <li>• <b>Encryption</b> (automatic and transparent) Data Encryption support</li> <li>• <b>Security</b> Considerations for <b>remote users</b></li> <li>• <b>Smart Card/Biometric</b> Authentication</li> </ul>

Stage	Computing Platforms	Data Communications	Data Mgmt & Structure	Development Tools	Methods, Staffing & Stds.	Enterprise Mgmt & Security
4	<ul style="list-style-type: none"> <li>• <b>Test Workgroup Environment</b> - Mirror of Production Environment Capabilities</li> <li>• <b>WinTerm/NetPC Windows</b> Terminals provide an easier environment to manage with limited staffing resources and broad geographical dispersion (roving desktop and application support)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Credit Card Clearinghouse</b> Access Credit Card processing support, for on-line transaction support</li> <li>• <b>Open Public Access</b></li> <li>• <b>Transient Tethered access</b> capability Support for temporary users</li> </ul>		<ul style="list-style-type: none"> <li>• <b>Development and Test Environment</b> - A standard test environment, distinct and separate of the production environment, needs to be established, with associated resources and tools.</li> <li>• <b>Development tools</b> in support of n-Level, web-enabled application delivery JAVA - servlets, applets, and applications. As a stand-alone environment, JAVA offers synergistic development with web-based approaches.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Document Management Policy</b> Create an approach to document management and dissemination</li> <li>• <b>Reusable Skill Set</b> Support - Skills Availability Tracking/Sharing</li> <li>• <b>Programming Skills</b> SQL, 4th generation language programmers, for database environments, plus test capabilities</li> </ul>	

**Table 4-5. Proposed Technology Staging**

## APPENDIX A—BUREAU ARCHITECTURE PROJECT ORGANIZATION

(December 1, 1999 to March 31, 2000)

### Bureau Architecture Core Team (Full-Time)

Roger Hildebeidel (WO-101), Architecture Project Director

Joe Chesser (WO-500/LRIS), Denver Project Manager

Renee Duval (WO-200)

John Bebout (WO-300)

Carolyn Ridge (WO-500)

Clark Collins (WO-700)

Peter Ertman (WO-800)

Duane Dippon (OR SO)

Wally Stiles (WY SO) (joined Feb. 15, 2000)

John Broderick (WO-300)

Mike Kraft, SOZA (SOZA Project Manager thru Feb. 11, 2000; p-t consultant thereafter)

Mort Glassberg, SOZA (SOZA Project Manager after Feb. 14, 2000)

+ Staff Resources from:

LRIS/PMCO Office, selected NIRMC, NILS, and other project staff, as needed.

SOZA Contractor Support:

Tom Chatfield

John Clay

Charles Davis

Martha Elder

Chris Ervin

Paul Gillen

Trilby Hunt

Felicia Ives

Brian Price

Rob Purkat

Kurt Rhinelander

John Taylor

### Architecture Oversight Board

Chair & Project Director.	Roger Hildebeidel*	WO-101
Co-Chair	Scott MacPherson*	NIRMC Director
Co-Project Manager	Joe Chesser	LRIS Program Manager
Member	Robert DeViney*	Oregon SO
Member	Aden Seidlitz*	Miles City FO, Montana
Member	Don Ogaard*	Worland FO, Wyoming
Member	Don Hinrichsen	DSD-Alaska SO
Member	Jim Gegen*	Eastern States Office
Member	Renee Duval*	WO-200 IRM Advisor
Member	John Bebout*	WO-300 IRM Advisor
Member	Peter Ertman*	WO-800 IRM Advisor
Member	Clark Collins*	WO-700 IRM Advisor
Member	John Broderick	WO-300
Member	Chris North*	Arizona SO (IRMAC)

Advisor (Strategic Planning)	Kit Muller*	WO-100
Advisor (Data Admin)	Carolyn Ridge*	WO-500 Bureau Data Admin
Advisor	Christopher Hopkins	New Mexico State Office
Advisor (Resources)	Duane Dippon	Oregon SO (Resources)
Advisor (Architecture)	Joan Putman*	WO-510
Advisor (System Engrg.)	Mike Garratt*	NIRMC
Advisor	Martin Terwilliger*	Fugen Inc.
Advisor (Internet Team)	Steve Wing	Arizona SO

\* Original Enterprise Architecture Team Designee

## APPENDIX B—THE ZACHMAN FRAMEWORK

### The Zachman Framework Method

John Zachman created the “Zachman Framework for Enterprise Architecture and Information Systems Architecture” as a tool to match IT development to the business needs of organizations. It is primarily a method to categorize all the kinds of business goals, policies, plans, business needs and elements of IT into one large matrix. When all critical elements of the enterprise have been assigned to the proper cells of the Framework, it is possible to identify strengths, gaps, and opportunities for improvement. The Zachman Framework therefore provides a way to organize the huge and varied data sets that make up an enterprise architecture.

The first step in applying the Zachman Framework was to inventory BLM’s resources in respect to:

- < Data and business information used by BLM (the “What”)
- < Functions that the BLM performs (the “How”)
- < The locations and networking among locations where work is performed (the “Where”)
- < People (the “Who”)
- < Time considerations (the “When”)
- < Motivations for the work BLM performs (the “Why”)

These elements provide the topics for the six columns of the Zachman matrix. The rows that intersect these columns represent the viewpoints of the different “players” involved from the highest level of the most general and comprehensive down to the level of the most specific and detailed:

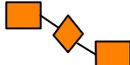
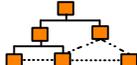
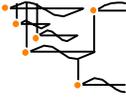
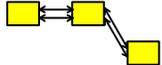
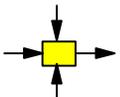
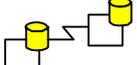
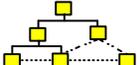
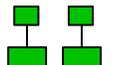
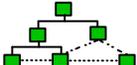
- < Planners
- < Owners
- < Designers
- < Builders
- < Subcontractors

The resulting Framework matrix is shown as **Figure B-1**. The Zachman Framework is used almost universally in architectural analysis, and using it therefore helps the Bureau with communicating its BA to other agencies and businesses. However, it does not include a step-by-step method for using all this information to decide on IT directions. For that purpose, the BA team used the “Ten-Step” work planning method recommended by SOZA and the Architectural Focus Areas Method predominantly in developing the Initial Bureau Architecture.

**Figure B-2** illustrates the extent of the work performed to date in regards to the Zachman Framework. Both future and current architecture are represented in the diagram Work Flow for the current architecture data, process and analysis was accomplished from the bottom up, physical to logical representations, with some cross column contribution and derivation to complete cell B3. Work flow for the future architecture data, process and analysis were

accomplished in a top down direction, with some cross column contribution and derivation to complete cell A3. The colored cells in the diagram represent cells that were beyond the scope of this project. They are only shown to keep the Zachman model rows and columns consistent with the Framework in its entirety.

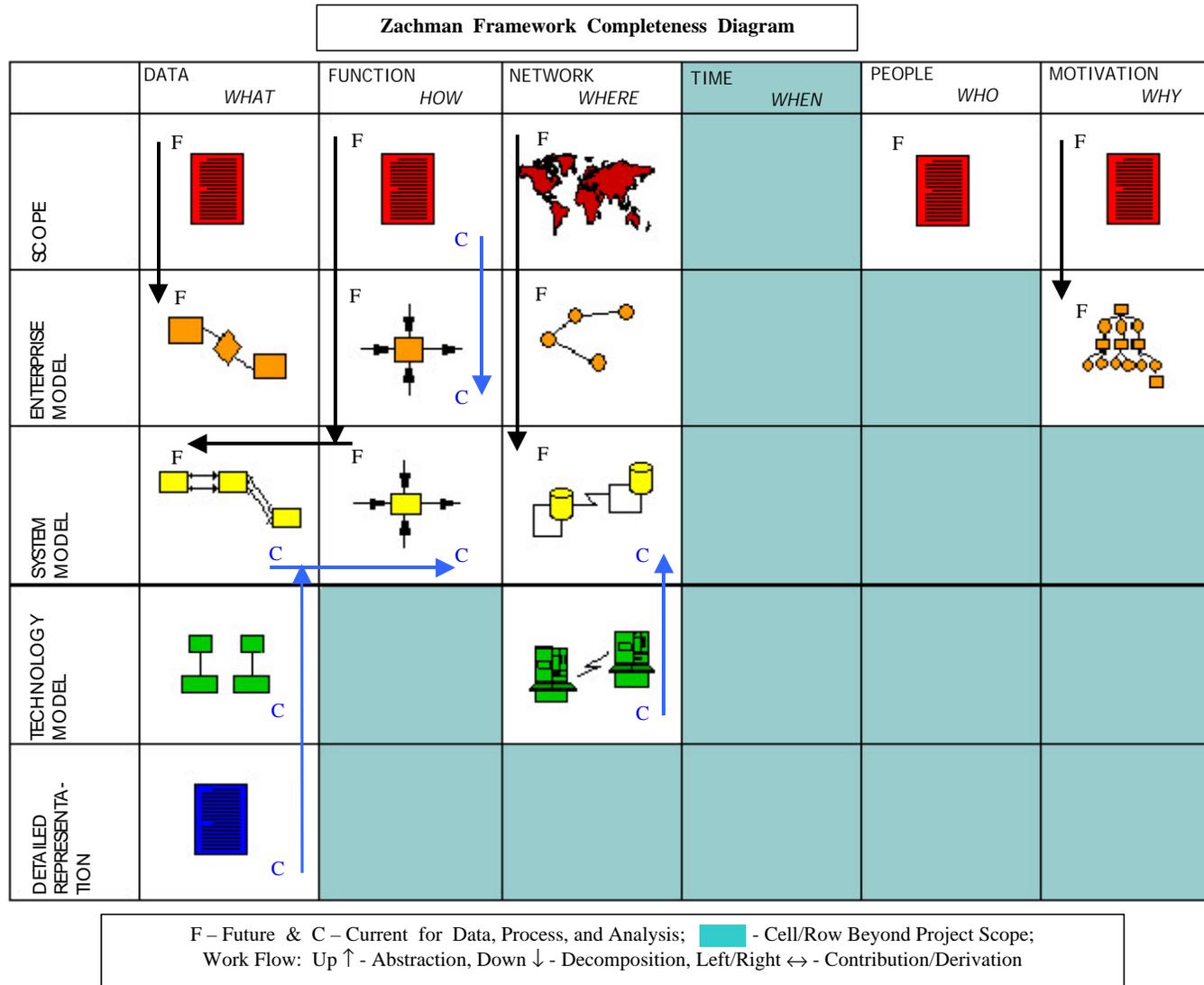
# ENTERPRISE ARCHITECTURE - A FRAMEWORK™

	DATA <i>What</i>	FUNCTION <i>How</i>	NETWORK <i>Where</i>	PEOPLE <i>Who</i>	TIME <i>When</i>	MOTIVATION <i>Why</i>	
SCOPE (CONTEXTUAL)	List of Things Important to the Business 	List of Processes the Business Performs 	List of Locations in which the Business Operates 	List of Organizations Important to the Business 	List of Events Significant to the Business 	List of Business Goals/Strat 	SCOPE (CONTEXTUAL)
<i>Planner</i>	ENTTY = Class of Business Thing	Function = Class of Business Process	Node = Major Business Location	People = Major Organizations	Time = Major Business Event	Ends/Mean=Major Bus. Goal/Critical Success Factor	<i>Planner</i>
ENTERPRISE MODEL (CONCEPTUAL)	e.g. Semantic Model  Ent = Business Entity Reln = Business Relationship	e.g. Business Process Model  Proc. = Business Process I/O = Business Resources	e.g. Logistics Network  Node = Business Location Link = Business Linkage	e.g. Work Flow Model  People = Organization Unit Work = Work Product	e.g. Master Schedule  Time = Business Event Cycle = Business Cycle	e.g. Business Plan  End = Business Objective Means = Business Strategy	ENTERPRISE MODEL (CONCEPTUAL)
<i>Owner</i>							<i>Owner</i>
SYSTEM MODEL (LOGICAL)	e.g. Logical Data Model  Ent = Data Entity Reln = Data Relationship	e.g. "Application Architecture"  Proc. = Application Function I/O = User Views	e.g. "Distributed System Architecture"  Node = IS Function (Processor Storage, etc.) Link = Line Characteristics	e.g. Human Interface Architecture  People = Role Work = Deliverable	e.g. Processing Structure  Time = System Event Cycle = Processing Cycle	e.g. Business Rule Model  End = Structural Assertion Means = Action Assertion	SYSTEM MODEL (LOGICAL)
<i>Designer</i>							<i>Designer</i>
TECHNOLOGY MODEL (PHYSICAL)	e.g. Physical Data Model  Ent = Segment/Table/etc. Reln = Pointer/Key/etc.	e.g. "System Design"  Proc. = Computer Function I/O = Screen/Device Formats	e.g. "System Architecture"  Node = Hardware/System Software Link = Line Specifications	e.g. Presentation Architecture  People = User Work = Screen Format	e.g. Control Structure  Time = Execute Cycle = Component Cycle	e.g. Rule Design  End = Condition Means = Action	TECHNOLOGY CONSTRAINED MODEL (PHYSICAL)
<i>Builder</i>							<i>Builder</i>
DETAILED REPRESENTATIONS (OUT-OF-CONTEXT)	e.g. Data Definition 	e.g. "Program" 	e.g. "Network Architecture" 	e.g. Security Architecture 	e.g. Timing Definition 	e.g. Rule Specification 	DETAILED REPRESENTATIONS (OUT-OF-CONTEXT)
<i>Sub-Contractor</i>	Ent = Field Reln = Address	Proc. = Language Stmt I/O = Control Block	Node = Addresses Link = Protocols	People = Identity Work = Job	Time = Interrupt Cycle = Machine Cycle	End = Sub-condition Means = Step	<i>Sub-Contractor</i>
FUNCTIONING ENTERPRISE	e.g. DATA	e.g. FUNCTION	e.g. NETWORK	e.g. ORGANIZATION	e.g. SCHEDULE	e.g. STRATEGY	FUNCTIONING ENTERPRISE

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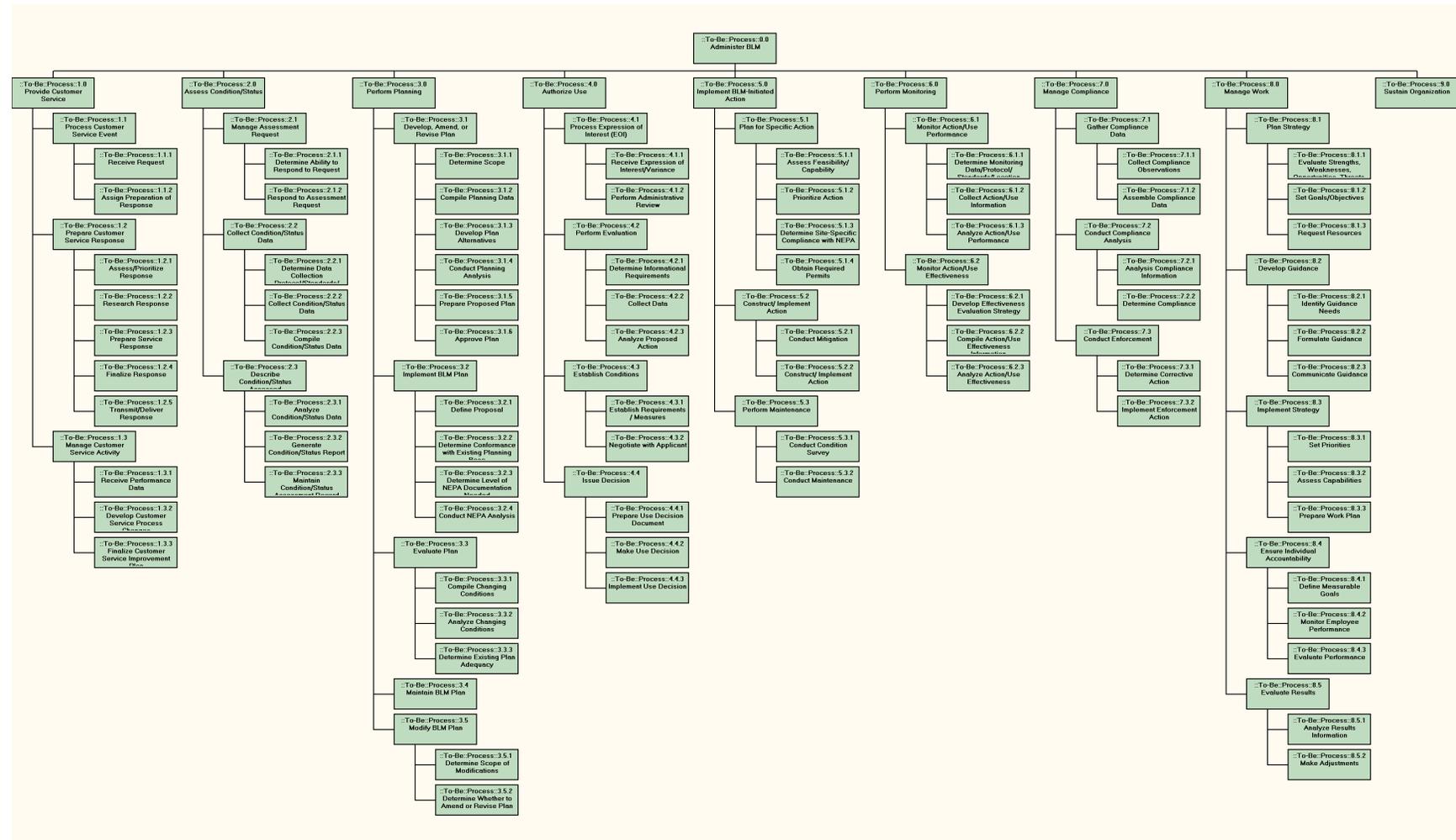
Copyright - John A. Zachman, Zachman International

**Figure B-1. The Zachman Framework**

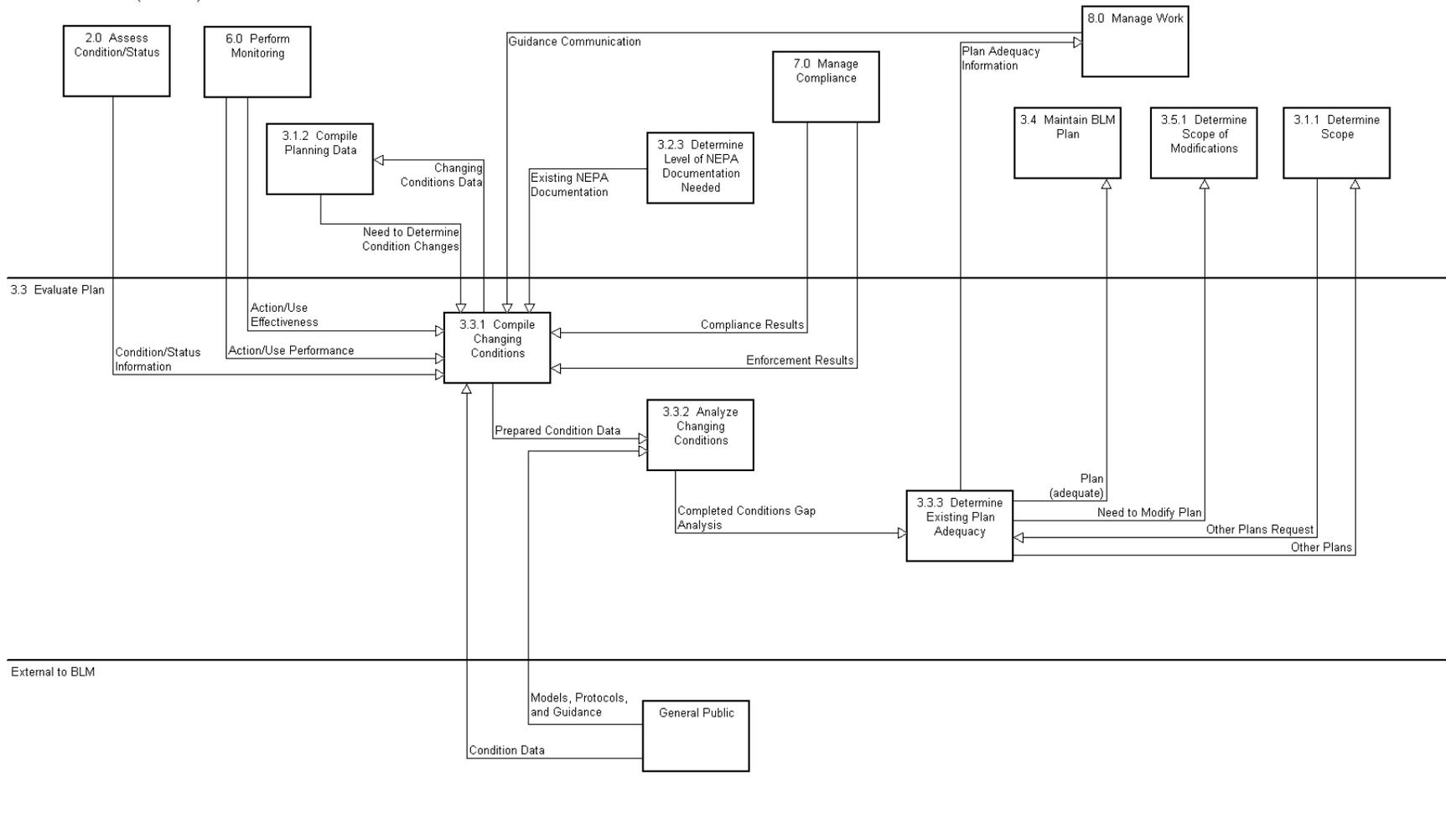


**Figure B-2. Status of Zachman Framework**

# APPENDIX C—A PROCESS DECOMPOSITION DIAGRAM



External Business Area (within BLM)



## APPENDIX D—WORK PRODUCT TABLES

### Process (P) Architecture Products

Architecture Product Name	Brief Description	Architecture Value
Process Decomposition (Current)	Hierarchy breakdown of activities and (Levels 1, 2 and 3) per ABC information. Definitions and some detail level information for each activity also captured. (Cool-Biz, Share Drive Folder,& 3/31/2000 Process Architecture Notebook)	Provides a diagrammatic representation perspective that establishes a current basis to understand impacts of future recommendations and initiatives
Decomposition (BLM Organization and Program Elements)	Hierarchy breakdown of 170 Bureau wide Program Elements within the Current Level 2 BLM Organizational units. (Cool-Biz, Share Drive Folder,& 3/31/2000 Process Architecture Notebook)	Provides a diagrammatic representation perspective that establishes a current basis to understand impacts of future recommendations and initiatives
Process Decomposition (Desired/Future)	Hierarchy breakdown of work activities (Levels 1, 2 and 3) per facilitated sessions with various BLM Subject Matter Experts (SMEs). Definitions for each process also captured. (Cool-Biz, Share Drive, 3/31/2000 Process Architecture Notebook. Some portions also on BLM Intranet)	Provides a common pictorial representation of work (what) is performed to accomplish the BLM mission and business objectives. It is the compilation of experience and knowledge that from the Subject Matter Experts (SMEs) performing the work
Process Decomposition (Desired/Future to Program Elements)	Hierarchy breakdown of 170 Bureau wide Program Elements within the Level 1 Desired/Future work activities. (Cool-Biz, Share Drive, 3/31/2000 Process Architecture Notebook.)	Provides a common point for relating a current 'organizational' based perspective of process to the future desired 'functional' perspective of what the work is.
Process Flows (Desired/Future)	These diagrams capture information flows into, out of and between Work Processes. Totally complete for Level 1 Processes, Complete for all level 2 and 3 'child' processes except for those in the 'Sustain Organization 9.0' Level 1 Process. Definitions for each information flow also captured, along with listings of the level 3 flows between the source and destination process. (Cool-Biz, Share Drive, 3/31/2000 Process Architecture Notebook. Some portions also on BLM Intranet)	Capture and illustrate the relationship and dependencies between work processes. The information flows further define/clarify the nature and quality of work performed by the processes and provide the basis to determine Data/Information requirements
Spatial Definitions Document	This document describes the groupings and the definitions used in producing both the Process to Spatial Analysis Type and Information Flow to Spatial Data Type Matrices. (Share Drive, 3/31/2000 Process Architecture notebook)	Used to determine the groupings for the Process and Information Flow Spatial Analysis Matrices.

<b>Architecture Product Name</b>	<b>Brief Description</b>	<b>Architecture Value</b>
Process to Spatial Analysis Type Matrix	An Excel spreadsheet that matches the decomposition Level Three Business Processes to three levels of Spatial Analysis. (Share Drive, 3/31/2000 Process Architecture notebook)	Used to determine the potential use of geospatial processing for performing business tasks within the BLM.
Findings, Observations, Recommendations (Current and Desired/Future)	The architecture products produced here result from analyzing the content of the diagrams and models in relation to various items such as: modeling evaluation standards, industry trends, and BLM business objectives and principles. (Share Drive, 3/31/2000 Process Architecture Notebook. <i>See selected 'summary' level items in section 4.1 of this report.</i> )	These documents provide a 'best, currently available', view of and guidance for establishing the roadmap of what needs to be done to transition from the current to the desired architecture environment from a Process specific perspective.

### **Data (D) Architecture Products**

<b>Architecture Product Name</b>	<b>Brief Description</b>	<b>Architecture Value</b>
Data Model (current)	Entity Relationship Diagrams (ERDs) for each of the data structures associated with 12 of the major BLM applications. A single merged model of the twelve ERDs models to support a summary analysis. Forty four detail data schemas were also created. (Cool-Biz, Share Drive Folder, & 3/31/2000 Data Architecture Notebook)	Provides a base of information upon which a detailed analysis of current data management practices and standards could be performed
High Level Data Entities (Desired/ Future)	List of the major data/information created/used by the future/desired business processes and their definitions. (Cool-Biz, Share Drive Folder, & 3/31/2000 Data Architecture Notebook)	Information and data important to the business.
Process to Information Flow Matrix	A matrix that matches the decomposition level 3 Information Flows to three levels of Geospatial Data Types.) Share Drive, 3/31/2000 Data Architecture notebook)	Used to determine the potential volume of geospatial data for performing business tasks within the BLM.
Findings, Observations, Recommendations (Current and Desired/ Future)	The architecture products produced here result from analyzing the content of the diagrams and models in relation to various items such as: modeling evaluation standards, industry trends, and BLM business objectives and principles. (Share Drive, 3/31/2000 Process Architecture Notebook. <i>See selected 'summary' level items in section 4.2 of this report</i> )	These documents provide a 'best, currently available,' view of and guidance for establishing the roadmap of what needs to be done to transition from the current to the desired architecture environment from a Data specific perspective.

**Applications (A) Work Products**

<b>Architecture Product Name</b>	<b>Brief Description</b>	<b>Architecture Value</b>
Applications Inventories (Current)	Compilation of several different 'lists' of existing BLM Applications sorted by several perspectives as specific information was available from various BLM sources. (Cool-Biz, Share Drive Folder,& 3/31/2000 Application Architecture Notebook)	Provides a base of information upon which an analysis of current BLM applications environment could be performed
GIS Functionality and Storage to Software Package capability diagram	Diagram showing various currently owned GIS software packages and applications according to their functionality. (Share Drive Folder)	Describes current GIS capabilities within the BLM.
Findings, Observations, Recommendations (Current and Desired/Future)	The architecture products produced here result from analyzing the content of the diagrams and models in relation to various items such as: modeling evaluation standards, industry trends, and BLM business objectives and principles. (Share Drive, 3/31/2000 Process Architecture Notebook. <i>See selected 'summary' level items in section 4.3 of this report</i> )	These documents provide a 'best, currently available', view of and guidance for establishing the roadmap of what needs to be done to transition from the current to the desired architecture environment from an Application specific perspective.

**Technology (T) Work Products**

<b>Architecture Product Name</b>	<b>Brief Description</b>	<b>Architecture Value</b>
Logical Tiers	Identifies the Technology Management Structure, irrespective of organizational management or work management structures. (Share Drive Folder & 3/31/2000 Technology Architecture Notebook)	Logical, architectural tiers enable structured analysis of technology to be performed from a management view.
Business User Needs/Role - Technology Interactions	Role-Technology Interactions identify the types of work people perform in the BLM and the different technology capabilities those types of work use/require to accomplish the work. These are also referred to as Environmental Characteristics. (Share Drive Folder & 3/31/2000 Technology Architecture Notebook)	Creates an overview/ reference of the work role requirements of technology based on the type of human interaction that occur with technology.

Architecture Product Name	Brief Description	Architecture Value
Technology Characteristics	Technology Characteristics are derived from the Role-Technology Interactions and list those technologies that address the BLM User Needs/Role requirements. The Technology Characteristics have also been structured into the Logical tiers and are used as input into the Target Environment. (Share Drive Folder & 3/31/2000 Technology Architecture Notebook)	While Technology Characteristics do not define a specific technology solution, they do specify the characteristics of the technology needed to satisfy the defined human - technology interactions. As such they provide guidance criteria to the technology selection process.
Current Technology Environment Inventory	This is a qualitative list (technology capabilities) of the existing BLM Technology organized into the Logical Tiers. NOTE: quantitative information was also captured, however, it has not been validated. (Share Drive Folder & 3/31/2000 Technology Architecture Notebook)	By organizing the current BLM technology capabilities into logical tiers the information is used for the Technology Gap Analysis
Technology Industry Trends with associated BLM implications.	Technology Trends are a compilation of information from various sources, including Gartner, Meta Group, and Vanguard, various trade publications, published corporate plans of major industry vendors, plus subject matter expertise of I/T experts within both SOZA and BLM. These Technology trends have been broken down into 6 major categories and are limited to those currently in the marketplace, under development and that logically extend BLM's Mission and current technologies. (Share Drive Folder & 3/31/2000 Technology Architecture Notebook)	Technology Trends should be used to influence technology decisions of an organization over the next 3-5 years to improve the quality of decisions and planning. Augmenting the technology with the likely BLM implications provides an additional level of guidance criteria to the technology selection process.
Target Technology Environment	Target Environment is built primarily from the Technology Trends/BLM Implications and the Technology Characteristics (which were derived from Roles/Technology Interactions). The Target Technology environment represents a best projection, as of a point in time, for an adaptable, cost effective, implement-able, consolidated foundation of technologies and technology related processes /business practices that work in concert to support and accomplish the overall business principles and goals of the BLM. NOTE: over 500 individual components are identified at the detail level of the Target Technology Environment. (Technology trends have been broken down into 6 major categories)	The Target Environment identifies the attainable technology architecture view and when organized into logical tiers the information is used for the Technology Gap Analysis. Also, the target environment will probably never be fully realized or achieved, rather it provides a direction to guide and manage necessary modifications and adjustments for the current "as is" environment to migrate/evolve towards better meeting the goals of the organization.

Architecture Product Name	Brief Description	Architecture Value
Technology Gap Analysis - Implementation Priority Matrix	The Technology Gap Analysis utilizes the outputs of the Current and Target Environment Inventories and organizes that information into a matrix associating the 6 major technology trend and the Logical tiers. (Technology trends have been broken down into 6 major categories)	The comparison of these two inventories produces a listing of 3 Technology Architecture Groups, namely; Items to Keep (SEC-Strategic Existing Components), Items to Retire (Non-strategic Existing Components), and, Items to Build/Buy (Missing Strategic Components).
Findings, Observations, Recommendations (Current and Desired/Future)	The architecture products produced here result from analyzing the content of the diagrams and models in relation to various items such as: modeling evaluation standards, industry trends, and BLM business objectives and principles. (Share Drive, 3/31/2000 Process Architecture Notebook. ( <i>See selected 'summary' level items in section 4.4 of this report</i> ))	These documents provide a 'best, currently available', view of and guidance for establishing the roadmap of what needs to be done to transition from the current to the desired architecture environment from a Technology specific perspective.

### A (PDAT) Consolidation

Architecture Product Name	Brief Description	Architecture Value
Association Matrix Process to Data (Information) (Desired/Future)	This matrix identifies the relationship between Level 3 Processes and Level 2 Data (Information). The nature of the relationship is expressed in terms of what affect the process has upon the data. These affects are expressed in terms Create, Read, Update and Delete, otherwise known as CRUD. (Cool-Biz, Share Drive Folder,& 3/31/2000 Architecture Management Notebook)	The CRUD Association Matrix is used to clearly identify the single process that is responsible to 'Create' a Data (Information) Entity. Also, to ensure a minimum number of processes (preferably one) are performing the Update and Delete of a Data Entity. Multiple Reads are expected. The identification of CUD responsibility is the fundamental upon which redundancy elimination and avoidance for process and data is accomplished.

<b>Architecture Product Name</b>	<b>Brief Description</b>	<b>Architecture Value</b>
Business Subject Areas (Desired/Future)	This output is a result of grouping together the logical sets of process functions and associated high level data entities based upon the CREATE aspect of the (CRUD) Matrix. Business Subject Areas become the foundation upon which future applications should be based. (Cool-Biz, Share Drive Folder, & 3/31/2000 Architecture Management Notebook)	Establishes clear boundaries between Business Areas (Process and Information) which in turn clarifies the system boundaries and interface points between applications.
Business Subject Areas to Current National Systems		
Findings, Observations, Recommendations (Current and Desired/Future)	The architecture products produced here result from analyzing the content of the diagrams and models in relation to various items such as: modeling evaluation standards, industry trends, and BLM business objectives and principles. Geospatial Observations Report created from various site visits and discussions centered around geospatial data and applications. The report cross cuts the impact of geospatial data and applications on all areas of the architecture study. Specific findings are noted in each section. (Share Drive, 3/31/2000 Process Architecture Notebook. <i>See selected 'summary' level items in section 4.5 of this report</i> ))	These documents provide a 'best, currently available', view of and guidance for establishing the roadmap of what needs to be done to transition from the current to the desired architecture environment from a combined Process, Data, Application and Technology based perspective.