

2 FRAMEWORK FOR BLUEPRINT DELIVERY

SFA's creation as the U.S. government's first PBO has resulted in an organizational commitment to becoming a world class customer service organization. Major modernization initiatives are under way within SFA to fulfill this commitment. A key component of these modernization initiatives is the SFA Modernization Blueprint. SFA has embarked upon the definition and implementation of a Modernization Blueprint that will define an IT target architecture and a detailed strategy for achieving it. This Section presents a framework for delivering the Blueprint (the Framework) through an integrated set of processes and tools.

This Section has four major components:

- **Current IT-related Activities** - a brief description of major IT-related activities underway within SFA that must be integrated to successfully deliver the Blueprint.
- **Framework Elements** - a description of the purpose, management processes, and key activities of each of the elements of the Framework.
- **Framework Processes** - a description of the activities that synthesize the Framework elements into a coherent process for delivering IT solutions.
- **Technology Tools and Standards** - a structured discussion of relevant standards for technology tools selected or recommended for consideration by SFA.

2.1 Introduction

SFA is currently pursuing multiple activities related to the improvement of their systems and management processes. These include the development of an SFA Modernization Blueprint that defines a target IT architecture for SFA, the adoption of the new ED/Systems Life-Cycle Development Methodology (ED/SLCDM), and the implementation of formal investment and acquisition management processes. These activities must be properly coordinated and integrated if the projects needed to implement the Blueprint are to be successful. Within this document, the implementation projects defined by the Blueprint sequencing plan are referred to as "IT initiatives"; this reference is consistent with the language used within the *ED/OSFAP IT Investment Management Operating Procedures*, dated February 1999.

This section defines a framework that links SFA's multiple IT-related activities to each other and to other elements such as configuration and architecture management. The purpose of this section is to provide SFA with a roadmap that documents the major actions needed to implement any of the IT initiatives defined in the Blueprint sequencing plan. In addition, this section presents the technology tools and techniques that will be used to implement the Blueprint and describes their relationship to the ED/SLCDM and to each other. The Framework describes IT-related activities; other business issues, such as facilities or human resources, are not discussed.

2.1.1 IT Initiatives Defined

The following definition of an IT Initiative is drawn from the *ED/OSFAP IT Investment Management Operating Procedures, version 1.0*. An IT initiative is any new or existing information technology idea/effort/entity/program identified by SFA personnel or other parties that:

- pertains to a discrete IT application, technology or IT management process that is controlled, used, in place, or administered by SFA;
- uses manual, or automated, or innovative information technology to directly or indirectly further, add value, advance, improve or help achieve SFA's mission, goals and performance targets;
- is feasible, manageable, unbundled, measurable, explicit and can be narrowly and specifically defined;
- is expected to involve costs of greater than \$100,000;
- can claim clear, specific and measurable value within a predefined timeframe; and
- can be sponsored (take ultimate accountability/responsibility) by a specific individual at SFA.

The *ED/OSFAP IT Investment Management Operating Procedures* categorize IT initiatives into the following three types:

- **Enterprise Application Systems** – software applications that directly deliver the products and services of SFA (e.g., the Direct Loan Servicing System).
- **Infrastructure** – initiatives that support the management and delivery of SFA products and services (e.g., Title IV Wide-Area Network (TIVWAN)).
- **Research and Development** – the exploration of new technologies that may enable SFA to improve products and/or services.

The majority of significant IT initiatives will be of the enterprise application system type. The methods for accomplishing an enterprise application system initiative are principally:

- acquisition of commercially provided functionality through either an external service provider or a Commercial-Off-The-Shelf (COTS) package;
- reuse of current system components; and
- creation of new, custom-developed software.

2.1.2 Assumptions

The following assumptions were made during the definition of the Framework:

- SFA will have written policies for the following activities:
 - planning for the acquisition of software
 - the acquisition of software
 - establishing and managing the software-related contractual requirements
 - the execution of software projects
 - contract tracking and oversight
 - managing the evaluation of acquired software products and services
 - transitioning of software products to the software support organization

- Organizational responsibility will be designated for each key process area of acquisition management. Individuals performing the activities of the key process areas will have experience and/or receive training.
- For each acquisition process, metrics will be defined and measured to determine the status of acquisition activities and related deliverables.
- A software acquisition management organization will exist within SFA and adequate resources (funding, staff, equipment, and tools) will be available to perform the required activities.
- Contracting specialists will support project teams in the preparation and execution of contracts.
- Groups involved directly or indirectly with a software acquisition will receive orientation on the objectives and procedures of acquiring software products and services.
- The *ED/SLCDM Handbook* defines the deliverables required as part of a systems development effort. Additionally, management processes may define deliverables that are prepared by ED/SLCDM activities.
- SFA/Program Systems Service (SFA/PSS) is responsible for the administration of ED/SLCDM activities.
- PSS staff will be fully trained and familiar with performing the detailed ED/SLCDM activities that lead to the creation of required deliverables.
- PSS will provide appropriate coaching and technical assistance to business sponsors and Contracting Officer's Technical Representatives (COTRs) on the ED/SLCDM.

The remainder of this Section is organized into the following subsections:

- Subsection 2.2 IT-Related Activities Within SFA
- Subsection 2.3 Framework Elements
- Subsection 2.4 Framework Requirements
- Subsection 2.5 Framework Processes
- Subsection 2.6 Technology Tools and Standards
- Subsection 2.7 Progress to Date

Additional detail for the Framework Elements is presented in Appendix C and for Technology Tools and Standards in Appendix D.

2.2 IT-Related Activities Within SFA

This subsection introduces some of the major IT-related activities currently underway within SFA. The purpose of the Framework is to integrate these activities in a manner that facilitates the realization of SFA's modernization vision.

The following activities are briefly described:

- Subsection 2.2.1 SFA Modernization Blueprint
- Subsection 2.2.2 IT Investment Management

- Subsection 2.2.3 ED/System Life-Cycle Development Methodology
- Subsection 2.2.4 Enterprise Encyclopedia Management
- Subsection 2.2.5 Acquisition Management
- Subsection 2.2.6 Enterprise Configuration Management

2.2.1 SFA Modernization Blueprint

SFA is currently defining a Modernization Blueprint. The Blueprint defines a target architecture for SFA. This definition will focus on SFA as a PBO. A sequencing plan will be developed as part of the Blueprint that identifies how the Blueprint will be implemented. This Blueprint is modeled after a successful modernization blueprint developed by the Internal Revenue Service. This effort is supported directly by Computer Sciences Corporation and indirectly by the many other contractors contributing to the activities being aligned by the Blueprint. The Blueprint effort is leveraging much of the work already done by Project EASI/ED and previous SFA architecture efforts. Version 1.0 of the Blueprint will be completed by September 30, 1999 and updated annually thereafter.

2.2.2 IT Investment Management

SFA has begun the implementation of a formal and rigorous IT investment management process in response to the Clinger-Cohen Act and various Office of Management and Budget (OMB) and General Accounting Office (GAO) related guidance documents. IT investment management is a process for ensuring that the selection and control of investments in IT is a business driven effort that achieves continuous alignment with the goals of SFA. The focus is a decision process that yields the best portfolio of IT initiatives to support SFA's business. This portfolio of initiatives is continuously reevaluated to ensure that the portfolio properly reflects ongoing priorities and changes. A Working Group Binder dated February 1999 was produced for SFA by Andersen Consulting that documents the results of the initiative as of that date. Incorporated in the Binder is the *IT Investment Management Operating Procedures Version 1.0*. Additional sections of the Binder resulting from this initiative are:

- the "Blue Report" that presents SFA's IT investment portfolio;
- the Investment Review Board Charter;
- an IT initiative prioritization model and methodology;
- tools and templates for the three phases of investment management; and
- an outline of risk factors that can have an impact on IT initiatives.

2.2.3 ED/System Life-Cycle Development Methodology

SFA has selected Andersen Consulting's METHOD/1 SDLC methodology as its standard for a systems development life cycle methodology (SDLCM). The initiative is referred to as the ED/System Life-Cycle Development Methodology (ED/SLCDM).

ED/SLCDM includes the following seven life cycle stages: Plan, Analyze, Design, Build, Test, Roll Out, and Evolve. Release 1.0 (February 1999) of the ED/SLCDM defines, by stage, the deliverables that SFA can request be completed by the contractors engaged to implement information systems components. In addition, system life cycle stage entry and exit criteria are specified for each of the stages. These criteria are used to determine whether the activities of a

stage are completed and whether the resulting outputs or deliverables are ready to serve as inputs to the subsequent stages. Future releases of the ED/SLCDM are expected to reflect a refined list of deliverables as determined by pilot projects and include references to specific activities that contractors may need to perform in the course of producing required deliverables.

2.2.4 Enterprise Encyclopedia Management

Multiple projects in SFA are currently using Sterling Software COOL:Gen for application development. Each project team creates its own repository to store the objects/models created by COOL:Gen. SFA is looking for standard tools to implement an enterprise encyclopedia management strategy to share COOL:Gen models between multiple contractors and across multiple development efforts. This strategy will integrate the multiple COOL:Gen repositories used on current SFA projects into a single, centrally managed encyclopedia and help create a seamless enterprise application development environment.

Sterling Software is leading the design and implementation of SFA's enterprise encyclopedia management strategy. The goal of this project is to develop a model management strategy that will facilitate the implementation of the enterprise COOL:Gen encyclopedia. This implementation will use both a strategic architectural perspective and a tactical project implementation perspective. This model management strategy is:

- a chosen method of organizing the COOL:Gen encyclopedias in terms of models and their interrelationships; and
- a defined plan for the initiation and maintenance of models and the propagation of changes between models using the encyclopedias.

2.2.5 Acquisition Management

Two efforts are currently being initiated by SFA to achieve the desired level of performance-based acquisition management. An acquisition strategy is being defined at the SFA level that will result in the implementation of streamlined and results-oriented acquisition management. The key characteristics of this strategy are reflected in the acquisition strategy component of acquisition management described in section 2.3, which outlines the Framework Elements.

Additionally, SFA has selected to align its software acquisition activities with the Software Acquisition Capability Maturity Model (SA-CMM) developed by the Software Engineering Institute (SEI) at Carnegie Mellon University. The initial alignment is with the standards and practices of Maturity Level 2, the Repeatable level. At the Repeatable level, basic software acquisition processes are established and the necessary process discipline is in place to repeat earlier successes of similar projects. With assistance from SEI, SFA is developing a strategy and plan for the incremental implementation of the policies, procedures, and organizational structures that will result in SFA being assessed at Maturity Level 2.

2.2.6 Enterprise Configuration Management

Configuration management (CM) is a formal discipline employed to control a system and its components during its development and operation. SFA is in the process of implementing incrementally an enterprise configuration management process. A Change Review Board (CRB) has been created that reviews all proposed changes and new initiatives passing selected thresholds. Key to the process of CM is the use of an automated tool that stores the detailed information comprising the configuration of the system. This information is stored in the form of

logically subdivided modules of the system called configuration items (CIs). SFA is obtaining and employing Endeavor, an automated CM tool, for its data center. The current plan is to deposit configuration items incrementally into this CM repository. The first stage will be mainframe application software. Other CIs, such as business and data models, may never be stored in Endeavor itself. They may, instead, reside in COOL:Gen or other encyclopedias or dictionaries that can be linked to Endeavor in a “virtual” CM repository. Endeavor would serve as the host repository. Control of all CIs would be under the responsibility of a Configuration Management Administrator.

2.3 Framework Elements

The Framework comprises a number of *elements* that are linked in order to provide a coherent management process for implementing IT initiatives. The elements of the Framework must include the activities described in subsection 2.2, as well as other existing or required processes and standards. The Framework elements described in this subsection are:

- Subsection 2.3.1 Architecture Management
- Subsection 2.3.2 Change Management
- Subsection 2.3.3 Investment Management
- Subsection 2.3.4 Acquisition Management
- Subsection 2.3.5 Configuration Management
- Subsection 2.3.6 Systems Development Life Cycle Methodology
- Subsection 2.3.7 Technology Tools and Standards

Each of these elements is introduced below. Additional detail for the Framework elements is presented in Appendix C - Framework Elements and Appendix D - Technology Tools and Techniques. Figure 2-1 provides an overview of the relationships among the Framework elements.

2.3.1 Architecture Management

Architecture management is the process by which an enterprise-wide IT architecture is defined and established, the architecture standards prepared and disseminated, the architecture enhanced and evolved, and the architecture applied to IT projects. The successful performance of architecture management activities is critical to the successful implementation of systems capabilities that support business strategies.

The four key underlying processes of architecture management are:

Development

Architecture development includes activities that document the baseline architecture, establish the target architecture (i.e., the SFA Modernization Blueprint), and develop the strategy and plan for transitioning from the baseline environment to the target environment. In addition, development activities implement organizational changes and initiate transition from the baseline architecture to the target architecture. Generally, development is a one-time effort.

Figure 2-1

Administration

After a target architecture is developed, the architecture guides the implementation of IT projects. The administration process establishes and maintains the connection between the target architecture and the implementation activities. Through the life cycle of an implementation activity, architecture administration ensures that developers are familiar with architecture standards and that the standards are appropriately applied in developing business cases, requests for proposals, and software products/services. Administration activities address architectural problems that are encountered during implementation. The administration process decides whether issues are addressed as changes to the implementation activity, exceptions to the architecture, or managed changes to the architecture.

Assessment

After new software products and services have been completed and rolled out to the user community, architecture assessment reviews the implemented systems capabilities. The purpose of the review is to determine whether the implemented projects comply with the architecture, whether the architecture is returning the value anticipated to SFA, and how the architecture may have helped or hindered the implementation of the systems capabilities. The architecture management team uses the analysis results to identify proposed architecture changes, which could result in changes to the systems capabilities. In addition, the assessment process is responsible for discovering and assessing information technologies that may enhance the overall architecture capabilities in terms of meeting business objectives.

Maintenance

The administration and assessment processes may propose changes to be made to the architecture. The architecture maintenance process evaluates, approves/disapproves, and packages together the approved changes. In addition, the maintenance process prioritizes and schedules projects to implement the packages. The maintenance process reviews the target architecture and updates it as needed.

2.3.2 Change Management

The change management process is a peer review of the impact of proposed changes to information technology. It builds upon SFA's existing change management organization. The process is designed to:

- evaluate project proposals through a systematic, visible process;
- receive and develop new ideas into project proposals;
- test proposals against the SFA business strategy;
- examine and communicate the effects of proposed changes before they are implemented; and
- foster communication across and within SFA groups effected by changes.

Change management embraces the following SFA groups and functions:

- Business and IT sponsors who begin with a new idea and develop it into a proposal.

- The Architecture Management Board (AMB) coordinates the change management process, ensuring that proposals are complete, manageable, and aligned with the IT architecture.
- The Decision Support Group (DSG) that tests proposals for technical and business value.
- The IRB that sets priorities for proposals within the SFA investment strategy.

2.3.3 Investment Management

SFA's IT investment management process is a business driven approach to managing IT initiatives that links the strategic priorities of SFA to the selection, control and evaluation of IT initiatives. The focus of the IT investment management process is to ensure that SFA's business priorities are continuously met. This is accomplished by:

- selecting the initiatives that best support the goals and objectives of SFA;
- controlling initiatives once they are selected to ensure that they are still aligned to SFA priorities and appropriate funding is provided; and
- evaluating initiatives after they have been completed in order to understand any deviations from established benefits, cost and schedule targets.

The IT investment management process provides SFA with:

- a clear accountability for each IT initiative (who is the sponsor, when does it start, when does it end, what are the benefits, how much it will cost, how will it be measured);
- a common understanding of when and how funding decisions are made;
- a process for managing SFA's entire IT Portfolio;
- a process for consistent and repeatable assessments of all IT initiatives; and
- standardized and concise documentation for each IT initiative.

The SFA IT investment management operating procedures were developed to provide a detailed description of SFA's IT funding decision-making process. This element is broken down into the following topics:

Decision Making Structure

Defines the role and composition of the executive decision making body, IRB, its working body, the DSG, and the individual Business Sponsors of IT initiatives, in the IT investment management process.

Process Overview

The process overview provides two perspectives:

- A high-level process map detailing the integration of IT investment management with strategic planning and capital planning and budgeting; and

- Provides a brief description of the process used to select, control, and evaluate SFA's IT initiatives.

Select Phase

The select phase presentation describes the processes for SFA's selection of a portfolio of IT initiatives. Prior to selecting the portfolio, SFA:

- establishes a definition for an IT initiative and the categories of IT initiatives;
- describes the process, tools, and roles for assessing and prioritizing IT initiatives to form the SFA IT Portfolio for budget formulation; and
- describes the process, tools, and roles for reprioritizing the SFA IT Portfolio when immediate funding needs occur during budget execution.

Control Phase

The control phase presents a description of the process, tools, and roles for assessing the performance of IT initiatives once they have been funded.

Evaluate Phase

Evaluation presents a description of the process, tools, and roles for evaluating IT initiatives once complete and for analyzing lessons learned to improve SFA's select and control phases.

2.3.4 Configuration Management

CM operates at the enterprise level for all automated systems supporting the Modernization Blueprint. It ensures IT architecture integrity by controlling changes to any component of any system. The use of CM during the delivery of an IT initiative ensures that any changes proposed to the IT initiative during the development process are properly evaluated for impact not only on the initiative under development, but also on any potentially affected element of the target architecture. CM also provides a centralized repository for information on the entire target architecture that supports reuse of software components for future IT initiatives. CM involves the disciplined application of technical and administrative management for four purposes:

- to identify and document functional requirements and physical system component characteristics;
- to control system component changes;
- to record and report change request, processing and implementation status; and
- to audit system components to verify conformance to requirements, specifications, and/or technical documents.

CM is a key discipline in all project environments. It directly relates to project management and quality. Effective CM is necessary to:

- prevent delivery of incorrect products;

- avoid high rework costs of incorrect product builds;
- provide processes for effective control of changes;
- manage product information;
- quantify the impact of changes; and
- ensure reliability and a quality environment.

A CM repository will make the following additional contributions to the Framework:

- Its tools will comprise a virtual repository of all business, analysis, design, and data models as well as all software and hardware, serving as a centralized resource for all SFA personnel; and
- As an enterprise-wide encyclopedia of IT implementations, enables and facilitates the reuse of IT applications in the delivery of new technology solutions to IT initiatives.

2.3.5 Acquisition Management

Acquisition management is a set of activities performed by an organization to successfully acquire and implement software services and products. By following a standard defined acquisition approach, an organization is better able to ensure consistent results in acquiring systems capabilities that enable its business strategies. Initially, acquisition management planning activities prepare an organization's acquisition strategy and plan; then the following steps are performed:

- Define a system need
- Develop and document requirements
- Prepare a solicitation package or request for proposal
- Evaluate and select vendors
- Manage the contractual relationship

The SFA acquisition management function is based upon the principles and concepts of SA-CMM. The model describes five maturity levels that are used to assess the maturity of an organization's software acquisition processes. The maturity levels are a means of identifying areas needing improvement and are used as operating targets for an organization. Beginning with Level 2, each maturity level indicates a process capability and contains key process areas (KPA's).

Table 2-1 presents the five maturity levels of SA-CMM.

Level	Focus	Key Process Areas
5 Optimizing	Continuous process improvement	<ul style="list-style-type: none"> • Acquisition Innovation Management • Continuous Process Improvement
4 Quantitative	Quantitative management	<ul style="list-style-type: none"> • Quantitative Acquisition Management • Quantitative Process Management
3 Defined	Process standardization	<ul style="list-style-type: none"> • Training Program • Acquisition Risk Management • Contract Performance Management • Project Performance Management • Process Definition and Maintenance
2 Repeatable	Basic project management	<ul style="list-style-type: none"> • Transition to Support • Evaluation • Contract Tracking and Oversight • Project Management • Requirements Development and Management • Solicitation • Software Acquisition Planning
1 Initial	Competent people and heroics	

Table 2-1: SA-CMM Maturity Levels

The current acquisition management objective in SFA is to achieve compliance with the SA-CMM Maturity Level 2, Repeatable. At the Repeatable level, standard software acquisition processes are established; the necessary process discipline is in place to repeat earlier successes of similar projects. Well-defined processes are the foundation for SFA's acquisition management process and are necessary to achieve higher levels of maturity.

2.3.6 Systems Development Life Cycle Methodology

A key element of the Framework is a standard, defined approach that enables an orderly growth of the information systems used by SFA. The methodology is a formal, structured, and pre-defined series of discrete activities. These activities will culminate in the delivery and deployment of a cost-effective software capability that meets defined business requirements. The methodology indicates which activities are to be performed at what time and in what sequence to successfully complete a system acquisition project. In addition to the development activities, the methodology addresses approaches for progress reporting, quality control, and other project management tasks.

A SDLCM typically includes the following major activities:

- Define the need
- Analyze the specific requirements
- Design the system
- Develop the system
- Test the system
- Install the system
- Evaluate the results

Along with the normally present development activities, other activities are performed throughout the duration of a system development project. These pervasive or cross-life cycle activities include:

- Manage and coordinate project activities and their interaction with other initiatives
- Refine standards for activities, methods, tools, and deliverables
- Document business facts and system specifications
- Assure quality of deliverables
- Confirm expected benefits at defined intervals of time

An information system may be implemented according to a number of different combinations of implementation approaches. The approaches that may be included in an implementation strategy include:

- **Traditional Information Engineering (IE) and Object-Oriented (OO) Development** - information system requirements are satisfied through custom development of required software either by contractors or by SFA developers.
- **Commercial Off The Shelf (COTS)** – Enterprise Resource Planning (ERP) solutions or other packaged software is acquired by SFA and is generally implemented with minor enhancements and possibly some business process changes.
- **Component-Based Development (CBD)** - software solutions are assembled from reusable software components; the components behave as "black boxes" that act on data and requests received, thus providing results needed by other processes.

Depending upon the selected implementation strategy, different combinations of SDLCM activities and deliverables may be selected.

In addition to developing information systems to satisfy business requirements, the delivery of services can be achieved by outsourcing business functions. In an outsourcing arrangement, a contractor arranges for the resources required to provide specific business functions. Information systems that are required to support the delivery of services would be the responsibility of the contractor.

2.3.7 Technology Tools and Standards

Technology tools enable enterprise application development within the Framework. These development process support and management tools offer an advantage to enterprise application development by helping to facilitate teamwork and collaboration as well as promoting the reuse of existing efforts. The following depicts classifications for development process support and management tools:

- **Analysis, Modeling, and Design** - these tools assist in generating requirements for applications.
- **Software Configuration**- these tools are used by application development teams to provide software revision control, source code versioning, and release management capabilities.

- **System Building** - these tools automate the build process of an application and ensure that compiling occurs with the latest approved source code files.
- **Automated Software Testing and Quality Assurance** - these tools represent a wide range of processes and technologies used to ensure that software does not contain “bugs.”
- **Software Project Management** - these tools help with the planning, scheduling, and cost estimating involved with software development projects.
- **Reusable Class Libraries** - these tools support functions and operations that are designed for a particular set of tasks and are required by the language standards but are not necessarily part of the programming language.
- **Code Repositories** - these tools assist large organizations to organize, classify and archive source code to facilitate reuse.

In general, these process support tools tend to solve overlapping problems but lack a good classification system. Consequently, due to the overlapping functionality in the various types of tools and a lack of standards in this area, it is sometimes difficult to mix and match tools from different vendors. Some tools try to solve a variety of related problems by offering extensive customization. However, customization can result in making the tools more difficult to use. Many of these tools (analysis, modeling, and design tools, for example) are not applied easily to already-existing projects. This situation causes problems because the need for such tools often is not obvious in the early stages of a design project. Likewise, each selected tool (e.g., analysis, modeling, or design tool) limits future choices for implementation approaches as well as additional tools.

Appendix D - Technology Tools and Standards provides a detailed summary of the development process and management tools used for software development projects.

2.4 Framework Requirements

This subsection will document specific requirements for the Framework. The Framework must align with the business principles and particular needs of SFA. This alignment is expressed as a set of requirements that the Framework must fulfill. The Framework requirements are as follows:

General

1. The Framework shall support and optimize the mission of SFA.
2. The Framework shall comprise both short-term and long-term efforts.
3. The Framework shall support periodic architectural design (AD) reviews, and alignment and refreshment of AD process.
4. The Framework shall be linked to management processes (i.e., investment management, acquisition management, architecture management, and configuration management).
5. The Framework shall be linked to technology tools.
6. The Framework can occur in multiple locations.
7. The Framework can support multiple contractors.
8. The Framework shall support various communication technologies that enable sharing and accessing of information (e.g., wide area networks, Internet, and dial-up remote access links).

Architecture Management Strategy

9. The Framework shall support the enforcement of the SFA enterprise architecture and common operating environment (COE).
10. The Framework shall support a common IT infrastructure.

Configuration Management

11. The Framework shall support configuration identification, configuration control, configuration status accounting, and configuration auditing.

Investment Management Strategy

12. The Framework shall incorporate policies and processes that comply with and advance relevant investment management policies adopted by ED.
13. The Framework shall incorporate policies and processes that enable the development of AD proposals that have a high likelihood of approval as an IT investment.

Acquisition Management Strategy

14. The Framework shall complement the SEI Software Acquisition CMM.
15. The Framework shall enable the cost-effective acquisition of services.
16. The Framework shall mitigate risk in acquiring systems capability.

Systems Development Life Cycle Methodology

17. The Framework shall use a formal software development life cycle methodology.
18. The Framework shall require contractors to use the ED department-wide SDLCM.
19. The Framework shall use a formal project management methodology.
20. The Framework methodology shall capture the relevant best practices of organizations in a way that allows them to be applied to a variety of applications.
21. The Framework shall support custom IE/OO development.
22. The Framework shall support COTS solutions.
23. The Framework shall support the reuse of existing as well as new core functionality across all applications.
24. The Framework shall support outsourcing.

Technology Tools and Standards

25. The Framework technology tools must be compliant with enterprise architecture standards.
26. The Framework shall embrace the opportunities offered by new technologies in the delivery and deployment of software systems.
27. The Framework shall support standardized, automated development and testing tools.
28. The Framework shall support the standard SFA entity-relationship tool for database design and documentation of data structures.
29. The Framework shall support quality metrics and performance measurements.
30. The Framework shall enable flexible system adaptation based on previously captured business rules and domain knowledge.
31. The Framework shall support the separation of business rules from data structures.

32. The Framework shall support the separation of business logic from data access logic.
33. The Framework shall support modular implementation for the upgrade of technology components.

2.5 Framework Processes

To be a useful management tool for SFA, the Framework must show how the elements described in subsection 2.3 link together and support each other to implement a specific IT initiative. Figure 2-2 depicts the high level relationships among the Framework elements.

This subsection describes the relationship of the Framework elements by presenting the two main scenarios into which most IT initiatives undertaken by SFA will fall:

- **Subsection 2.5.1 Annual Budget Cycle.** The majority of SFA IT initiatives will have their funding approved through the annual budget cycle. This subsection will describe how the framework elements come together to support the initiation and implementation of an IT initiative using this process.
- **Subsection 2.5.2 IT Initiatives of a More Urgent Nature.** While most IT initiatives will proceed through the annual budget cycle, exceptions to the standard processes will arise. These exceptions include emergencies, mandates, and high return initiatives:
 - **Emergency or mandated initiatives** represent a requirement for an expeditious decision and implementation process focused on *how* the initiative will be funded and accomplished, not whether it will be funded and carried out. These initiatives are typically activities that must be initiated immediately due to an urgent need. – In this instance, the usual early investment and acquisition management decision processes are not necessary. Mandates typically include an implementation deadline. Such initiatives will not go through many of the normal management decision and control processes because time does not permit.
 - **High return initiatives** represent those where the benefits are too significant to wait until budget formulation. They are implemented in a somewhat more accelerated manner with judiciously identified omissions of normal decision and control standards.

2.5.1 Annual Budget Cycle

The annual budget cycle is the normal context for the formal identification, approval, funding, and beginning of the delivery of new IT initiatives. This cycle begins with the yearly review and reprioritization of SFA's IT portfolio. This reprioritization precedes the submission of SFA's proposed fiscal year budget for Departmental, OMB, and congressional approval. The annual review process of SFA's funded and unfunded IT initiatives occurs as part of this process and results in an allocation of budgeted funds to ongoing and new IT initiatives, in addition to operations, infrastructure, and administrative budget allocations. IT initiatives identified and defined during the fiscal year are submitted for IRB approval. Some of these initiatives are funded and authorized for inception within this cycle. During subsequent budget cycles, the progress, relative priority, and funding level of each IT initiative are reviewed and adjusted, if appropriate. This activity occurs as part of the IT investment management element of the Framework. Other activities carried out for funded IT initiatives are guided by the other elements of the Framework. These activities occur on a frequency dictated by the schedule developed for the IT initiative.

Figure 2-2

Organization and management structures are defined that direct and support the Framework processes and ensure their adherence to standards. These structures generally represent the management of the individual elements of the Framework such as architecture or IT investment management. Figure 2-3 depicts the high-level relationships and key products of these management processes for the annual budget cycle.

The conduct of management and decision processes for each Framework element will be the responsibility of each separate element's organization. The processes must also be coordinated by the business sponsor and/or project manager, who are ultimately responsible for ensuring the fulfillment of each element's requirements. A PSS project manager will be identified to manage the activities of the IT initiative, supporting and acting on behalf of the business sponsor in those instances where:

- the initiative is urgent, costly, or complicated enough to require a dedicated project manager;
- the PSS business sponsor cannot transfer or delegate enough other responsibilities to make the necessary time available to manage the IT initiative and a suitable project manager can be identified; or
- the business sponsor is in a Service other than PSS.

The Major Steps in the Annual Budget Cycle

The integrated activities that comprise the Framework are described in the following presentation as nine major steps that are roughly sequential. Some of these activities could be carried out in parallel, rather than sequentially, since the initiation of many of the activities is not dependent on the completion of other activities described as occurring earlier. For instance, the development of an acquisition strategy and plan and project management plan can begin at the same time as the preparation of the Business Case. Decisions on whether the steps should be performed sequentially or in parallel will depend on the time and resources available, as well as on the specific nature of the IT initiatives.

Step 1. Preparing the Business Case

The business sponsor, in order to achieve an approved Funding Request, manages the preparation of the following documents:

- Feasibility Assessment
- Business Case
- IT Initiative Funding Request
- IT Initiative Scoring Sheet

PSS support may be required when the business sponsor is outside of PSS. The Business Case and related documents must be guided through:

- the development process, where the business and technology issues and solutions are defined, including cost and schedule estimates;
- the peer review process;

Figure 2-3

- review and approval by the AMB;
- review and approval by the DSG; and
- submission to the IRB, if thresholds are satisfied.

These processes may be iterative; requiring revision, clarification, or updating as determined by the peer review process, DSG, or IRB. These processes, associated templates, and prioritization criteria are described more fully in Appendix C and in the SFA IT investment management operating procedures. The business sponsor must ensure that relevant specific managed standards and processes are addressed and incorporated in the Feasibility Assessment and Business Case. The following information must be included in the documents:

- IT architecture standards and requirements
- business rules, process models, and data models maintained in the enterprise repository
- technology standards

Step 2. IRB approval

The Business Case and associated materials submitted in step one to the IRB or DSG only, if under the threshold, are evaluated by the IRB (or DSG only) for approval and funding. The IRB will decide if the initiative is to be approved and if it is to be included in the funded IT portfolio in the ensuing fiscal year. It may take several iterations of Step 1 to get an initiative into the funded IT portfolio.

Step 3. Acquisition planning

Acquisition planning can begin after completion of the Business Case and prior to AMB approval if there is an adequate degree of certainty that the initiative will be approved and funded in the current budget cycle. Acquisition planning should begin after IRB approval and budget funding is allocated, if that degree of certainty does not exist. The project manager is responsible for:

- defining and developing the acquisition strategy and acquisition plan;
- obtaining the appropriate input and concurrence from the architecture management, acquisition management, configuration management, and ED/SLCDM specialists in SFA for developing the acquisition plan;
- identifying the need for and managing or coordinating with acquisition personnel the performance of a market survey;
- developing a more detailed and reliable life cycle cost and schedule estimate; and
- developing a comprehensive definition of the project in order to allow requirements definition to proceed with adequate clarity.

Step 4. Requirements development

Requirements development comprises the definition of business, processing, and data models at least sufficient for a detailed Performance Work Statement (PWS) that can be used by prospective service vendors in order to provide an adequately detailed technical and cost proposal. The development of these requirements can begin as early as completion of the Business Case, again,

based on the degree of certainty of imminent funding of the initiative. Otherwise, the development of detailed requirements should be scheduled to begin in time to be complete and available for the solicitation and proposal evaluation planning step as it is tied to the overall schedule previously prepared.

The project manager is responsible for the following activities:

- preparing the requirements analyses, business process modeling, and the various definitions and management plans required for the solicitation process
- preparing the various management plans for this initiative, including acquisition management, project management, and configuration management
- developing a comprehensive statement of the envisioned contractual requirements

Step 5. Solicitation and contract award

The information and plans developed in the requirements development step are used to develop a detailed PWS and software solicitation plan. The project manager is responsible for:

- developing, with the assistance of the acquisition management specialist, the software solicitation and proposal evaluation plans;
- developing a PWS for inclusion in the Request for Proposal (RFP);
- assisting the acquisition management specialist, as necessary, to prepare an RFP;
- guiding the detailed PWS through the necessary review and approvals by the
 - Architecture Working Group (AWG)
 - AMB
 - DSG
 - IRB
- gathering an appropriate pool of specialists to review submitted RFP's and select a contractor for award; and
- defining the Work Package(s) awarded to the winning contractor(s).

Step 6. Completion of requirements analysis

The contractor(s) selected in the previous step now performs the detailed requirements analysis and begins submitting the deliverables responsive to the PWS. The project manager, working with the COTR and appropriate PSS specialists, are responsible for the:

- review and approval of the deliverables submitted by the contractor in fulfillment of the PWS's requirements for detailed analysis of system requirements;
- development and submission by the contractor(s) of acceptable development and test plans; and
- coordination of the activities necessary to satisfy the requirements of the configuration management, architecture management, acquisition management, and IT investment management for review and approval.

The project manager or business sponsor (or both) will work with the COTR and the standing Boards and Working Groups to ensure that all requirements are met.

Step 7. Completion of the design and build stages

Detailed design and development of the IT initiative begins after the necessary approvals from all of the standing review groups in Step 6. The project manager, working with the COTR and appropriate PSS specialists, are responsible for the:

- review and approval of the deliverables submitted by the contractor in fulfillment of the PWS's requirements for detailed design of system components and assemblies;
- development and submission by the contractor(s) of acceptable component test results; and
- coordination of activities necessary to satisfy the requirements of the configuration management, architecture management, acquisition management, and IT investment management standards.

Step 8. Completion of acceptance testing and system implementation

The final acceptance testing and delivery of the subproject begins after SFA acceptance of unit and integration testing results, which completed Step 7. The project manager, working with the COTR and appropriate PSS specialists, are responsible for the:

- review and approval of the deliverables submitted by the contractor in fulfillment of the PWS's requirements for system testing results adequate to approve delivery of the system;
- execution of the conversion plan to full or pilot production;
- execution of the Transition to Support Plan; and
- coordination of the activities necessary to satisfy the requirements of the configuration management, architecture management, acquisition management, and IT investment management standards.

Step 9. Post implementation evaluation and follow-ups

This final step is one most often omitted in systems development projects, after the new system is implemented in Step 8. Completion of this step is key to maintaining the integrity and effectiveness of the Blueprint. Lessons learned are usually informally institutionalized in the people who carried out the effort. Ensuring that the lessons learned become part of the Blueprint and updating the Blueprint with modifications evolving out of the subproject on a continuous basis will help to maintain the viability of the Blueprint.

The project manager, working with the COTR and appropriate PSS specialists, are responsible for the:

- preparation of a post implementation analysis and report identifying any changes that should be considered for any of the technology or management standards, based on lessons learned during the initiative development and implementation process; and

- submission of final review documents as required and coordination of activities necessary to satisfy the requirements of the configuration management, architecture management, acquisition management, and IT investment management standards.

2.5.2 IT Initiatives of a More Urgent Nature

This scenario presents generalized guidance for what is really a continuum of scenarios describing IT initiatives that are considered particularly urgent. There are two key characteristics of an IT initiative that would cause it to be more urgent:

- the initiative should not wait for the annual review process to be considered for approval and funding; and
- the initiative must be completed in a shorter period of time than would be possible if all of the normally applicable plans, deliverables, and coordinating reviews and approvals were employed.

These more urgent IT initiatives can be characterized as:

- **Emergencies** - An emergency is a problem of an urgent and significant nature that require an immediate IT solution component outside the scope or resources of current contract vehicles.
- **Mandates** - A mandate is a legislative or executive directive to revise or initiate a process requiring an IT solution component. Mandates may come with or without funding for the IT component. The IT investment budget planning and decision processes are unnecessary when funding is appropriated, except for scheduling the budget expenditure. The funds would be incorporated into the IT portfolio budget, but earmarked exclusively for the mandated initiative, unavailable for reallocation in a reprioritization process. Any unfunded mandate that has an estimated cost of less than \$5,000,000 and any mandate that has an implementation date of less than one year is subject to this guidance.
- **High return initiatives** - A high return IT initiative is an unscheduled, non-emergency initiative representing an opportunity where the benefits are too significant to wait until budget formulation. This could be any IT initiative which offers the potential for a service level improvement or a cost savings or cost avoidance significant enough that other funded activities with a lesser payoff should be reduced, deferred, or cancelled and this activity initiated in their stead. This initiative proposal may have come about because of:
 - a good idea for increased efficiencies in the service delivery or support structure;
 - an advance in technology that makes an increased service level or reduced cost possible; or
 - commitments made to customers regarding increased service levels.

Figure 2-4

The decision on whether to accelerate or bypass normal management processes must be based on an assessment of the relative risk of the initiative. The greater the cost to SFA of not achieving timely implementation of an initiative, the more risk will be tolerated in that initiative's execution. Controls such as management plans, status reports, and reviews and approvals can be reduced based on the best judgement of the business sponsor, the project manager, and the AMB.

Figure 2-4 presents general guidance on the activities to be carried out when implementing one of these types of more urgent initiatives. The activities presented in Figure 2-4 are described in more detail in the nine steps outlined below.

Step 1. Preparing the Business Case

The business sponsor or designated project manager prepares an abbreviated Business Case. The benefits and alternatives sections of the business case are omitted. The other information, principally cost, schedule, and technology, is prepared only to the level of detail necessary to obtain concurrence from a knowledgeable peer in either the affected Program Division of PSS or TPAS and the Director of TPAS.

Step 2. IRB approval

The business case and associated IT Funding Request do not need to be reviewed by the entire DSG; approval by the Director of TPAS is sufficient for presentation to a majority of the members of the IRB. The IRB need not be convened to review and approve the IT Funding Request, if time and scheduling conflicts do not permit a timely meeting. All members of the IRB will be sent copies of the IT Funding Request and the Business Case for review and approval. A simple majority of the members of the IRB responding with approval would be adequate for proceeding with the initiative. Scoring will not be required at this time. A scoring sheet should be prepared, peer reviewed, and submitted for the next regularly scheduled meetings of the DSG and IRB for review and approval and reprioritization of the IT portfolio.

Steps 3 - 5. Acquisition planning, requirements development, solicitation and contract award

Requirements development should begin no later than upon receipt of the approved IT Funding Request and may begin at the same time that the Business Case is initiated. Acquisition strategy, acquisition management, software solicitation, proposal evaluation plans, and detailed life cycle cost and schedule estimates may all be omitted for emergencies and should be considered for omission depending on schedule and other resource availability for mandates. If a sole source procurement is a practical option, then the RFP providing a detailed PWS may also be omitted. A proposal displaying an understanding of the need and a sound approach, both technical and management, should still be obtained prior to contract award.

A copy of the Business Case submitted to the DSG or the Director of TPAS should be submitted simultaneously to the Director of Acquisition Management. This early notification will enable the acquisition process to be initiated at the earliest possible time, expediting the acquisition of the necessary contract and/or technology support.

Step 6. Completion of requirements analysis

Normal reviews (along with the project deliverables supporting those reviews) by the AWG, AMB, Configuration Control Board (CCB), DSG, and IRB will be reduced to that minimum necessary to ensure the ongoing integrity of the architecture and configuration management.

Steps 7 - 8. Completion of the design and build stages, completion of acceptance testing and system implementation

Controls and safeguards built into the ED/SLCDM should not be omitted, but may be abbreviated, for mandated initiatives. This would include activities or deliverables such as quality assurance plans, training plans, and the transition to support plans. Technical deliverables to satisfy the systems development life cycle requirements should be selected based on the minimal requirements necessary to assure the project manager and COTR that the initiative is proceeding in a technically correct manner. Emergencies justify a further reduction in controls, but require mandatory post-implementation audits to ensure that architectural and configuration management integrity is maintained or restored.

Step 9. Post implementation review and follow-ups

The AMB and the IRB will reconsider the strategic and tactical initiatives in the Sequencing Plan in light of any significant changes resulting from the mandated initiative implementation or lessons learned from the emergency IT initiative.

Exceptions to standards in the implementation of the initiative may be justified if the cost savings or increased service level is significant enough. These differences would be the reduction of planning, coordinating, reporting, and controlling activities and deliverables necessitated by an imperative to implement the initiative at the earliest possible date at the minimum prudent cost. The majority of the activities and deliverables eliminated would be control mechanisms. Principally, certain management and strategy plans as well as regular reporting to and review by the IRB and AMB intended to ensure the integrity of the AD framework and the IT architecture. This lessened control increases the risk of the loss of integrity. This, in turn, increases the cost to restore integrity later, if integrity was actually lost. The expected payoff of the initiative in terms of customer satisfaction, cost avoidance, or cost reduction must justify the increased risk during implementation. The AMB and the IRB will both want to reconsider the strategic and tactical initiatives in the Sequencing Plan in light of any significant changes resulting from the unscheduled initiative implementation.

The following list is a suggested set of minimum documents and/or substeps that should be completed for more urgent initiatives:

- Investment Management:
 - Abbreviated Business Case
 - Justification
 - Cost and schedule estimates
 - IT Funding Request
 - DSG Chair review and approval
 - IRB majority review and approval

- Acquisition Management
 - Requirements development
 - Project Management Plan (Mandates only)
 - Contract requirements
 - PWS
 - Proposal evaluation plan (if sole source procurement not feasible)
 - Contractor selection
 - Contract execution

- Progress metrics, technical and budget, reports
- SDLCM
 - Expedited requirements analysis deliverables
 - Test plan
 - Conversion plan
 - Minimum necessary Design, Build, Test, and Roll-out Stages technical deliverables
- Configuration Management
 - Configuration Management Plan (Mandates only)
 - Configuration Item Identification (Emergencies - deferred, but not omitted)
 - CCB review and approval (Mandates only)
 - Configuration Status Audits, post-implementation
- Architecture Management
 - AWG and AMB review and approval of technical solution (Mandates only)
 - Architecture Change Requests, if necessary (Emergencies - deferred, but not omitted)
 - Architecture Standards Project Compliance Report (Mandates only)

2.5.3 Detailed Framework Process Steps

Figure 2-5 below presents a detailed depiction of the individual process steps taking place within each of the Framework elements, and shows the relationships among each of these steps.

Figure 2-5

2.6 Technology Tools and Standards

This subsection identifies the major types of technology tools and standards that can be used to implement the Blueprint. In some categories, SFA has already selected some specific tools and methodologies. For areas in which SFA has yet to make decisions regarding tools and standards, this subsection lists representative products that could meet SFA's expected needs.

This subsection presents the following topics:

- Subsection 2.6.1 Technology Tools
- Subsection 2.6.2 Repositories
- Subsection 2.6.3 Systems Development Life Cycle: Methodology, Documentation, and Techniques
- Subsection 2.6.4 Models
- Subsection 2.6.5 Managing the Framework Standards
- Subsection 2.6.6 Exceptions to the Framework Standards

2.6.1 Technology Tools

A technology tool is a product that automates the performance of a Framework activity. This subsection lists a set of the technology tools necessary to facilitate enterprise application development within SFA. Subsection 2.6.3 presents scenarios showing how these tools are used to support different implementation approaches. Appendix D provides a detailed explanation of these technology tools and application development techniques, with a detailed treatment of component-based development (CBD). Table 2-2 below lists a set of general technology tool types, and lists products that have either been selected as a standard by SFA (marked by an asterisk “*”) or are best-in-breed products capable of meeting SFA's needs in their particular technology area. Table 2-3 provides similar information, but focuses specifically on tools used to support CBD.

Product Tool Type	Vendor and Product Name
Analysis, Modeling, Design	Sterling Software COOL:Gen*, COOL:Biz, RTM, Sterling Software COOL:Jex, Rational Rose
Software Configuration Management	Computer Associate Endeavor*
System Building	Sterling Software COOL:Gen*, Sterling Software COOL:Jex, Rational Rose
Automated Software Testing and Quality Assurance	Mercury Interactive Product Test suite, SQA Suite
Software Project Management	Microsoft Project 98*
Repositories	Sterling Software COOL:Gen*, Microsoft Repository

Table 2-2: General Technology Tool Standards

CBD Product Tool Type	Vendor and Product Name
Component Modeling	Sterling Software COOL:Gen* (CBD-96), Sterling Software COOL:Spex, PLATINUM Paradigm Plus, Rational Rose
Component Construction	Sterling Software COOL:Gen* (CBD-96), IBM VisualAge, MS VisualSeries, Symantec Cafe
Component Repository	Sterling Software COOL:Gen* (CBD-96), MS Repository, tool-specific repositories (e.g., Rational Rose ObjectStore)
Component Assembly	Sterling Software COOL:Gen* (CBD-96), IBM VisualAge, MS VisualSeries, beta release tools from IBM, Sun Microsystems, Sterling Software
Component Integration	IBM WebSphere, Sun NetDynamics, BEA Systems WebLogic, MS DCOM/MTS

Table 2-3: CBD Technology Tool Standards

2.6.2 Repositories

A repository stores and shares information about the artifacts (e.g., objects, models, source code, and documentation) of software systems and their interrelations. This information enables multiple tools to work together across the system development life cycle. By providing a common format for storing information about databases and reusable components, disparate tools can easily share metadata (i.e., information describing the attribute) about software artifacts.

A repository should provide the following:

- Support for multiple types of components
- Support for storing and locating components and component design specifications
- Support use and reuse of components across teams of developers
- Version control and configuration management
- Visualization and reporting facilities
- Dependency and cross referencing facilities
- Import/export facilities for model and specification sharing

Repository-enabled products can automate many functions that would normally be done manually. For example, by using a component's detailed design information created by a modeling tool, a programming tool can automatically generate much of the actual code and database definition language (DDL). Applications can be re-targeted to different operating systems, databases, networks, and transaction processors automatically by using repository data to drive the implementation tools.

SFA has selected the COOL:Gen encyclopedia as the standard repository for COOL:Gen models and CBD 96 components. Since the COOL:Gen encyclopedia is limited to COOL:Gen models, objects, and components, Microsoft Repository is recommended as an enterprise repository to help compliment the exchange of information between the Sterling COOL suite products and other third party vendors. Some of the main features of COOL:Gen encyclopedia and Microsoft Repository are explained below.

COOL:Gen Encyclopedia

The COOL:Gen encyclopedia is a repository specifically designed for COOL:Gen objects, models, and specifications. The encyclopedia allows all facets of an application specification to be shared and reused. Features of the encyclopedia allow multiple development teams to work concurrently and support version control. All encyclopedia information is directly accessible by Application Programming Interfaces (APIs) for manipulation and reporting by third party and custom tools.

Microsoft Repository

The Microsoft Repository allows component information to be shared not only by multiple team members, but also by multiple tools. By providing an open, extensible framework for storing software components and information about them (such as their methods, data types, and relationships to other components), Microsoft Repository enables tool interoperability across the application life cycle.

The repository simplifies CBD component management by providing the following benefits:

- Makes the models widely accessible
- Provides a place for a component catalog
- Stores components and related artifacts
- Links third-party tools into the development process

2.6.3 Systems Development Life Cycle: Methodology, Documentation, and Techniques

This subsection presents standards for the systems development life cycle. The standards include methodology, documentation, and techniques.

Methodology

SFA has selected Andersen Consulting's METHOD/1 SDLCM as the basis for developing and implementing a standard methodology across all IT initiatives. Each division within PSS will use the customized implementation of METHOD/1, referred to as ED/SLCDM, for delivering required systems capability. The methodology specifies a defined set of deliverables for alternative development approaches. An implementation handbook has been developed which describes the life cycle major activities or stages and its deliverables. ED/SLCDM stages are as follows:

- Plan
- Analyze
- Design
- Build
- Test
- Roll Out
- Evolve
- Manage

Documentation

The *ED/SLCDM Handbook* defines deliverables that are produced at different points in the life cycle. All projects should be required to produce the appropriate set of deliverables that are consistent with the implementation approach of a project.

Techniques

The Department of Education standard tool assets have been selected to support application system development using a variety of methods and techniques. Project personnel select the specific approach to be used on a particular system development effort and the approach chosen is supported by the standard tool inventory. The following paragraphs provide scenarios that can be taken by a development project using a particular development approach and associate the methods or techniques from the standard tools inventory that support specific ED/SLCDM deliverables defined in the *ED/SLCDM Handbook*.

Information Engineering Scenario

Those development projects using the information engineering (IE) approach will accomplish the Plan and Analyze stages of the ED/SLCDM using the capabilities of the COOL: Biz and COOL: Gen tool suites. In the Plan stage, COOL: Biz will be used to develop the Business Case for the development project. COOL: Biz will support the Analyze stage by providing the mechanism to develop the Functional Requirements and Application Conceptual Plan. The Analysis stage is also augmented by the capabilities of the COOL: Gen tool, which can be used in support of the Application Conceptual Plan. In the Design stage the COOL: Gen product will be used in the creation of the Application Flow, Database Design, Program Specification, and User Interface Design. The Build stage will use the COOL: Gen tool to arrive at the technical solution. The Test stage will use automated test tool suites depending upon the environment in which the application will execute. Figure 2-6 depicts a process flow scenario using the standard tools with for an IE approach. Table 2-4 summarizes the components of the standard tool set used in the scenario.

Vendor	Product Name	Used In Life Cycle Stage	Deliverable
Sterling Software	COOL: Biz	Plan	Business Case
Sterling Software	COOL: Biz	Analyze	Functional Requirements
Sterling Software	COOL: Biz	Analyze	Application Conceptual Plan
Sterling Software	COOL: Gen	Analyze	Application Conceptual Plan
Sterling Software	COOL: Gen	Design	Application Flow
Sterling Software	COOL: Gen	Design	Database Design
Sterling Software	COOL: Gen	Design	Program Specification
Sterling Software	COOL: Gen	Design	User Interface Design
Sterling Software	COOL: Gen	Build	Technical Solution
Rational Mercury Interactive (MI)	SQA Suite MI Product Suite	Test	Integrated System Product Test Results

Table 2-4: Standard Tools for Information Engineering Approach

Figure 2-6

Object Oriented Scenario

Development projects selecting the object-oriented (OO) approach will accomplish the Plan and Analyze stages of the ED/SLCDM using the capabilities of the COOL:Biz, COOL:Jex, or Rational Rose tools. In the Plan stage, COOL:Biz will be used to develop the Business Case for the development project. COOL:Biz will also support the Analyze stage by providing the mechanism to develop the Functional Requirements and Use Case constructs. The capabilities of the COOL:Jex or Rational Rose tool augment the Analyze stage by supporting the preparation of Sequence Diagrams and State Transition Diagrams. During the Design stage, the COOL:Jex or Rational Rose tools can be used to develop the Database Design deliverables. In addition, both tools can be used in the Build stage to arrive at the Technical Solution. The Test stage will use an automated test tool suite depending upon the environment in which the application will execute. Figure 2-7 depicts a process flow scenario using the standard tools with the OO approach. Table 2-5 summarizes the components of the standard tool set used in the scenario.

Vendor	Product Name	Used In Life Cycle Stage	Deliverable
Sterling Software	COOL:Biz	Plan	Business Case
Sterling Software	COOL:Biz	Analyze	Functional Requirements
Sterling Software	COOL:Biz	Analyze	Use Case
Sterling Software Rational	COOL:Jex Rational Rose	Analyze	Sequence Diagram
Sterling Software Rational	COOL:Jex Rational Rose	Analyze	State Transition Diagram
Sterling Software Rational	COOL:Jex Rational Rose	Design	Database Design
Sterling Software Rational	COOL:Jex Rational Rose	Build	Technical Solution
Rational Mercury Interactive (MI)	SQA Suite MI Product Suite	Test	Integrated System Product Test Results

Table 2-5: Standard Tools for Object-Oriented Approach

COTS Scenario

Development projects making an initial investment management decision to pursue a COTS approach will use a combination of SA-CMM and ED/SLCDM to create the deliverables needed for this approach. The SA-CMM Solicitation stage will be invoked to develop the Software Solicitation Plan. The COOL:Biz tool can be used in the Plan and Analyze stages of the COTS approach. The COOL:Biz tool will be exploited to generate the Business Case in this approach. In the Analyze stage, COOL:Biz will be used to create the Functional Requirements, and Application Conceptual Design. Some portions of the Analysis stage, as well as the entire Design and Build stages, will be completed using whatever COTS solution is acquired. The Test stage will use an automated test tool suite depending upon the environment in which the application will execute. Figure 2-8 depicts a process flow scenario using the standard tools with the COTS approach. Table 2-6 summarizes the components of the standard tool set used in the scenario.

Figure 2-7

Figure 2-8

Vendor	Product Name	Used In Life Cycle Stage	Deliverable
Software Engineering Institute (SEI)	SA-CMM	Solicitation	Software Solicitation Plan
Sterling Software	COOL:Biz	Plan	Business Case
Sterling Software	COOL:Biz	Analyze	Functional Requirements
Sterling Software	COOL:Biz	Analyze	Application Conceptual Design
Rational Mercury Interactive (MI)	SQA Suite MI Product Suite	Test	Integrated System Product Test Results

Table 2-6: Standard Tools for Commercial Off-The-Shelf Approach

Outsourcing Scenario

Projects that make a decision to pursue an outsourcing approach, like a COTS approach-based project, use a combination of the SA-CMM and ED/SLCDM to create the deliverables needed for this approach. The SA-CMM Solicitation stage will be invoked to develop the Software Solicitation Plan. The COOL:Biz tool will be used to generate a Business Case deliverable for the outsourcing approach. In the Analyze stage, COOL:Biz will be used to create the Functional Requirements and Application Conceptual Design. Figure 2-9 depicts a process flow scenario using the standard tools with the outstanding approach. Table 2-7 summarizes the components of the standard tool set used in the scenario.

Vendor	Product Name	Used In Life Cycle Stage	Deliverable
Software Engineering Institute (SEI)	SA-CMM	Solicitation	Software Solicitation Plan
Sterling Software	COOL:Biz	Plan	Functional Requirements
Sterling Software	COOL:Biz	Plan	Business Case
Sterling Software	COOL:Biz	Analyze	Application Conceptual Design

Table 2-7: Standard Tools for Outsourcing Approach

CBD Scenario

Development projects making an investment management decision to pursue a CBD approach will use the ED/SLCDM, augmented by the Catalysis methodology, to create the deliverables needed for this approach. (Catalysis is described in more detail in Appendix D). The COOL:Biz tool will be exploited to generate the Functional Requirements and Business Case deliverables in this approach. To specify components within an application domain, the Catalysis methodology will be used, being supported by Sterling Software COOL:Spex, PLATINUM Paradigm Plus, or Rational Rose tools. Components may then be constructed using any of the implementation approaches: IE with COOL:Gen; OO with IBM VisualAge, Symantec Café, or MS Visual Studio, or COTS through outsourcing. The Test stage will utilize one or more automated test tool suites depending upon the environment in which the application will execute. Figure 2-10 depicts a process flow scenario using the standard tools of the IE approach. Table 2-8 summarizes the components of the standard tool set used in the scenario.

Figure 2-9

Figure 2-10

Vendor	Product Name	Used In Life Cycle Stage	Deliverable
Sterling Software	COOL:Biz	Plan	Business Case
Sterling Software	COOL:Biz	Analyze	Functional Requirements
Sterling Software PLATINUM Rational Software Sterling Software	COOL:Spex Paradigm Plus Rational Rose COOL:GEN	Analyze	Domain Model
Sterling Software PLATINUM Rational Software Sterling Software	COOL:Spex Paradigm Plus Rational Rose COOL:GEN	Design	Component Models Specification Diagrams Interface Diagrams
IBM Corporation Symantec Microsoft Sterling Software	VisualAge Symantec Café Visual Studio COOL:GEN	Build	Software Components Assembly Test Results
Rational Mercury Interactive (MI)	SQA Suite MI Product Suite	Test	Integrated System Product Test Results

Table 2-8: Standard Tools for Component-Based Development Approach

2.6.4 Models

A modeling language is a graphical notation and syntax used to express and document system analyses and designs. Based on the implementation approach chosen, a variety of modeling notations are available. Differing notations may be most appropriate in different situations. Each modeling tool generally follows a specific modeling notation. By using modeling notations that are considered industry standards, models generated by specific tools become more portable across multiple products from different vendors. This increases the potential for reuse.

The modeling notations used by the technology tools described within this document are as follows:

- **Business Process Modeling: Rummler-Brache** - the Rummler-Brache (or “swim lanes”) modeling technique is a well-known notation for process modeling; this notation is supported by the COOL:Biz tool.
- **IE Modeling** – James Martin’s IE methodology is a de-facto standard for large-scale systems development using a procedure (as opposed to an OO) approach. Sterling Software’s COOL:Gen product implements the IE methodology.
- **OO Modeling: Unified Modeling Language (UML)** - the UML has become the de facto standard for OO development, due to its extensive usage among OO developers and its wide support by tool vendors (including Sterling Software and Rational).
- **CBD Modeling** - the following two modeling notations are recommended for CBD:
 - **UML Extensions** - for CBD, UML and CBD-specific UML extensions are supported by the Catalysis methodology; therefore, UML and UML extensions are recommended as a CBD modeling language standard. Products from Sterling

Software, Rational, and Platinum Technologies support Catalysis and the UML extensions notation.

- **CBD96** - where CBD is being done using COOL:Gen, the CDB96 modeling standard should be used for defining COOL:Gen components.

2.6.5 Managing the Framework Standards

As SFA begins to implement the Blueprint, the existence of clearly defined standards for application development will become increasingly important because:

- multiple contractors' teams will participate in implementing the Blueprint;
- development teams will be geographically dispersed; and
- development will occur over time in multiple phases.

Like any set of standards, SFA's standards for application development can be expected to change over time to accommodate shifts in business requirements and in technology. A management process must be in place to carefully control changes in application development standards. This management process should follow the same procedures as described in Appendix C for architecture management.

2.6.6 Exceptions to the Framework Standards

To the extent possible, all Blueprint implementation projects should comply with SFA's standards for application development. However, it is inevitable that situations will occur that warrant an exception to the standards. Exceptions to these standards will exist for several reasons:

- **Incomplete infrastructure** - consistent application of SFA's standards requires that the full infrastructure of organizations, policies, and technology tools be in place and functioning smoothly. This is not yet the case. SFA's standards should be employed and enforced to the extent that they can be in the current environment until SFA's infrastructure is able to fully support them.
- **Technological maturity** - some of the technology tools and techniques described in this document are relatively new. Since SFA is designing for the future, it should be expected that the level of maturity and interoperability of some of its tools and techniques is still developing. However, great care should be taken to ensure that any technologies that are employed, especially in the beginning phases of the Blueprint's implementation, are fully mature and proven in production environments.
- **Overriding business priorities** - in the short term there will be compelling business reasons to maintain and enhance current systems or deploy new systems using tools and policies that vary from SFA's standards. These reasons will include the impact of the two previous observations concerning technological and organizational infrastructure and maturity. In some cases there may be an over-riding business reason to use different tools simply because of the specific capabilities needed that may not be supported by the standards.

Any time that an exception to SFA's standards is authorized by the CRB, AMB, and (if necessary) the IRB, the plans and methods for ensuring current or future integration of non-standard technologies with the target architecture must be documented.

2.7 Progress to Date

A substantial amount of work has been done over the last several years on defining a modernization vision for SFA. The work completed by Project EASI/ED and other modernization initiatives is being leveraged to develop the SFA Modernization Blueprint. Once the initial version of the Blueprint is complete and implementation work begins, many of the products and deliverables required by the SFA investment management process and the ED/SLCDM will already exist in whole or in part. Table 2-9 maps Project EASI/ED work to the contents of the Blueprint, and to deliverables required by the ED/SLCDM and Framework processes. This table shows that SFA already has a starting point for much of the work necessary to implement the Blueprint. The work that SFA has already completed can be leveraged to ensure that SFA implements modernized systems that are both aligned with the mission of the new PBO and are consistent with the Project EASI vision.

Project EASI/ED	Blueprint	ED/SLCDM-Framework *
Business Area Requirements Document (BARD), Ver. 2.0	Level II Business Requirements	Functional Requirements (U211)
Application Services Definition Document (ASDD), Ver. 2.0	Level II Subprocesses	Application Conceptual Design (M031) Interface Memorandum (T127)
Application Services Definition Document/Target Architecture (ASDD/TA), Ver. 2.0	Level II Subprocess Flows	Event Model (D080), Process Model (D051)
Logical Data Model (LDM), Ver. 2.0	Level II Data Model (Logical Databases)	Logical Database Design (D521)
LDM, Ver. 2.0	Level III Data Model	Data Element Definition (D710) Logical Database Diagram (D520)
ASDD, Ver. 2.0	Level III Subprocess Flows	Application Flow (T120)
Common Operating Environment (COE)	Systems Standards Profile (Volume VI)	SFA Standards; identified in <i>ED/SLCDM Handbook</i>
Configuration Management Plan	Not yet defined	Configuration Management Plan (A840)
Transition Strategy	Sequencing Plan	Business Case
Baseline Characterization	Current System Architecture Appendix	Baseline Architecture; identified in <i>ED/SLCDM Handbook</i>
Program Management Plan, Ver. 2.0	Not yet defined	Project Management Plan

Table 2-9: Project EASI/ED / Blueprint / ED/SLCDM-Framework Deliverables Mapping

* The ED/SLCDM-Framework column lists certain documents followed by codes within parentheses that identify ED/SLCDM deliverables.