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GLOSSARYII

1. Project Description

The ROSS Project will result in a system that provides automated support to interagency dispatch and coordination offices within the wildland organization. This system will:

1. Provide current status of available resources for supporting mobilization activities,
2. Enable dispatch offices to electronically exchange and track resource order information,
3. Enable dispatch offices to rapidly and reliably exchange mission-critical electronic messages,
4. Exchange data with current and future dispatch and incident information systems through live transmittal processes (1 and 2 way), periodic copy, import/export, and through the use of either an Application Program Interface Library or Object Class Library.

2. Current Environment

Currently, interagency and agency wildland dispatch /coordination centers across the country use manual methods to process resource status and ordering documents. Status information is gathered and documented locally (using various local manual and electronic methods). Some of this information is transmitted to Geographic Area Coordination Centers and to the National Interagency Coordination Center each morning. Since this data is often out-of-date before it is transmitted, the status information is generally not used to assess resource availability when orders for resources are taken. Resource orders are currently documented using manual forms, which are completed, at each office. The information included on these forms is then relayed to the next dispatch office via telephone, fax and occasionally in form format via e-mail. It is then re-entered on a form at the receiving dispatch office. This process continues until a resource is found that fills the order. This manual system has been successful but inefficient. Several independent efforts to automate resource status and ordering systems have been attempted including AROS, form based templates, and MIRPS. However, no system has been successfully implemented nationally that supports the needs of the interagency dispatch community. The processes used to collect and document the status of resources, order resources, and transmit mission critical dispatch information are the core business function of the interagency wildland dispatch community.

2.1 Dispatch Messaging

Dispatch messaging is an important business function within the dispatch environment. When the use of e-mail communication applications began on an interagency basis, system compatibility issues have been raised. Currently, each agency maintains their own administrative messaging systems for mission critical dispatch message and document transmissions. Interagency exchange of information through these systems has proven difficult due to differing document exchange formats and system

performance or availability. Support for agency administrative systems has generally not met the needs of the dispatch community. Most agencies do not have 7 x 24 support for their operations. During the summer of 1998 the NWCG established the Interagency Document Exchange Standard (IDES). That standard is Rich Text Format (RTF) and the use of RTF has been largely successful.

The lack of e-mail address standardization is another important issue. While the NWCG has adopted an interagency standard for e-mail addressing, issues pertaining to the commonality of server domains continue to exist.

3. Project Intent

This project encompasses the initiation; planning; establishment of the business and technical requirements; application design, development, and build; and implementation of a resource status and ordering system for wildland dispatching and coordination organizations across the nation. The National Wildfire Coordination Group (NWCG) sponsors the project. The system is designed to manage resources for all risk dispatching, but does not provide decision-making tools that are better suited for Computer Aided Design (CAD) systems. The system will be capable of communicating with CAD systems, Incident Based Automated Systems and other dispatch related systems through an Application Program Interface (API) or through the use of an Object Class Library. The system will provide services for the statusing, ordering, tracking, mobilization and demobilization of resources and a consistent approach to dispatch messaging, document storage and website hosting.

This project takes advantage of the processes and functionality of the Multi-agency Incident Response Processing System (MIRPS). MIRPS is currently an active application used by dispatch centers managed by units in California (U.S. Forest Service and the California Department of Forestry).

4. Project Objectives

The primary objectives of ROSS are to:

- automate the current manual processes associated with documenting the status, mobilization, and demobilization of wildland resources in the United States,
- eliminate the need to manually (re)enter resource orders from other dispatch offices,
- obtain "near real-time" status of resources throughout the nation
- allow geographic/national coordination centers to prioritize pending resource orders
- provide a single user interface regardless of organizational or system-specific requirements
- focus development efforts on common areas of resource status and ordering
- share information between the cooperating offices on a "near real-time basis"

- provide accurate information to management on a “near real-time basis”
- ensure system reliability and support 7 days per week / 24 hours per day
- establish an Application Programmer Interface (API) specification or Object Class Library for use by external systems
- ensure the delivered system can be implemented at all levels of the dispatch organization including expanded dispatch operations
- ensure mission-critical dispatch messages are exchanged rapidly and reliably between dispatch offices, caches and incidents on a “near real-time basis”.

5. Project Scope

The project scope encompasses all business functions related to the resource ordering and status process. This requires a detailed business analysis that identifies and documents, in the form of models and detail descriptions, all business processes, business rules, and data items related to the resource ordering and status business. It also also requires a detailed infrastructure analysis that identifies such items as system response and load requirements, network architecture design, access alternatives etc..

The following resource ordering and status functions that are considered to be within the scope this project:

- data input, update and delete functions for all resource order fields and supporting documents
- assignment, release, reassignment, and tracking functions for all resource types
- sending, receiveing, cancelling and forwarding functions for all resource ordering and status information between all offices with the system implemented
- an array of standardized reports useful to all levels of the interagency community
- a consistent approach to dispatch messaging for Dispatch Offices, Caches and Incidents per pre-established user specifications
- report writing capability for users to build custom reports without the use of outside support
- travel arrangement documentation and flight planning
- real-time status of resource orders
- financial information documentation, including documentation of information required for reimbursable mobilization of resources
- status and track capability for all tactical, logistical, service, and support resources mobilized by the wildland dispatch community.

The system shall be capable of operation using a multi-tier dispatch organization (National, Geographic Area, Zone, Local) and be operational in an expanded dispatch environment.

The following dispatch business functions are not within the scope of this project:

- situation reports compilation and distribution
- preparedness levels designation
- decision making processes that lead to the ordering and assigning of resources
- all decisions and actions regarding a resource after it has been delivered to an incident.

6. Project Implementation Strategy

The ROSS project will be carried out by an Interagency Team under the leadership of a project team leader assigned by the NWCG. The leader will closely coordinate all project efforts with the project function area manager. The NWCG IRM Working Team provides project oversight.

The ROSS team will complete portions of the ROSS tasks (see WBS) through the utilization of contractors. The contractors will closely interact with the ROSS team and the dispatch community at large. It is vital that the contractor develop a positive, upbeat and professional relationship with the dispatch and wildland incident management community. This relationship is important to the successful acceptance of the ROSS deliverables. These tasks that will require significant contract work include:

Design, Prototype, and Validation of the ROSS Application and System	WBS 3
Document, Build, and Test	WBS 4
Field Training, Testing, and Validation	WBS 5
Rollout	WBS 6
Application and System Maintenance	Production

Contractors will be utilized with other portions of the project on an as required basis.

The designing and building of the ROSS application be broken into modules if mutually agreed upon in advance by both the ROSS Team and the Contractor. Typical modules may include:

Resource Status
Resource Order
Dispatch Notifier
Reports
Map Displays

A pilot program approach will be used to implement the ROSS application and dispatch messaging system for an evaluation/test period, which will be followed by full implementation. The Dispatch Messaging System will be implemented first, followed by the ROSS application.

The pilot sites will be determined just prior to implementation. The system will be implemented in real-time mode at the National Interagency Coordination Center (NICC) and in two adjacent geographic areas. Upon successful completion, the system will be implemented in the remaining geographic areas. This strategy will be utilized for both the Dispatch Messaging System and the ROSS Application.

The Dispatch Messaging System pilot will be implemented by February 1999. Full implementation will occur by July 1999. Timing for ROSS application implementation is estimated for mid to late year 2000.

Training, help desk, documentation, system, and maintenance support provisions shall be available during or just prior to the pilot implementation.

6.1 ROSS Application Build Strategy (Summarized)

The ROSS Application will be built utilizing a mixture of contract and agency personnel as follows:

1. Design, build, and test the Status application as an individual unit, using the related portions of the Business Process, Conceptual Data, Relational and Interface data models.
2. Design, build, and test the Resource Order application as an individual unit, using the related portions of the Business Process, Conceptual Data, Relational and Interface data models.
3. Integrate the Status application and the Resource Order application into a single ROSS application.
4. Test integration to assure all components meet business requirements.
5. Write documentation (technical, administrative and user).
6. Provide training and support services.
7. Implement the pilot program at NICC and in two adjacent geographic areas.

During the pilot program, the ROSS application will be evaluated for performance, functionality, and ease of operation. Changes to the ROSS application will be performed as needed. Upon successful completion of the pilot program, the ROSS application will be implemented in the remaining geographic areas.

6.2 Development Assumptions

For estimating purposes, the following assumptions were made by the ROSS team:

- Programming language(s): Java/HTML, C++/Visual Basic
- Architecture: 2-tier Client-Server via Inter/Intranet
- DBMS: Oracle
- Communications connectivity: Connectivity between physical implementation sites shall be via existing agency networks with access to internet/intranet. Access will also be delivered via dial-up connection utilizing commercial off the shelf software.

- Security: For system integrity and access control, the system and applications must be password protected and have communication fire walls in place. Full system security must be in place. A generic username/password scheme shall be utilized.
- Performance: System throughput, response time, and system reliability must be instantaneous. The system must respond on-demand and the user must not be able to out-type screens.
- Client hardware specifications (minimum):
 - Personal computer with Pentium processor/MMX technology/166MHz
 - Color graphics monitor
 - Mouse
 - High resolution graphics
 - High speed network connection/High speed modem
 - Internet access
 - Internet browser installed
 - Windows 95 installed.
- Server hardware specifications (minimum):
 - To be determined.
- Dispatch Messaging System specifications (minimum):
 1. Compatible with all agency systems (based on internet standards)
 - SMTP-MIME
 - LDAP
 - Fire agencies will be able to access and share the directories of their administrative messaging systems via LDAP as they become available
 - LDAP will used to publish the Dispatcher E-Mail user directory. This directory will include
 - Full Name
 - Naming convention utilizing standard NWCG unit identifiers, as described in NFES 2080
 - Telephone number
 - Fax Number
 - Office Location
 - Associated Agency
 - IMAP4, "on-line", "off-line" and "disconnected" access modes
 - Off-Line and Disconnected modes are required, potentially, for incident base support.

2. Fault tolerance

- Redundant connectivity
- Via standard agency LAN connections to the internet
- Via async to the internet (PPP via any acceptable internet access provider)
- Via modem bank at server location for direct dialup PPP connection to mail server without internet (alternative in case of internet congestion)
- Power protection
- Off-site disaster recovery and backup procedures
- Server hardware and operating system features (RAID5, dual power supply, etc.)

3. System Administration

- Professional 7x24 support
- Round the clock system availability, no down time without advanced scheduling and approval

4. Limited to generic (not personal) role-based names

- Limit server e-mail profiles only to standardized non-personal generic names approved by the NWCG
- Ability to rapidly assign a temporary but unique hierarchical set of generic Incident Command System mail profiles (and sharable filing space) to any connecting incident base (once an NWCG incident base e-mail profile naming standard is established)

5. Electronic data retention

- Automated, configurable, archiving of all messages and attachments, sent and/or received
- Archive sortable by sender, date, subject line

6. Filtering/autoforwarding capability

- Allow user managed autoforwarding of generic profile to agency administrative system profile -- this permits incremental vs global changeover for those offices which want to utilize their administrative e-mail system as long as it serves their need. The primary profile is always on the dispatch messaging server but, if autoforwarded to an agency profile, one can "fall-back" to the dispatch message server transparently by cancelling autoforwarding.

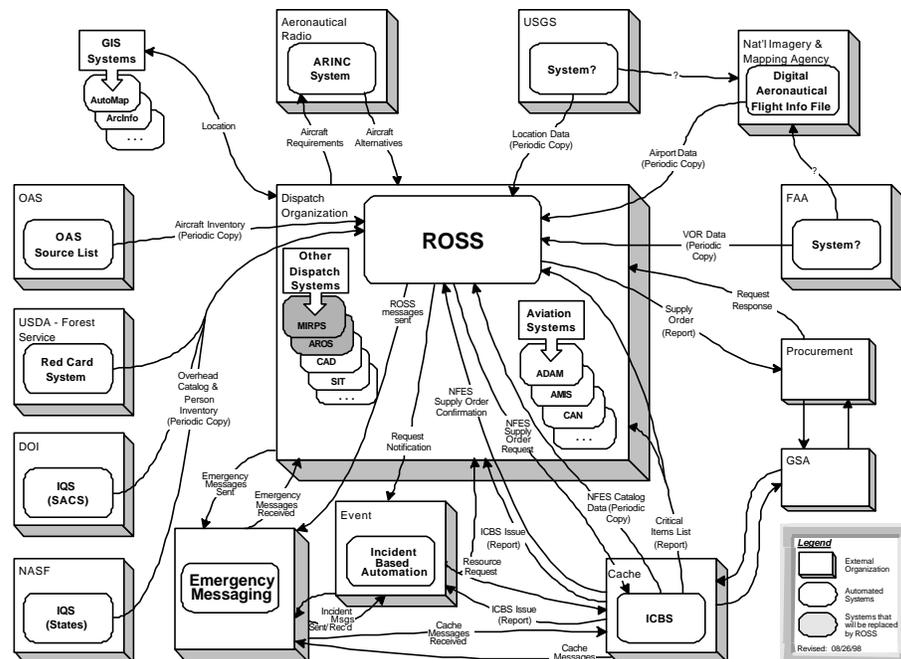
- All e-mail addresses and mailing lists point to generic dispatch messaging profile.
 - Ability to filter abuse/misuse (spamming) from external sources.
- 7. Other System Requirements**
- Proximity to federal "backbone" telecom infrastructure
 - Scale
 - 200-2000 accounts
 - 100-200 concurrent users
 - Responsiveness
 - Close to instantaneous messaging
 - Physically co-located with ROSS when that system is in production if this special messaging environment is still required.
 - High-bandwidth, redundant (multi-vendor) primary telecom connections
 - File attachments of at least 2.5Mb
 - Mail-to-fax (one way) capability
 - Group Mailing Lists
 - Ability for an office to create and manage mailing lists accessible by others
 - Ability for an office to selectively restrict access to its "public" mailing lists
 - Ability to selectively grant privileges for other offices to change or add profiles in mailing lists
- 8. Accommodate Agency Administrative Constraints**
- No direct billing to agency, NWCG /FS pay for total e-mail service
 - Internet access provider service is not included, use agency approved internet connections.
- 9. Security**
- Provide security features oriented toward prevention of system sabotage that could result in information loss, reduced reliability, or reduced performance.
 - Information on this system is not generally sensitive, confidential or a likely candidate for waste, fraud or abuse.
 - Dispatch Messaging System Software specifications (minimum)

- Data access and visibility: The ability to control access to data must allow for the maximum flexibility of rules. Any tier can set these rules, to control the exchange of resources at National, GACC, and local levels by pre-determined planning or preparedness level or administratively determined rules.

6.3 Interfaces

- Data Sharing: Data sharing between ROSS and other applications include data sharing via copy and via real time link. The following chart outlines specific organizations, systems, and data sharing to and from ROSS:

ROSS System Interface Diagram



Summary Table

Organization	System	Data Content	Direction to/from ROSS	Style
OAS	OAS Source List	Aircraft Inventory	Inbound	Periodic Copy
USDA – Forest Service	Red Card System	Overhead Catalog & Person Inventory	Inbound	Periodic Copy
DOI	IQS (SACS)	Overhead Catalog & Person Inventory	Inbound	Periodic Copy
NASF (States)	IQS	Overhead Catalog & Person Inventory	Inbound	Periodic Copy
Cache	ICBS	NFES Catalog	Inbound	Periodic Copy

6.4 Support

- Personnel: To support the technology needed for Ross, units must have Information Systems Team support for hardware and software, already use automated systems, and are trainable in the use of automated systems.
- Administrative: Units must be able to adopt system and business process changes, including the automation of processes.
- Database: System support personnel are available twenty four hours per day, seven days per week.
- Communications: System support personnel are available twenty four hours per day, seven days per week.
- System Support-Applications: System support personnel are available twenty four hours per day, seven days per week.
- Training and User Support: All support services are provided, including a user's guide, computer-based training, on-line help, formal training of users, and a full-time support team.

7. Project Plan

A detailed Work Breakdown Structure has been developed which provides detailed task for each phase of the project.

7.1 Project Phases

Project Initiation and Planning (WBS 0)

In the *Project Initiation and Planning Phase*, the objectives, scope, boundaries, expectations, and plans for the entire project are established. Necessary approvals and funding are obtained.

Business and Technical Requirements Analysis (WBS 1)

In the *Business and Technical Requirements Analysis Phase*, the current business operations and systems are assessed; business and technical requirements are defined, modeled and documented; operational (business and technical) constraints are documented; and system design concepts and standards are determined.

Contract for ROSS Application Design and Build (WBS 2)

Design, Prototype, and Validation (WBS 3)

In the *Design, Prototype, and Validation Phase*: the system/application requirements are translated into technical/application specifications which

include system/application testing requirements; implementation and operations requirements including training and data conversion are determined; the systems architecture is demonstrated; coverage of all product requirements confirmed; fitness of the system is confirmed; implementation constraints including timing impacts due to inter-project dependencies and/or business process evolution are determined; relational data, interface, and transaction models are developed and documented; technical, site, network, training alternatives, and system support and administration requirements are defined; Change management procedures are implemented; screen prototypes are developed based on the data items documented in the Interface Model and the functionality opportunities discovered in the MIRPS application; and deliverable acceptance criteria and contract specifications are determined.

Document, Build, and Test (WBS 4)

During the *Document, Build, and Test Phase* the ROSS application and database are built using the design specifications detailed in the Design, Prototype, Validation Phase. Application components are tested under average and maximum stress conditions using pre-defined scenarios that depict known conditions. System documentation is developed.

Training, Testing, and Validation (WBS 5)

The *Field Training, Testing and Validation Phase* provides training materials and opportunities to all potential users, system and support personnel (with the highest priority being test sites), system installation, and validation. This phase utilizes real-time operations and provides the first real exposure of the ROSS application to field units through the pilot test. System documentation is validated. This phase marks the early stages of Rollout of the ROSS application.

Rollout (WBS 6)

During the *Rollout Phase* sites are prepared and the system is installed. This phase takes the ROSS application to full implementation at all levels approved for installation.

Implement Dispatch Messaging System (WBS 7)

Post Implementation Review and Project Closeout (WBS 8)

Project Management (WBS 9)

7.2 Deliverables

Deliverables for each phase are identified in the Work Breakdown Structure (WBS) document.

7.3 Estimated Cost (in thousands) by Fiscal Year

The following table outlines the estimated lifecycle costs for all phases of the ROSS project.

FY97	Project Planning/Management/Administration	\$ 75
	Business and Technical Requirements Analysis	\$ 146
		\$ 221

FY98	Project Planning/Management/Administration	\$ 150
	Business and Technical Requirements Analysis	250
	Contract Preparation	75
	Design Preparation	135
	Dispatch Messaging System Hardware	255
		\$865

FY99	Project Planning/Management/Administration	\$ 610
	Application / Database Design	500
	Application Prototype / Validation	1000
	Application Build	2500
	Host System Use and Maintenance	250
	Equipment/Telecommunication	150
	Software	20
	Training	250
	Training Materials Development	600
		\$ 6210

FY00	Project Planning/Management/Administration	\$ 505
	Application Build	600
	Application Testing / Validation	800
	Field and Administrative Training	1000
	Help Desk Training and Start-up	500
	Rollout	800
		\$ 5205

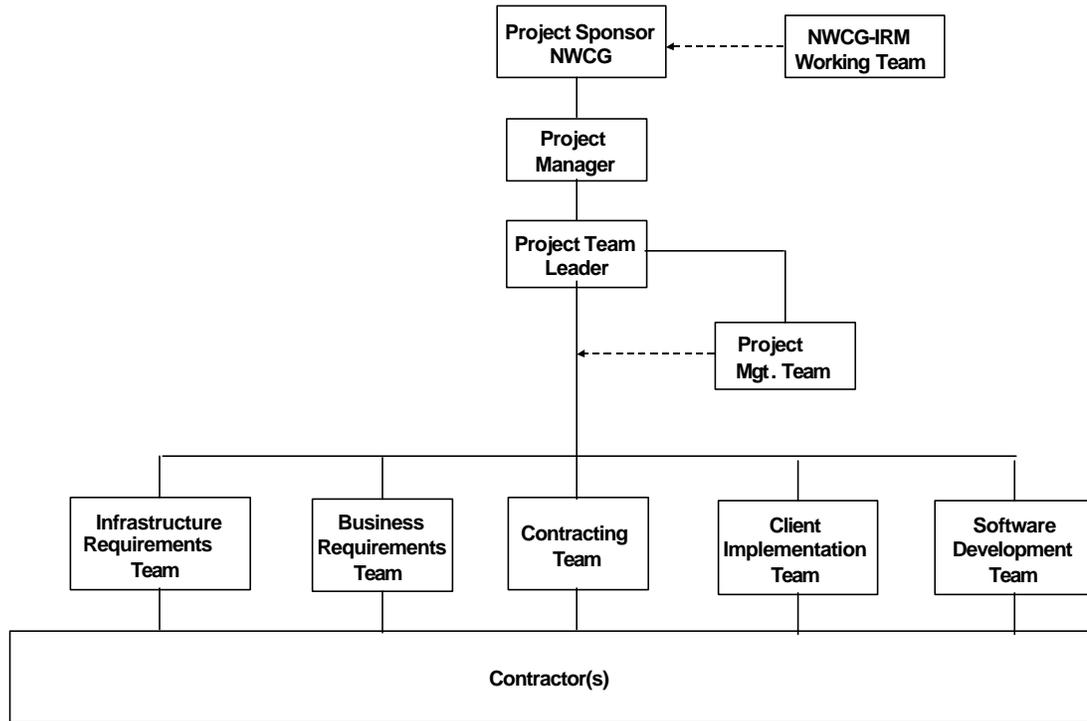
FY01	Project Planning/Management/Administration	\$ 500
	Field and Administrative Training	900
	Rollout	700
	System Maintenance	695
		\$ 2795

FY02	Project Planning/Management/Administration	\$ 250
	Field and Administrative Training	500
	Rollout	400
	System Maintenance	670
		\$ 1820

FY03 through FY10 (per year costs)	Project Planning/Management/Administration	100
	Field and Administrative Training	50
	System Maintenance	545

7.4 Estimated Timeline

8. Project Organization



8.1. Project Sponsor

The National Wildland Fire Coordination Group (NWCG) is the project sponsor, responsible for:

- approving the project charter and work plan
- reviewing and approving modifications to the project work plan
- providing management direction to ensure that the project resources and financing are available and dedicated to the project.

8.2. NWCG IRM Working Team

The representative oversight group is the NWCG Information Resource Management (IRM) Working Team. The NWCG IRM Working Team, responsible for:

- recommending approval of the Project Charter and Work Plan
- coordinating the funding requirements of the project
- providing status reports for the project to NWCG
- making "go/no-go" decisions at the end of each project phase and at milestones defined in the project plan.

8.3. Project Manager

The Project Manager is responsible for:

- providing project status to the project sponsor
- working with the project sponsor for funding and resource support
- identifying and committing the personnel resources
- resolving problems that cannot be resolved within the project team
- briefing cooperators and stakeholders on project status and issues
- resolving business process related issues identified by the ROSS Business Team.

8.4. Project Team Leader

The Project Team Leader is responsible for:

- developing and implementing the project plan
- identifying and committing personnel resources and project financing
- establishing and utilizing project financial tracking system
- providing leadership and/or direction to all phases of the ROSS project
- ensuring that reasonable and prudent project management procedures are executed.

8.5. Project Teams

The Project Team will consist of specialty sub-teams, which carry out a variety of tasks. The team composition is as follows:

8.5.1. Project Management Team

Purpose

The Project Management Team *provides the leadership, resources, and support* necessary to complete the ROSS project. This group is responsible for all actions taken toward completing the work requirements of ROSS.

Scope

The Project Management Team serves as the central control, coordination, and communication group for the ROSS project. It also performs the business management functions of the project, including planning, monitoring and reporting progress, improving project processes, maintaining the project library, and providing administrative support to team members.

The Internal Affairs Communications Advisor will deal with getting the word out to the community so that everyone has the same information. This person is responsible for developing and implementing the ROSS project communications plan. This includes developing briefing and communications products and conducting internal and external briefings with agency officials, users, and internal/external parties.

Composition

The Project Management Team is comprised of ROSS leadership and key project players serving in the following positions:

- Project Team Leader
- Assistant Project Team Leader
- Internal Affairs Communications Advisor
- Project Tracking Specialist (project plans, financial reports, official documents, project communications support)
- Staffing Specialist
- Business Consultant
- Project Consultant
- Business Requirements Team Leader
- Infrastructure Requirements Team Leader
- Client-Implementation Team Leader
- Software Development Oversight Team Leader
- Contracting Team Leader
- NWCG representative.

8.5.2. Business Requirements Team

Purpose

The Business Requirements Team *represents the ROSS business community* and ensures the project, product, and processes implemented are appropriate to serve the business requirements as represented in the ROSS Requirements Statement.

Scope

The Business Requirements Team documents the business data and processing requirements within the scope of the ROSS project. They also serve as an oversight group for the Design and Build efforts to ensure the ROSS application implements the documented business processes correctly.

The Business Team Leader identifies and resolves internal Business Team issues. Issues that cannot be resolved are documented with recommendations and forwarded to the Project Team Leader for resolution.

This team specifies the external design guidelines for software and procedures of the delivered product and process, including *the look and feel* and user interface standards.

Composition

The Business Requirements Team is comprised of the following positions:

- Business Requirements Team Leader
- Business Community Representative (Tier 1)
- Business Community Representative (Tier 2)
- Business Community Representative (Tier 3) - two positions
- Business Community Representative (Tier 4) - two positions
- Integrated Systems Modeling Specialist
- Technical Writer.

8.5.3. Infrastructure Requirements Team

Purpose

The Infrastructure Requirements Team represents the ROSS information technology community and ensures that the project, product, and processes implemented are appropriate to serve the technical requirements as stated in the ROSS Requirements statement.

Scope

The Infrastructure Requirements Team will discover and document the technical requirements of the ROSS application and supporting hardware/networks. The work of this team is focused on defining the technical requirements such as hardware specifications, network load requirements, space and power requirements, needed peripherals, training and support requirements for the ROSS infrastructure, security needs, and average/maximum usage levels and impacts on overall system performance. This team specifies the internal design guidelines for software and infrastructure of the delivered product, which includes security, recovery, and rollback approach guidelines.

Composition

The Infrastructure Requirements Team is comprised of the following positions:

- Infrastructure Team Leader
- Networking Specialist
- Infrastructure Planning Specialist
- Technical Consultant(s)
- System Configuration Specialist.

8.5.4. Contracting Team

Purpose

The Contracting Team *ensures compliance with legal and contracting requirements* and the effectiveness of operating the project with contracted resources.

Scope

The Contracting Team serves as the principal contract administration team. The team prepares and issues all contract documents for all post Business Analysis ROSS contract work.

Composition

The Contracting Team is comprised of the following positions:

- Contracting Team Leader
- Contracting Specialist
- Contracting Officer's Technical Representative (Business Requirements)
- Contracting Officer's Technical Representative (Infrastructure and Software Requirements)

8.5.5. Client-Implementation Team

Purpose

The Client-Implementation Team *ensures the highest chance of acceptance of* ROSS deliverables, including systems, procedures, and processes.

Scope

These services include training and marketing ROSS applications, documenting client requested business process changes, and converting all reference data for the operational aspects of ROSS.

Composition

The Client-Implementation Team is comprised of the following positions:

- Client-Implementation Team Leader
- Communications Specialist - two positions
- Educational Materials Specialist
- Integrated Systems Educator - two positions
- Electronic Graphic Arts Specialist
- Data Conversion Specialist
- Data Rationalization Specialist
- Internet Web Development Specialist
- Videographer
- Systems Trainer - six positions
- Help Desk Support - two positions

8.5.6. Application Development Oversight Team

Purpose

The Application Development Oversight Team *provides direction and ensures the technical effectiveness of the contracted Application Development Team* and its products.

Scope

The Application Development Oversight Team provides all services related to the design, prototyping, building, testing and documentation, (including system administration manuals, user manuals, business process manuals, form development of the ROSS deliverables). The team ensures that application development is completed according to business and technical needs and requirements as represented in the ROSS Requirements Statement.

Composition

The Application Development Oversight Team is comprised of the following positions:

- Software Development Oversight Team Leader
- Application Test Analyst
- Contract Inspector - two positions
- Documentation Review Specialist
- Integrated Component Support Specialist (DBA)
- Networking Specialist
- System Test Analyst.

9. Project Management Process

reporting requirements
review approach
authorization
cost reporting

10. Change Management Process

contract management approach
scope clarification how to's
adjustments to plan
Contracting Plan (not included at this time)
Client-Implementation Plan (not included at this time)
System Test Plan (not included at this time)
Application Test Plan (not included at this time)
Network Infrastructure Plan (not included at this time).

Glossary

A

Analyst Capability. A measurement of the system engineers' capability as a team average. The analysts define the software architecture and produce the preliminary design specifications. This includes requirement identification and decomposition as well as preliminary design of the computer system.

C

Classified Application. A measurement of the extra work required to develop software either in a classified security area or for a classified security application.

Computer Turnaround Time. A measurement of the time spent waiting for the development environment to complete the compilation and for the modified code to be ready for testing. If testing requires that the compiled code be downloaded to a target computer, this download time must be included.

D, E

Database Size. A determination of the effects on the software development due to the size of the database that must be maintained and manipulated.

Execution Time Constraints. A measurement of the approximate percentage of the available CPU execution time that will be used by the software in order to achieve the system's performance objectives.

L, M

Language Experience. A measurement of the design and programming team's experience with the programming language, which will be used to implement the design in the software.

Main Storage Constraints. A measurement of the amount of constraint imposed on the software due to main memory limitations in the target computer.

Modern Programming Practices. A value that quantifies the use of modern programming practices such as structured design, object-oriented design, and formal data design methodologies.

P

Product Complexity. A value that quantifies the complexity of the software product that is to be developed.

Programming Team Capability. A measurement of the capability of the programmers who will actually perform the detailed design and write/test the physical code during the coding and unit testing phases.

Project Application Experience. A measurement of the familiarity of the design and development team with this specific application area.

R

Required Reusability. A measurement of the extra effort needed to generalize software modules when they must be developed specifically for reuse in other software programs.

Required Product Reliability. A value that quantifies the required reliability of the finished software. As the required reliability increases, more time must be spent in the critical design and testing phases.

Requirement Volatility. A measurement of the amount of project design and development rework that results from changes in customer specified requirements. This factor compensates for the extra system engineering and management effort required to evaluate the changes in requirements, estimate the design impacts, prepare the engineering change proposals, and change the software.

S

Software Tools. A measurement of the use of automated software tools such as computer aided software engineering (CASE), an Ada programming support environment, and integrated team development and test environments.

V

Virtual Machine Experience. A measurement of the design and programming team's experience with the virtual machine. the virtual machine includes the actual target physical hardware, operating system, development environment, database management system, and similar environmental tools.

Virtual Machine Volatility. A measurement of the amount of changes that the virtual machine is expected to need during the design and development phases. The virtual machine includes the actual target physical hardware, operating system, development environment, database management system, and similar environmental tools.