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Fiscal Years 1994-1998 Information Technology Strategic Plan

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ABSTRACT

A team of senior managers from across the U.S. Nuclear Regulatory Commission (NRC), working with the Office of Information Resources Management (IRM), has completed an NRC Strategic Information Technology (IT) Plan. The Plan addresses three major areas: (1) IT Program Management, (2) IT Infrastructure, and (3) Information and

Applications Management. Key recommendations call for accelerating the replacement of Agency workstations, implementing a new document management system, applying business process reengineering to selected Agency work processes, and establishing an Information Technology Council to advise the Director of IRM.

CONTENTS

	<i>Page</i>
Abstract	iii
Executive Summary	vii
1 Introduction	1
2 NRC Information Technology Strategic Planning Process	1
3 NRC IT Strategic Plan	3
3.1 IT Program Management	3
3.1.1 IT Planning and Budgeting	4
3.1.2 IT Policy and Standards	5
3.1.3 IT Acquisition Management	6
3.1.4 IT Human Resource Strategy	7
3.1.5 IT Architectures	8
3.2 IT Infrastructure	8
3.2.1 Workstation Replacement	9
3.2.2 Networking and Connectivity	10
3.2.3 Applications Development Platforms	10
3.2.4 High-Performance Computing Infrastructure	11
3.3 IT Information and Applications Management	13
3.3.1 Improving the Quality of NRC Information Systems	13
3.3.2 Agency Processes and Workflow	13
3.3.3 Data and Document Management	15
3.3.4 High-Performance Computing Applications	16
LIST OF ACRONYMS	18
APPENDIX A - Agency IT Management	A1

EXECUTIVE SUMMARY

A team of senior and executive managers from across the Agency, working with the Office of Information Resources Management (IRM), has completed a U.S. Nuclear Regulatory Commission (NRC) Information Technology Strategic Plan. This strategic plan is the basis for the Agency's information technology (IT) program guidance and activities in the NRC Five-Year Plan (FYP) and will be submitted to the Office of Management and Budget to satisfy the IT planning requirements of OMB Circular A-130, "Management of Federal Information Resources."

The Information Technology Strategic Plan addresses three major areas: (1) IT Program Management, (2) IT Infrastructure, and (3) Information and Applications Management. Key recommendations call for accelerating the replacement of Agency workstations, implementing a new document management system, applying business process reengineering (BPR) to selected Agency work processes, and establishing an Information Technology Council to advise the Director of IRM.

The strategy for **IT Program Management** emphasizes the need to expand the role of NRC Headquarters and regional offices in planning and budgeting for information resources to ensure that these resources are effectively deployed to support the Agency's mission. A key element is the establishment of an IT Council that includes senior managers representing the major NRC offices and regions. The Council will assist the Agency's IRM Director in annually updating the IT strategy, establishing agencywide IT policies and standards, prioritizing new applications and major enhancements to existing systems, and performing management reviews of major systems. The IT program management strategy also calls for improving the IT acquisition process, revising current IT policies and standards to emphasize "open" systems, developing architectures for the Agency's information, applications, and technology, and preparing a new IT human resource strategy."

The strategy for **IT Infrastructure** emphasizes significant investment in the underlying hardware, software, and telecommunications technologies needed to create a robust and reliable automation environment capable of supporting the Agency's current and future applications and communication needs. These needs are associated with both administrative and programmatic information systems and with technical computing and scientific modeling applications that support NRC's mission. Although the Agency has been installing microcomputers and has been networking offices through an extended local and wide area network over the past several years, the rapid growth of decentralized local area network (LAN) applications will require more robust and higher capacity networks, more powerful workstations, and more aggressive adoption of new LAN-based systems development platforms to meet the Agency's needs. The new strategy calls for greater investment in workstations and distributed client-server architectures and continuation of the Agency's network upgrade plans to support both technical computing and office systems.

The strategy for **Information and Applications Management** focuses primarily on improving the overall quality and integration of the Agency's information and applications by changing the way that information systems are developed and managed. This strategy includes three major components: (1) strengthening systems life cycle management for all new systems, focusing on major development projects; (2) piloting BPR as a routine part of the systems life cycle process to reevaluate and streamline current processes before they are automated; and (3) implementing a data management program to improve the quality and accessibility of the Agency's information, with a focus on key application areas. By completing these components, the Agency would improve the overall quality of its applications. The strategy also includes the investment of resources in two key application areas: document management and high-performance computing applications.

1 INTRODUCTION

Agency Mission

The U.S. Congress has determined that the safe use of nuclear materials for peaceful purposes is a legitimate and important national goal. It has entrusted the U.S. Nuclear Regulatory Commission (NRC) with the primary Federal responsibility for achieving that goal. NRC's mission is to ensure adequate protection for the public health and safety, the common defense and security, and the environment, in the use of nuclear materials in the United States.

NRC's scope of responsibility includes regulation of commercial nuclear power plants; research, test, and training reactors; fuel cycle facilities; medical, academic, and industrial uses of nuclear materials; and the transport, storage, and disposal of nuclear materials and wastes. NRC carries out its mission by developing, adopting, and enforcing standards and requirements that licensees must meet to design, construct, and operate safe facilities, in the form of rules, license conditions, and regulatory guidance; inspecting facilities and taking enforcement action as necessary to ensure that such standards are followed; and conducting research to support, assess, or refine judgements used in regulatory decisions.

Agency Goals

The NRC Five-Year Plan (FYP) for FY 1994-1998 includes ten agencywide goals that address the regulatory mission and objectives of the Agency. These are listed below in four categories: regulation of nuclear reactors, nuclear regulatory research, regulation of nuclear materials, and effective Agency management.

- Goal 1 Ensure that nuclear power plants and other licensed facilities are operated safely and that licensees are adequately prepared to respond to accidents.
- Goal 2 Ensure that facilities, when no longer in operation, are adequately and safely decommissioned.
- Goal 3 Ensure that nuclear power plants under construction are designed and constructed properly and are ready for safe operation.
- Goal 4 Prepare for future standard reactor design licensing and reactor license renewal activities, including making revisions to regulatory guidance and standard review plans.
- Goal 5 Ensure that research provides the technical bases for timely and sound rulemaking and regu-

latory decisions in support of NRC licensing and inspection activities.

- Goal 6 Ensure that current and future uses and transportation of nuclear and radioactive materials are safe and have adequate safeguards.
- Goal 7 Ensure that high-level and low-level nuclear waste and uranium mill tailings are safely managed and disposed of.
- Goal 8 Continue to maintain special and independent reviews and investigations of NRC activities.
- Goal 9 Allocate NRC's human and capital resources and direct the Agency's affairs so that they contribute most effectively to the mission of protecting the public health and safety.
- Goal 10 Ensure that the NRC has effective external communications and relations with outside organizations, the public, international organizations, and foreign governments.

2 NRC INFORMATION TECHNOLOGY STRATEGIC PLANNING PROCESS

This is the first year that the NRC has addressed the need for a information technology (IT) strategic planning process that involves significant agencywide participation with a focus on long-range direction. During this first year, the NRC established the foundation, emphasizing technology infrastructure and cooperative IT management practices. In future years, the NRC will fully integrate the IT planning process with other Agency planning processes and focus more attention on technology standards, architectures, and major information systems.

Agency Information Technology Strategic Planning

Office of Management and Budget (OMB) Circular A-130 requires Federal agencies to "establish multi-year strategic processes for acquiring and operating information technologies that meet program and mission needs, reflect budget constraints, and form the basis of their budget requests." Until recently, the planning and budgeting for information technologies has been carried out by the NRC's Office of Information Resources Management (IRM) with other offices submitting written responses to an annual request by IRM for planning information.

Recently, the Agency recognized the need to plan for the more distant future and expand the role of other NRC

components in planning and budgeting for IT resources to more effectively support NRC's mission and the goals enumerated in Section 1. The General Services Administration (GSA) endorsed this approach in its recent triennial review of NRC's IRM program. The new IT planning process involves a broad spectrum of participants from across the Agency and covers all NRC major programs involving information technology, both centralized IT programs carried out by IRM and officesponsored IT programs.

Initiating the New Strategic Planning Process

The new strategic planning process was based on the following two fundamental goals:

- To produce a flexible and feasible plan that effectively supports the evolving needs of the NRC and its stakeholders and is appropriately balanced in addressing both technical and administrative needs; and
- To institute an agencywide IT strategic planning process that is designed to support the NRC's mission, integrated with the five-year planning process, and performed by participants representing the spectrum of NRC's information technology needs.

The quality of the IT strategic planning process is critical to building consensus for the selected strategies and commitment for successful implementation. The NRC IT strategic planning process was carried out by two groups of participants representing a broad perspective of Agency interests. Agency executives were represented by a nine-member IRM Review Board. Senior management were represented by a Strategy Team of staff and line managers from both large and small offices and regions. An experienced facilitator led the IRM Review Board and the Strategy Team through the strategic planning process which the NRC had also successfully used to prepare the first NRC FYP.

The IT strategy was developed in a five-step process:

- (1) assess the current situation and develop IT challenges
- (2) develop alternatives to meet IT challenges
- (3) evaluate the costs and benefits of alternatives
- (4) decide among the alternatives

- (5) prepare implementation plans

Initially, senior executives were asked to give overall guidelines and direction for the process. A series of IT challenges were clarified and used throughout the process for focus and vision. At each step, the Information Resources Management Review Board gave the Strategy Team guidance to ensure that senior executives' concerns and views were addressed. This approach, involving a broad spectrum of participants, with review by senior executives at each step, has resulted in a strategy that is fully supported by the NRC offices, regions, and senior executives.

The Future Strategic Planning Process

One of the fundamental goals of the strategic planning initiative was to institute an agencywide IT strategic planning process and integrate it with the Agency five-year planning process. To accomplish this goal, the Agency must annually revise the plan and incorporate the results of the planning process into the Agency's program guidance approved by the Commission as the basis for planned accomplishments and resources in the NRC FYP.

In the future, the IT strategic planning process will be carried out by a permanent IT Council composed of senior managers from the major NRC Headquarters and regional offices.

The Council will help to annually update the IT Strategic Plan for IRM and the other NRC offices to use in revising their program guidance for the FYP. Both the IT Strategic Plan and the resulting revised guidance will be submitted to the Agency's Steering Committee for Strategic Planning, the Executive Director for Operations, and the Commission for review as part of the Agency's five-year planning process.

Relationship of the IT Strategic Plan to Other Documents

This document describes the NRC IT challenges, long-range strategic directions, and the strategic initiatives which will be undertaken to meet the challenges. This "strategic" document is the basis for many of the IT goals, objectives, assumptions, and program guidance in the NRC FYP. A separate "tactical" document contains the implementation plans which describe the tactical, scheduling, and fiscal estimates for implementing the strategic initiatives. This "tactical" document describes the basis for major IT planned accomplishments and associated resources in the NRC FYP.

Figure 1 Information Technology Council

3 NRC IT STRATEGIC PLAN

The goal of the strategic plan is to improve the effectiveness of the NRC in meeting its program and mission needs by successfully acquiring and deploying information technologies. This includes specific information systems and the infrastructure and IT program management activities needed to support those applications.

The strategic plan describes the challenges, the current environment, and strategies in three major strategic areas: (1) IT program management, (2) IT infrastructure, and (3) information and applications management. In this first year of the new planning process, key recommendations include major initiatives for accelerating the Agency's workstation replacement strategy, implementing a new document management system, applying business process reengineering (BPR) to selected work processes for the Agency, and establishing an IT Council to advise the Director of IRM. In future planning years, initiatives will be more aligned with specific program and mission needs of the NRC, addressing technology standards and architectures and integrating major information systems.

3.1 IT Program Management

The strategy for IT Program Management emphasizes the need to expand the role of NRC Headquarters and regional offices in planning and budgeting for information resources to ensure that these resources are effectively deployed to support the Agency's mission. A key element is the establishment of an IT Council that includes senior managers representing the major NRC offices and regions. The Council will assist the Agency's IRM Director in annually updating the IT strategy, establishing agency-wide IT policies and standards, prioritizing new applications and major enhancements to existing systems, and performing management reviews of major systems. The IT program management strategy also calls for improving the IT acquisition process, revising current IT policies and standards to emphasize "open" systems, developing architectures for the Agency's information, applications, and technology, and preparing a new IT human resource strategy."

Table 1 summarizes the program elements, challenges, and strategic initiatives for IT program management. The program elements for IT program management are IT planning and budgeting, IT policy and standards, IT acquisition management, IT human resource strategy, and IT architecture.

Table 1 IT Program Management

PROGRAM ELEMENTS	CHALLENGES	STRATEGIC INITIATIVES
IT Planning and Budgeting	Institute an annual IT planning and budgeting process that is designed to support the NRC mission, focuses on IT throughout the Agency, increases customer (office and region) participation and accountability, enhances the ability of senior executives to make IT decisions, and is integrated with the Agency's five-year planning process.	<ul style="list-style-type: none"> • Create an Information Technology Council • Expand the role of NRC Headquarters and regional offices in planning and budgeting for IT resources
IT Policy and Standards	Develop clear IRM policies and standards, with client participation, that support the Agency's IT strategy and maintain a balance between the benefits of standardization and the need for flexibility.	<ul style="list-style-type: none"> • Assess status of Agency IT policies and standards • Update/develop new IT policies and standards
IT Acquisition Management	Develop an IT acquisition strategy to provide quality IRM products and services in a timely manner, and to accommodate rapid changes in technology.	<ul style="list-style-type: none"> • Develop strategic and tactical IT acquisition plans • Reevaluate and document FIP acquisition processes, policies and procedures
IT Human Resource Strategy	Develop a new human resource strategy to (1) increase the proficiency of the NRC staff with information systems and encourage effective use of electronic systems and media, and (2) develop and maintain a highly competent and motivated Agency IRM staff, organized to effectively support customers and conduct the IRM program.	<ul style="list-style-type: none"> • Develop IT proficiency standards for all employees • Perform an IRM skills assessment and implement an IRM employee development program • Realign IRM work activities
IT Architecture	Define information and technology architectures to guide the planning and implementation of technology for both infrastructure and applications.	<ul style="list-style-type: none"> • Plan the update/development of information, applications, and technology architectures

3.1.1 IT Planning and Budgeting

The Challenge/Vision

Institute an annual IT planning and budgeting process that is designed to support the NRC mission, focuses on IT throughout the Agency, increases customer (office and region) participation and accountability, enhances the ability of senior executives to make IT decisions, and is integrated with the Agency's five-year planning process.

Description of the Current Environment

In the past, the IT long-range planning and budgeting process was conducted principally by IRM, with informa-

tion from NRC Headquarters and regional offices supplied in their responses to an annual request by IRM for planning information. The planning process emphasized the needs of individual offices and gave the offices little opportunity for communication and coordination to achieve effective agencywide solutions. The information requested by IRM was closely associated with the Agency's budgeting process, which resulted in short-term requirements rather than long-term strategic direction. Most of the Agency's IT activities were prioritized, budgeted and defended by IRM, with little participation by the offices. This made it difficult for the offices to defend their IT needs in the budget process and was not always effective or equitable in allocating resources to the most important IT projects.

Strategy for IT Planning and Budgeting

The new strategy for IT planning and budgeting proposes to expand the participation of Headquarters and regional offices to achieve more effective agencywide solutions and to allocate resources to the projects with the greatest benefits to the Agency. The new strategy will encourage agencywide communication, priority-setting, and shared perspective.

The IT Council, chaired by a customer office representative, will be vitally important for instituting the new approach to IT planning and budgeting throughout the Agency. The goals of the Council are:

- Shape the development of NRC's IT strategies
- Maintain agencywide support for and adherence to IT policies, standards and guidelines
- Optimize the allocation of IT resources agencywide
- Improve IT decisionmaking
- Improve communication and coordination among Headquarters and regional offices concerning IT issues

The Council will give the Director, IRM, advice and assistance in:

- Annually reviewing and recommending changes to the Agency's IT strategies for incorporation in the NRC FYP and the IT Strategic Plan
- Establishing a framework of IT policies, standards, and guidelines
- Reviewing proposed new IT applications and major modifications, and recommending priorities as part of the budget process
- Reviewing significant IT application projects before beginning key project phases

The new planning and budgeting strategy transfers from IRM to the large offices and regions the responsibility for defending and budgeting new sponsored applications, special workstation equipment and software, and data entry. IRM will continue to budget for smaller offices and most of the IT resources, including all infrastructure and agencywide applications. The Agency will consolidate the descriptions of all IT activities into an agencywide IT technology plan.

3.1.2 IT Policy and Standards

The Challenge/Vision

Develop clear IRM policies and standards, with client participation, that support the Agency's IT strategy and maintain a balance between the benefits of standardization and the need for flexibility.

Description of the Current Environment

The current framework of Agency IT strategies, policies, and standards is out-of-date for planning or managing programs within the Agency. For example, existing policies and standards do not reflect changes in the IRM organization, current organizational placement of the designated senior official (DSO) for information resources management, changes in technologies, or the move to open systems. Limited policies and standards result in high maintenance and support costs, difficulty in sharing information, and duplicative data and applications. An up-to-date framework is important for establishing a consistent, integrated IT environment throughout the Agency.

The process for updating the IT framework also needs modification. In the past, strategies, policies and standards were often developed by IRM. Other NRC components were not involved until late in the process, when they were asked to comment on near final products.

Strategy for IT Policy and Standards

IRM, in collaboration with Headquarters and regional offices, will develop and institute an updated framework of Agency IT strategies, policies, and standards. The IT Council and Senior Information Resource Management Officials (SIRMOs) representing the major Headquarters and Regional offices will be involved throughout the process to assist in developing and implementing clear practices, policies and standards that satisfy user office needs.

IT policies will be updated to establish roles and responsibilities for planning and budgeting, acquiring Federal Information Processing (FIP) resources, reviewing and implementing major information systems, and managing documents and data as Agency resources.

IT standards will be updated to implement open systems and life cycle management and to support the management of documents and data as Agency resources consistent with user office needs.

3.1.3 IT Acquisition Management

The Challenge/Vision

Develop an IT acquisition management strategy to provide quality IRM products and services in a timely manner, and to accommodate rapid changes in technology.

Description of the Current Environment

IRM relies to a great extent on contractors to perform its basic functions and deliver services to its customers. Performance in acquiring information technology and services and in managing IRM contracts affects the ability of the Agency to successfully execute its information resources management program. Areas that could be improved are FIP acquisition planning; acquisition processes, policies, and standards; and staffing.

Acquisition Planning

IRM has many small contracts that may cover similar aspects of certain work processes or work areas (for example, six separate contracts support the local area network (LAN) and microcomputer environment). This results in complex and costly contract management by NRC staff. More attention to planning acquisition strategies ahead of time could consolidate individual acquisition requests into larger contracts with broader scopes of work, where appropriate.

Acquisition Process, Policies, and Standards

The IT contracting function requires many FTEs, includes numerous steps and procedures, and requires effective cross-functional efforts by NRC acquisition specialists, lawyers, and internal customers. Although many of the contracting procedures are determined by external rules and regulations such as the Federal Acquisition Regulation (FAR) and Federal Information Resource Management Regulation (FIRMR), there may be ways to increase flexibility in the implementation of these requirements.

An effective acquisition process would generally include clearly defined roles and responsibilities for all participants, collegial relationships among participants who work as a team to achieve a common objective, incentives and accountability for completing the acquisition process in an efficient and timely manner and for getting the best value for the Agency, clear and consistent acquisition procedures, and early consideration of whether the FTE time spent in procurement effort and risk management (steps taken to avoid protests) are commensurate with the size of the procurement.

The current IT acquisition process does not always include the above characteristics and the complex information resources acquisitions often take longer than expected for a variety of reasons. The lengthy acquisition process and the rapidly changing technology have at times resulted in the purchase of equipment that was nearly obsolete by the time the procurement was completed. Acquisition procedures are not always well understood and acquisition documents are sometimes inadequate or incomplete. Although much effort is expended on acquisitions, this effort is not always perceived as effective or appropriate for the cost of the goods or services being acquired.

Although the Office of Administration (ADM) has recently updated the NRC Acquisition Regulation, which covers the Agency's general acquisition policies, more specific NRC policies and guidance are needed to address FIP acquisitions. IRM is working with ADM to develop FIP-specific acquisition policies.

In its recent review of IRM, GSA noted that "careful attention should be paid to the definition of roles and responsibilities, in IRM and ADM, to DPA [Delegation of Procurement Authority] tracking responsibilities, and to establishing guidance on entering into and approving interagency agreements."

Staffing

The balance between NRC and contractor staff in performing technical work is weighted toward contractors, which raises concerns about maintaining an adequate level of NRC expertise and talent. The following are problems that have been identified: (1) too much technical FIP work is being contracted, (2) insufficient use of computing skills is affecting the ability of NRC computer professionals to stay technologically current, and (3) insufficient direct technical involvement by NRC computer professionals is affecting their ability to adequately manage contractors performing technical work.

In reviewing IRM, GSA also noted this problem with balancing NRC and contractor staff:

"[the] IRM program at NRC is heavily dependent on contract support. At the end of fiscal year 1992, IRM was using 33 contracts with 275 contractor employees and had 137 full time employees. The ratio of contractors to staff is even greater in one IRM Division, where there are as many as seven contractors for every NRC employee."

Strategy for IT Acquisition Management

A new IT acquisition management strategy is critical to implementing other strategic initiatives defined in this

document. For the Agency to update its technology and equipment, it must process acquisition requests in a timely and effective manner. The following sections describe the proposed improvements in the planning, process, policies, standards, and staffing for acquisitions.

Acquisition Planning

The NRC will develop both strategic and tactical IT acquisition plans to consolidate and reduce the number of procurement actions and to save administrative time and costs, while improving the quality of acquisitions. The NRC will establish agencywide contracts for IT architectural and infrastructure components described elsewhere in this document such as the workstation replacement effort. The NRC will examine other means of acquisition, including the GSA Government-wide Agency Contracts program.

Acquisition Process, Policies and Standards

The NRC will improve the FIP acquisition management process by increasing management attention and staff resources. IRM and ADM have each hired a senior IT acquisition specialist with expertise in FIP acquisitions. The NRC is beginning to define and document NRC FIP acquisition procedures, policies, and guidance, including DPA tracking responsibilities, and oversight of interagency agreements.

The Agency will use BPR to analyze and improve a selected area of acquisition procedures, processing practices, and the use of automation. (See Section 3.3.2 on BPR pilot projects). This acquisition strategy may be expanded to include other areas of the FIP acquisition life cycle process and resolve other recurring procedural problems.

In implementing the Agency's standards in FIP acquisitions, all Agency project managers will be required to attend training and obtain certification in FIP acquisition. A substantial investment has already been made in preparing a comprehensive course in "FIP acquisitions for Project Officers" which will be mandatory for certification as an IRM project officer.

Staffing

IRM is analyzing the skills of its staff to address the concerns of balance between contractors and NRC expertise. IRM will make adjustments as needed to its organization and plans for contracting systems work. Better acquisition planning and consolidated contracts can also make contract management more efficient.

3.1.4 IT Human Resource Strategy

The Challenge/Vision

Develop a new human resource strategy to (1) increase proficiency of the NRC staff with information systems and encourage effective use of electronic systems and media, and (2) develop and maintain a highly competent and motivated Agency IRM staff, organized to effectively support customers and conduct the IRM program.

Description of the Current Environment

Only a few years ago, the Agency's original microcomputers were viewed as little more than "glorified" typewriters. Today powerful microcomputers, plentiful software options, improved technology, and improved computer literacy skills have significantly changed the way we perform our work. This change has also raised the level of IT literacy expected of most Federal employees. The NRC now has the capability to reduce its paper laden processes by using computers to transmit information electronically. With the completion of the Agency Upgrade of Technology for Office Systems (AUTOS) project during fiscal year 1993, almost all NRC staff will have access to workstations and basic office automation functions. In the near future, many office functions, currently accomplished by telephone or through the mail with paper distribution, will be performed in the LAN environment. It will soon be essential for all NRC employees to possess at least a minimum level of proficiency in using IT capabilities such as electronic mail (e-mail) and word processing. Many NRC staff will also require IT competencies in such software applications as spreadsheets, graphics, and information retrieval.

NRC's Information Technology Services Training Lab and Individual Learning Center give all NRC employees opportunities for hands-on classroom instruction and individual study in the use of NRC's IT capabilities. Information on training courses and prerequisites are routinely distributed to all staff. For the most part, employees in Headquarters and the regions can obtain the instruction they need to use the NRC's IT resources.

Although most employees believe that the NRC offers excellent IT training opportunities, the IT Strategy Team recommended further steps to bring about the cultural changes needed for the Agency to effectively use the technology. Particular attention is needed to address requirements of senior managers who have little time for formal training and who frequently have the least experience with computer technologies.

Strategy for Human Resources

IT Proficiency of Agency staff

To begin improving overall IT proficiency at the Agency, the NRC will assess the cultural problems and needs associated with the increasing use of technology. The NRC will establish basic competency goals for clerical, professional, supervisory, and executive positions. To meet these assessed needs and competency goals, the Agency will establish necessary training and development programs to assist employees in achieving the target competency levels and effectively using technology.

IT Proficiency of IRM Staff

IRM recognizes the importance of maintaining the technical proficiency of its staff. IRM recently assessed the skills of IRM staff to determine both strengths and weaknesses. IRM will use the results of this assessment in conducting initiatives to better use existing skills and develop or acquire those skills needed to more effectively perform the IRM program.

3.1.5 IT Architectures

The Challenge/Vision

Define information and technology architectures to guide the planning and implementation of technology for both infrastructure and applications.

Description of the Current Environment

NRC information technology systems have been developed over time in a mixture of technologies and architectures. Most of NRC's major agencywide systems were developed as separate applications running in a time-shared mainframe environment with remote access. These applications were developed using a variety of often incompatible languages and database management systems. As distributed minicomputer systems became cost-effective, the Agency developed its payroll, personnel, property, and financial systems in local minicomputer environments. In the mid 1980s, the Agency developed a data architecture and began implementing an integrated "corporate" database, primarily supporting reactor applications. Recently, with the advent of powerful microcomputers, some Agency users developed office systems on stand-alone or LAN-connected microcomputers. While the ease-of-use and flexibility of microcomputer applications have provided many benefits to NRC users, it has also caused problems with application and data integration. Many of the problems occurred because the NRC has not yet prepared architectures for information, applications, and technology which would give the staff a consistent environment for implementing individual microcomputer applications.

Although a data architecture was used in developing some of the Agency's reactor-related applications, the Agency has not made a consistent, sustained effort to define its data, applications, and supporting technology architectures. Guidelines and policies to encourage adherence by offices to such architectures have never been defined. The growth of distributed LAN-based systems emphasizes the need for a coherent, complete architectural model that will foster the ability to share and effectively use information.

GSA noted that:

NRC has begun initiatives that could be coordinated into an architectural strategy addressing long-term needs... [W]ithout coordinating individual modernization efforts and directing them toward a strategic IRM plan, NRC risks a severe cost impact. A coordinated approach to modernization can help avoid potential redundancies, establish Agencywide standards, enhance identification of emerging technologies, and reduce costs.

Strategy for IT Architectures

IRM will work jointly with the Headquarters and regional offices to develop and institute Agency information, application, and technology architectures to define the context and standards for future applications and to assure that user office applications needs are met.

3.2 IT Infrastructure

The strategy for **IT Infrastructure** emphasizes significant investment in the hardware, software, and telecommunications technologies needed to create a robust and reliable automation environment to support the Agency's current and future applications and communication needs. These needs are associated with both administrative and programmatic information systems and technical computing and scientific modeling applications that support NRC's mission. Although the Agency has been installing microcomputers and has been networking offices through an extended local and wide area network over the past several years, the rapid growth of decentralized LAN applications will require more robust and higher capacity networks, more powerful workstations, and more aggressive adoption of new LAN-based systems development platforms to meet the Agency's needs. The new strategy calls for greater investment in workstations and distributed clientserver architectures, and continuation of the Agency's network upgrade plans to support both technical computing and office systems.

Table 2 summarizes the program elements, challenges, and strategic initiatives for IT Infrastructure. The pro-

gram elements for IT Infrastructure are: workstation replacement, networking and connectivity, applications development platforms, and high-performance computing infrastructure.

The Challenge/Vision

Ensure that NRC's technology infrastructure is robust, reliable, and capable of supporting current and future applications needs.

3.2.1 Workstation Replacement

Description of the Current Environment

In FY 1993, NRC will complete an agencywide program to supply Headquarters and regional offices with microcomputers attached to standardized LANs and to provide agencywide communications capabilities among the LANs. Although the original objective was to replace the agency's aging word processing systems, the Agency later expanded the plan to give most clerical, professional and

managerial staff microcomputers connected to LANs capable of supporting standard office automation functions. As the staff became familiar with microcomputer technology and the varieties of available software increased, the staff identified many new applications and productivity tools that could be used to improve the efficiency and effectiveness of the Agency's programs. Many of the Agency's original workstations could not support newer application requirements and could not be maintained cost effectively. Demand for replacement of technologically obsolete machines was growing before the Agency met its initial goal of providing workstations to all employees who needed them. The NRC recognized that the existing workstation strategy and level of investment in replacement workstations were insufficient to support growing application needs.

Strategy for Workstation Replacement

The new long-term workstation strategy emphasizes an accelerated investment in office automation workstations to avoid the costs of operating and maintaining old

Table 2 IT Infrastructure

PROGRAM ELEMENTS	CHALLENGES	STRATEGIC INITIATIVES
Workstation Replacement	Ensure that NRC's technology infrastructure is robust, reliable, and capable of supporting current and future applications needs.	<ul style="list-style-type: none"> • Adopt a new workstation replacement strategy
Networking and Connectivity		<ul style="list-style-type: none"> • Continue with plans to implement a single multi-function wide area network • Continue with plans to implement a network management center
Applications Development Platforms		<ul style="list-style-type: none"> • Move aggressively to implement client-server technology for new systems
High-performance Computing Infrastructure		<ul style="list-style-type: none"> • Continue emphasis on improved connectivity, increased training and technical assistance, acquisition of engineering workstations, and program office coordination through the Technology Advancement Board

equipment and to provide workstations capable of running current and future applications. The strategy is to (1) replace NRC's office automation workstations to meet high standards for functionality, reliability, performance, and interoperability by maintaining a workstation inventory that, on average, lags current technology by one generation; (2) meet this standard within 2 years; (3) after achieving this standard, maintain it by replacing approximately one fifth of NRC's workstations each year with new technology.

The NRC will establish standards and policies to acquire, install, maintain, and replace workstations as appropriate. Finally, NRC will implement a configuration management and inventory control project to efficiently manage the use, maintenance, and timely replacement of workstations, and the disposal of obsolete equipment.

3.2.2 Networking and Connectivity

Description of the Current Environment

NRC has three separate data communications networks—a LAN-to-LAN communications network, a network for printing from the National Institutes of Health (NIH), and a network providing access to various computer facilities—in addition to special purpose connections. NRC staff must also understand a variety of communications software and often cumbersome procedures for connecting to various applications or data sources. These procedures are unique for specific types of computers, hardware, and software being used, with, for example, one procedure to access the Nuclear Document System (NU-DOCS), another to access event data, and a third to enter inspection plans.

This multiplicity of data circuits and communication protocols results in complexity for customers and the telecommunications staff and difficulties in integrating information from different applications. IRM would like to simplify this environment so that a customer would simply select an application or data source from a workstation menu, without needing to know the specifics of an application's location, hardware, or software platform. This simplification would ultimately extend to the use of a single communication protocol for most NRC applications. An important step in moving towards this desired environment is to implement one multi-function network to replace the three existing data communications networks. This step is an important one in moving towards a single, vendor-independent (open) communications protocol for all NRC applications.

Strategy for Networking and Connectivity

IRM will extend NRC networks to accommodate the connection of all NRC computer resources to a single NRC communications network. This network will support an open systems architecture to enable connectivity and high-speed information transfers among diverse workstations, NRC-owned minicomputers, regional and resident sites, outside locations such as the Southwest Research Institute, the U.S. Department of Energy laboratories, national and international public networks such as Internet, and timesharing facilities. The network must function reliably and must be implemented in a cost-effective manner that provides adequate speed and capacity as traffic increases, but does not provide the capacity before it is needed.

As the NRC increasingly depends on the network for its critical functions, more sophisticated network-monitoring and configuration management methods will be needed to adequately monitor, maintain, and support the NRC computer and network environment. The NRC will establish a network management center to manage the operation and configuration of the network.

3.2.3 Applications Development Platforms

Description of the Current Environment

Applications within NRC have been implemented across a variety of development platforms that include timesharing services on NIH IBM mainframes, internal IBM and Data General minicomputers, standalone microcomputers, and LAN servers. Over time it has become increasingly ineffective and costly for the Agency to develop and maintain applications over this wide range of platforms. Even more importantly, access to information is hindered by incompatibilities between the proprietary products of various vendors.

Other businesses and agencies have similar problems with the cost and support for their older systems. The computer industry is addressing this problem by developing "clientserver" application architectures which can interconnect diverse systems across platforms. These client-server architectures have the following additional advantages: (1) user-friendly interfaces, allowing the user to operate the "client" part of the application on an intelligent microcomputer workstation, and (2) scalability, since the server part of the application, which stores the data and does most of the processing, can be a microcomputer, minicomputer, or mainframe, as necessary.

Strategy for Applications Development Platforms

NRC's strategy is to move aggressively to implement client-server technology for new systems. Required tasks

will include training IRM staff in the new technology, planning and implementing operational support for the new platform, establishing necessary development contracts, establishing policies and standards, and using client-server technology for pilot applications.

As a first step, IRM is developing a pilot application for the Office of Personnel using client-server technology to enable NRC staff to perform onsite computing using the data from mainframe, minicomputer, and microcomputer systems. The goal is to replace these various platforms with a high-performance desktop computer connected to the LAN and wide area network (WAN). NRC will pilot and evaluate other applications in the LAN environment using client-server technologies. The results of these pilots will be assessed jointly by IRM and client offices and integrated with the policy, standards, and architecture activities.

Other elements of NRC's strategy for its development platforms are to reduce the costs and improve the effectiveness of applications by (1) moving applications from the NIH timesharing platform, (2) pursuing cross-servicing or acquiring common applications, such as those supporting administrative, financial, personnel, payroll functions, and (3) establishing standards for application platforms based on newer technologies supporting an "open systems" approach.

3.2.4 High-Performance Computing Infrastructure

Advances in high-performance computing are bringing scientific computing and analytical modelling to the desktop. Existing codes are being moved from large mainframe environments to less expensive and more accessible engineering workstations. Scientific user communities are dynamically exchanging codes and data using electronic interfaces. The NRC has been responding to these changes by planning and implementing the infrastructure needed to support the staff in making the most effective use of the new high-performance computing technologies for licensing and regulatory applications.

The main elements of the infrastructure strategy for high-performance computing are interoffice coordination, high-performance workstations, networking and connectivity, network security, and high-performance computing support services. See Section 3.3.4, "High-performance Computing Applications" for a description of planned applications.

Description of the Current Environment

Interoffice Coordination

A Technology Advancement Board (TAB) has been established to coordinate interoffice needs for advanced computing and to assist the Office of IRM and major program offices in identifying and transferring applicable information technologies to projects related to the agency's safety mission. TAB activities will also address the use of new technologies to facilitate the sharing and exchange of information with licensees, the nuclear industry, the States, Federal agencies, and the public.

High-Performance Workstations and Associated Computing Resources

To meet Agency high-performance computing needs, the NRC is using the National Aeronautics and Space Administration (NASA) Governmentwide Agency Contract to acquire a variety of RISC (reduced instruction set computation) workstations, all of which can run in the UNIX environment. UNIX is the *de facto* standard non-proprietary ("open") operating system that has been adopted for NRC's high-performance networks. The agreement with NASA also provides the NRC with related software, hardware, networking equipment and maintenance. By the end of the year, the high-performance workstations available to the technical staff will have doubled, reaching an inventory of over fifty RISC units.

Networking and Connectivity

To meet needs for sharing and communication among high-performance computing users, the NRC has developed an initial high-performance computing systems architecture. The basic concept is that most RISC stations will be networked to enable resource sharing within each of the program offices. To date, UNIX networks have been established in NRC's Office of Nuclear Reactor Regulation (NRR), Office for Analysis and Evaluation of Operational Data (AEOD) and Office of Nuclear Material Safety and Safeguards (NMSS). For example, a high-performance UNIX-based network server has been installed in NMSS Division of High-Level Waste Management (DHLWM) to support high-level waste repository licensing and will soon be linked to other RISC stations, a graphics station and standard microcomputers.

The local program office high-performance networks are, in turn, being integrated into the NRC WAN. The NRC WAN will have fully integrated e-mail and directory services. This will allow high-performance computing users to have e-mail and document transfer capability with all NRC staff, the Center for Nuclear Waste Regulatory Analyses (CNWRA), certain U.S. Department of Energy (DOE) laboratories, and with outside users over the public Internet network.

NRC is standardizing on the Transmissions Control Protocol/Internet Protocol (TCP/IP) for LAN/WAN communications among high-performance UNIX workstations, NRC minicomputers, the NIH mainframes, and Internet. Initial implementation of TCP/IP has begun and will continue through next year. Adopting the TCP/IP protocol will simplify and reduce the number of communications procedures that a user must know to access different computing facilities, and will make it possible for NRC staff to access Internet directly from the NRC LANs.

The program offices with high-performance networks have requested two features available on Internet: file transfer protocol (FTP) and remote interactive access (TELNET). FTP provides the capability to transmit high volumes of data and TELNET allows outside users, such as DOE laboratory staff, to interactively access NRC high-performance computers to diagnose problems, install code, configure files, and provide other technical assistance. While only implemented on a limited basis, the FTP has already proved a valuable resource for the technical staff. NRR employed the FTP features to receive and configure the RELAP5 facility decks for the Westinghouse AP600 advanced design and the SPES test facility directly from the Idaho National Engineering Laboratory. The NRC Technical Training Center used the interactive capabilities to work with the graphical interface package, PICASSO, with experts from the European community on the Halden Reactor Project.

The use of the Internet TELNET feature, which allows outside users to access NRC machines, has required NRC to enhance the security architecture of its networks. A "fire wall" approach using special network configurations, software, and hardware will protect the NRC networks by monitoring, checking, and controlling outside access. NRC plans to implement the new security features by the end of the fiscal year.

In addition to the use of Internet for large volume data transfers, NRC has installed a direct line for such transfers between DHLWM high-performance workstations and the CNWRA computer facility in San Antonio, Texas and the CNWRA Washington Technical Support Office in Arlington, Virginia. The large volume file transfer techniques used by DHLWM will be expanded to other Agency high-performance computing projects as needed.

High-Performance Computing Support Services

A technical assistance program has been established to support the high-performance computing environment. This program combines in-house training and technical exchanges with industry to encourage and accelerate the

development and implementation of highperformance computing within NRC. Two DOE Laboratories that currently support NRC have been tasked to review and integrate requirements and provide assistance to bring advanced computing resources in-house. Current tasks include an assessment of NRR highperformance computing requirements to support the licensing of advanced design reactors and an overall assessment of program office networking needs.

IRM staff have been trained in the UNIX/RISC technologies to install software, administer networks, and provide onsite customer support to the program offices. This staff expertise is currently augmented with contractor support for hardware and software installation and maintenance.

Technical exchanges with industry, vendors and other government agencies have also enhanced the program. For example, NRC staff have met with experts from the Electric Power Research Institute (EPRI), Construction Systems Association, and The Georgia Institute of Technology. Access to EPRIInet has been established and the staff reviewed the EPRI management information system requirements for the advanced design reactors. NRC staff have seen the Westinghouse computerized information management system for the AP600 project, have scheduled a demonstration of the Duke Power Computer Aided Design/Computer Aided Manufacturing system, and also plan to meet with General Electric (GE) to review the computing resources used by GE to implement the management information system for their simplified boiling water reactor (SBWR) design.

Strategy for Technical Computing Infrastructure

NRC will continue to develop in-house technical knowledge and skills for high-performance computing through training and technical exchanges with industry and vendors. IRM will continue to place a high priority on TAB member requirements for future licensing and regulatory activity in the program offices. Connectivity and accessibility will be enhanced to take advantage of and share resources among high-performance networks. With the implementation of the security fire wall and TCP/IP protocols, users will have faster, more flexible access to one another other and well as to Internet and other external networks.

In a related area, NRC has established office guidance to monitor the development of the National Education and Research Network, established by the High-performance Computing Act of 1991, and will evaluate the utility of the network to the NRC when it is available.

3.3 IT Information and Applications Management

The strategy for Information and Applications Management focuses primarily on improving the overall quality and integration of the Agency's information and applications by changing the way that information systems are developed and managed. This strategy includes three major components: (1) strengthening systems life cycle management for all new systems, focusing on major development projects; (2) piloting BPR as a routine part of the systems life cycle process to reevaluate and streamline current processes before they are automated; and (3) implementing a data management program to improve the quality and accessibility of the Agency's information, with a focus on key application areas. By completing these components, the Agency would improve the overall quality of its applications. The strategy also includes the investment of resources in two key application areas: document management and highperformance computing applications.

Table 3 summarizes the program elements, challenges, and strategic initiatives for IT Information and Applications Management. The program elements for Information and Applications Management are: improving the quality of NRC information systems, Agency processes and workflow, data and document management, and high-performance computing applications.

3.3.1 Improving the Quality of NRC Information Systems

The Challenge/Vision

Efficiently and effectively implement easily accessible, reliable, secure, and integrated information systems for high-priority administrative and mission-related needs.

Description of the Current Environment

The NRC developed its information systems over the years using a variety of technologies and approaches. Systems development project managers had few operational guidelines and the NRC had few development standards to encourage a consistent level of quality in developing, testing and maintaining these systems. With the introduction of microcomputers, the problem of compatibility and quality expanded as individual users and offices began to implement individualized, unique systems.

One way that IT managers have found to improve the quality and consistency of information systems is to practice a standard systems life cycle management (LCM) approach to structure the systems development process of

new information systems from initial requirements and programming activity through obsolescence and replacement. LCM generally encompasses the key components that make up a system: software, data, hardware, telecommunications, training, user support, and systems maintenance.

An effective LCM should include a rigorous, proven methodology; standards; project management; computer-aided systems engineering (CASE) tools; data management; configuration and software management; and independent reviews. The use of CASE tools as part of LCM can significantly reduce the costs of system maintenance, improve quality and reliability, and increase the productivity of development staff. For these reasons, over 90 percent of Fortune 500 companies use CASE tools to develop and maintain their information systems. Most Federal agencies are also establishing LCM frameworks and using CASE tools.

NRC has practiced LCM primarily by applying internally drafted guidelines, using CASE tools in only a few development projects.

Strategy for Improving the Quality of NRC Information Systems

IRM, with client office input and review, will acquire and implement within the Agency a standard LCM and CASE tool set, implement standards for all major IT deliverables, assign customer and IRM responsibilities for life cycle steps, revise project management standards, and require independent monitoring and reviews for each life cycle step. The NRC will use the new standard LCM for all major projects over an established threshold. Smaller, more simple applications will have an LCM commensurate with their size and complexity and may not require the use of CASE tools.

Initiatives under "IT Architectures" (Section 3.1.5), "Applications Development Platforms" (Section 3.2.3), "Agency Processes and Workflow" (Section 3.3.2), and "Data and Document Management" (Section 3.3.3) also will contribute to the improvement of NRC Information Systems.

3.3.2 Agency Processes and Workflow

The Challenge/Vision

Apply technology to improve NRC workflow management processes; increase NRC ability to communicate electronically with licensees and other agencies; and increase the effective and efficient use of electronic forms, mail, signatures, and records.

Table 3 IT Information and Applications Management

PROGRAM ELEMENTS	CHALLENGES	STRATEGIC INITIATIVES
Improving the Quality of NRC Information Systems	Efficiently and effectively implement easily accessible, reliable, secure, and integrated information systems for high-priority administrative and mission-related needs.	<ul style="list-style-type: none"> Strengthen systems life cycle management
Agency Processes and Workflow	Apply technology to improve NRC workflow management processes; increase NRC ability to communicate electronically with licensees and other agencies; and increase the effective and efficient use of electronic forms, mail, signatures, and records.	<ul style="list-style-type: none"> Pilot "business process reengineering" to streamline important processes Implement paper reduction initiatives
Data and Document Management	Manage shared data and documents as Agency resources and ensure they are accessible, secure, and reliable. Update the Agency's document management capabilities to meet current and anticipated programmatic needs.	<ul style="list-style-type: none"> Strengthen Agency data administration in key business areas Implement a modern document management system for agencywide use
High-Performance Computing Applications	Increase activities to develop and implement technical computing applications needed to support future licensing and regulatory activity in the program offices, such as for advanced reactor design certification, plant life extension, and high level waste (HLW) repository licensing.	<ul style="list-style-type: none"> See Section 3.3.4, High-Performance Computing Applications

Description of the Current Environment

Most business processes and workflow systems in the NRC are paper-based and rely on internal desk procedures or mailroom distribution of paper copy. As distributed office automation capabilities, e-mail, and networks are implemented in the Agency, many of these paper-based workflow systems can be replaced with electronic media and communications methods. NRC is conducting three agencywide projects to increase the application of electronic technology to business processes.

First, a Paperwork Reduction Task Force is determining types of information that are good candidates for electronic access. These types have been categorized as follows: forms of information that can be provided within the current LAN configuration, those that can be implemented with a WAN, and those that are part of other systems development efforts. Second, a Forms Automation

Project team is examining the many forms used in the Agency to determine those that are likely candidates for converting to an electronic format on the AUTOS LAN. Third, an electronic communications project team is determining and coordinating requirements and planning for known electronic information receipt and dissemination projects. The NRC is implementing several pilot projects for electronic communications with licensees. With these three projects, the NRC is exploring the application of technology to existing paper-based systems. Many companies and federal agencies are also streamlining their existing processes using BPR to eliminate redundant and unproductive activities and simplify and integrate essential activities. A typical BPR initiative includes consolidating tasks; reducing centralized processing; assigning local authority for decision-making; analyzing workflow across organizations and processes; modeling and measuring costs to help reduce them; eliminating redundancy; and evaluating and applying new technologies. Although there has been some discussion within NRC of streamlin-

ing specific internal processes, a structured approach such as BPR has not yet been applied.

Strategy for Improving Agency Processes and Workflow

As workstations and networking are extended to every NRC employee, the Agency will focus on replacing its paper-based systems by expanding the current paperwork reduction, forms automation, and electronic communication projects to include more processes. The Agency will need to establish policy for electronic workflow management, including criteria for accepting electronic signatures and electronic media for official Agency records.

NRC will explore the use of BPR by conducting BPR pilot projects and evaluating their effectiveness to determine how BPR might be further applied within the Agency. Candidate areas being considered for piloting BPR are document management, commercial contracting, materials licensing, and fee billing.

3.3.3 Data and Document Management

The Challenge/Vision

Manage shared data and documents as Agency resources and ensure they are accessible, secure, and reliable. Update the Agency's document management capabilities to meet current and anticipated programmatic needs.

Description of the Current Environment

Data Management

Like many agencies, NRC has experienced problems with the quality, redundancy, and integrity of data in many of its existing systems. In 1985, the Agency developed a data architecture and began to apply data management principles to a portion of its information in order to reduce development and maintenance costs, improve data for management decision-making, improve the integrity and reliability of data, reduce data redundancy, and provide for more efficient data entry.

In conducting its initial data management efforts, the Agency used mainframe systems which supported reactor-related functions, including inspection, enforcement and event data. Many benefits resulted from this central data management program; for example, the Agency (1) improved analysis and management in the inspection program by instituting a uniform inspection planning process and database across all regions with the ability to track the actions taken to followup and close out inspectable items; (2) found national trends in safety performance by making uniform comparisons of licensee performance and inspec-

tion activity data; and (3) improved the scheduling and coordination of licensee site activities by the use of the shared centralized database.

Although obtaining good results from this initial data management initiative, NRC found difficulty extending the program to other areas. The program relied on a highly controlled, centralized mainframe data repository, dial-up user access, and data management staffing by IRM. The NRC was replacing mainframe systems with newer, more user-friendly, cost-effective, microcomputer-based systems. While these new systems had many benefits, the distributed microcomputer environment was making data management much harder. Integration and uniformity can be achieved only with a strong data administration program and with customer support for policies to ensure that data structures are uniform and designed for sharing.

Document Management

Document management in the Agency includes a range of office document management systems and the Agency's major centralized NUDOCS. Although the NRC program and support offices rely on these older systems, users accustomed to newer and more flexible technologies are becoming increasingly dissatisfied with their limitations. These limitations include redundant document scanning and entry systems; the inability to use certain methods for search and retrieval, such as full-text and proximity searching; the inability to cut and paste from existing text; and the lack of cost-effective methods for distributing documents. In many cases, document management systems are being developed by the NRC program offices to address unique needs not satisfied by NUDOCS. Although further investment in the current NUDOCS system could overcome certain document-processing limitations and provide additional search features, this would not be cost-effective, significantly improve user satisfaction, or address inherent retrieval limitations.

Strategy for Data and Document Management

Data Management

To support improved integration and data management, NRC will implement a strong data administration program to ensure that data is managed as an Agency resource by (1) establishing policies and standards for shared data, (2) defining roles and responsibilities for shared data, and (3) implementing a data quality assurance program. The staff will apply these data management policies and standards to major functional areas, including financial and contracts data.

Document Management

To improve document management systems in the Agency, NRC will undertake a major initiative to imple-

ment a modern text and image management system to replace NUDOCS, provide the staff with robust document management systems, and reduce the need for other systems. The NRC will begin by applying BPR to streamline document management processes. In performing the analysis, the NRC will categorize existing and proposed text management applications, to determine their requirements. The staff will select the new approach based on the results of cost/benefit and alternatives analyses.

3.3.4 High-Performance Computing Applications

The Challenge/Vision

Increase activities to develop and implement technical computing applications needed to support future licensing and regulatory activity in the program offices, such as for advanced reactor design certification, plant life extension, and high level waste (HLW) repository licensing.

Description of the Current Environment

The new, more powerful, microcomputer technologies enable the staff to perform scientific modeling and simulation in distributed high-performance computing environments. These systems have the potential to greatly enhance the way the Agency conducts its mission activities in such areas as advanced reactor design certification, plant life extension, HLW repository licensing, and technical training of NRC the staff. Although many of the staff recognize the potential benefits of high-performance computing, most NRC offices are still in the experimental stages of using this new technology. More training and experience will be needed before the staff can take full advantage of high-performance computing applications in performing licensing and regulatory work. The following high-performance computing projects are currently underway in the program offices:

Office of Nuclear Reactor Regulation

In NRR, networked RISC/UNIX workstations have been installed to enable the staff to share computer codes and data between NRR Divisions. The staff uses these workstations to run computer models for analyzing advanced reactors and operating reactor events. For example, high-performance models have been used to more clearly understand the behavior and containment concerns for advanced light water reactors such as the AP600 and the SBWR. Models have also been used to analyze the significance of inspection findings at operating reactors. For example, the staff modeled a degraded high pressure emergency cooling system at an operating plant to determine the effect on safety.

Office of Nuclear Regulatory Research

The Office of Nuclear Regulatory Research (RES) staff use networked UNIX workstations to support evaluation and engineering activities associated with the design, acceptance, and implementation of computer codes. These codes perform analyses for graphical system interfaces, reactor simulation, plant process protection and control applications, seismic analysis, severe accident analysis, and other engineering simulations. The staff is moving existing codes from mainframe environments to these high-performance workstations; is updating, enhancing, or consolidating other codes; and is using satellite data communications to connect with outside networks such as the U.S. Geological Survey's National Seismic Network to obtain specialized data.

Office for Analysis and Evaluation of Operational Data

The Technical Training Center (TTC) is using a variety of analytical codes for upgrading of reactor simulator models and for development of classroom simulations. The classroom simulations will be accomplished using these codes on RISC/UNIX-based workstations to compute and display information that cannot be observed on simulator instrumentation. As part of this effort, the staff is using advanced graphics software for process control applications, obtained through the Halden Reactor Project, to develop the graphical interface through which the information will be dynamically displayed for classroom simulations. A necessary part of this effort is the electronic exchange of data and code among AEOD, the Halden Reactor Project, and the national laboratories.

A high-performance Ethernet network enables TTC instructors to control the center's GE and Babcock and Wilcox (B&W) reactor simulators using Macintosh-based instructor stations. The recently-acquired Combustion Engineering (CE) simulator uses a RISC/UNIX-based Silicon Graphics 4D system and three Silicon Graphics workstations. These Silicon Graphics workstations and several Sun SPARCstations are, likewise, connected to the Ethernet network.

At Headquarters, the AEOD is developing a Reactor Safety Assessment System on a Sun SPARCstation which uses expert system technology to support the analysis of operational events at the NRC Operations Center.

Office of Nuclear Material Safety and Safeguards

NMSS has completed the initial installation phase of an Advanced Computer Review System that will be used to develop methods needed for review and licensing of the proposed Yucca Mountain repository by the DHLWM.

Regulatory activities that will be supported by the system include (1) development of the NRC License Application Review Plan, (2) review of DOE pre-licensing activities, (3) development of guidance for DOE on regulatory requirements (4) iterative performance assessments (IPAs) of the repository, and, eventually, (5) review the license application. These functions will require the staff and its consultants to develop and use a variety of engineering and scientific computer programs to evaluate repository design and performance. The staff needs to communicate large computer files and source code to its consultants and to outside mainframe computers using INTERNET and other networks to work effectively at long distances on such tasks as the IPA. Graphical hardware and software will be needed to allow the staff and its consultants to analyze large quantities of complex spatial and temporal data describing repository site characteristics, environment, and projected repository behavior and to help communicate and publish complex engineering drawings, site characterization data, and results of computer models. To meet these needs, the review system design presently utilizes a high-performance UNIX-based network comprised of a SPARCstation server, SUN-IPX workstations, a highresolution printer, and 486 microcomputers. Other components to be added include an advanced graphics server, a color printer, a digitizer, a scanner, a drum plotter, additional workstations, and extensive software and software support.

Strategy for Analytical and Scientific Computing

The Agency will continue and expand analytical and scientific computing on highperformance workstations to support licensing and regulatory activities. Following are future plans for individual NRC offices:

Office of Nuclear Reactor Regulation

NRC will continue using RISC/UNIX workstations to model and analyze reactor systems and containment behavior for advanced reactors. The staff will increasingly use models and scientific codes to analyze the significance of inspection findings and assess reportable events at operating reactors.

Office of Nuclear Regulatory Research

It is planned that RES activities requiring analytical and scientific computing on highperformance workstations

will be continued and enhanced as needed. Future activities will include additional analytical codes and modifications to existing codes, graphical data transfers over high-speed communication lines, improvements in satellite data communications techniques, and faster data exchanges between workstations and on high-performance computing networks.

Office for Analysis and Evaluation of Operational Data

The TTC will continue to develop workstation-based classroom simulations using RISC/UNIX workstations at the best speed permitted by available resources, including coordinating with other offices to provide access, as requested, to the simulation codes and tools acquired through TTC procurements. The TTC will prepare to do advanced reactor simulation, as time is available, as part of the Multiple Advanced Reactor Simulator project and will work toward moving more of the full scope simulator models to the UNIX environment.

As a result of major software improvements to several of TTC's full scope simulators (completed for GE BWR/6, in progress for B&W, and currently planned for Westinghouse), the existing super-minicomputer systems are fully utilized with little or no excess capacity. Future enhancements will therefore require additional computer capacity. RISC-based processors capable of executing code from earlier platforms appears to be the best option for this needed additional computer capability. The new processors will be integrated in the TTC's high-performance network architecture, which enables the use of new UNIX tools while preserving the investment in older simulation software.

Office of Nuclear Material Safety and Safeguards

The Division of High-Level Waste Management will continue to develop the Advanced Computer Review System, described previously, according to the 3-year implementation schedule. Upon completion, the system will serve about 30 DHLW staff. IRM will assist NMSS by acquiring special commercial software and providing system support.

LIST OF ACRONYMS

ADM	Office of Administration	HLW	high-level waste
AEOD	Office for Analysis and Evaluation of Operational Data	IPA	iterative performance assessment
APR	Agency Procurement Request	IRM	Office of Information Resources Management
AUTOS	Agency Upgrade of Technology for Office Systems	IT	information technology
BPR	business process reengineering	LAN	local area network
B&W	Babcock & Wilcox	LCM	life cycle management
CASE	computer-aided systems engineering	NASA	National Aeronautics and Space Administration
CE	Combustion Engineering	NIH	National Institutes of Health
CNWRA	Center for Nuclear Waste Regulatory Analyses	NMSS	Office of Nuclear Material Safety and Safeguards
DCFO/C	Deputy Chief Financial Officer and Controller	NRC	U.S. Nuclear Regulatory Commission
DHLWM	Division of High-Level Waste Management	NRR	Office of Nuclear Reactor Regulation
DPA	delegation of procurement authority	NUDOCS	Nuclear Document System
DSO	designated senior official	OMB	Office of Management and Budget
e-mail	electronic mail	RES	Office of Nuclear Regulatory Research
EPRI	Electric Power Research Institute	RISC	Reduced Instruction Set Computation
FAR	Federal Acquisition Regulation	SBWR	Simplified Boiling Water Reactor
FIP	Federal information processing	SIRMO	Senior Information Resource Management Official
FIRMR	Federal Information Resources Management Regulation	TAB	Technology Advancement Board
FTP	File Transfer Protocol	TCP/IP	Transmission Control Protocol/Internet Protocol
FYP	five-year plan	TTC	Technical Training Center
GE	General Electric Company	WAN	Wide Area Network
GSA	General Services Administration		

APPENDIX A

Agency IT Management

As a Federal agency, the NRC is required to manage its information technology resources according to OMB Circular A-130, which formally established the concept of information resources management. OMB Circular A-130 specifies that Federal agencies manage their information in an efficient, effective, and economical manner and comply with the information policies, principles, standards, and guidelines prescribed by the Director of OMB.

OMB A-130 also required that the head of each agency appoint a DSO for IRM. The DSO is responsible for performing the IRM functions assigned to the Agency by OMB A-130 including

- Reviewing the agency's IT activities
- Ensuring all FIP resource acquisitions are conducted as required by the Federal Acquisition Regulation and Federal Information Resources Management Regulation
- Ensuring that the agency's IT systems do not overlap or duplicate one another
- Implementing government-wide and Agency information policies, standards, and guidelines
- Reviewing and improving the accuracy and completeness of data and records
- Developing and annually revising a five-year plan for agency IT needs
- Maintaining an inventory of the agency's major information management systems

NRC Designated Senior Official

The Deputy Executive Director for Nuclear Materials Safety, Safeguards, and Operations Support is the NRC DSO for information resources management. The DSO has delegated authority for principal IRM functions to the Director, IRM, and the Director, ADM. The DSO has redelegated GSA's authority to acquire FIP resources for those IRM functions under the purview of each of the two office Directors and to sign all Agency Procurement Requests (APRs) to GSA for competitive procurements below a \$10 million threshold.

The DSO retained authority to sign APRs requesting a delegation of procurement authority from GSA for non-competitive procurements and for competitive pro-

curements that exceed \$10 million. The DSO also retained authority for establishing and maintaining an overall IRM Review Program for major IRM activities.

Roles of the Office of Information Resources Management

IRM is responsible for providing information resource management services in the following areas:

"computer, telecommunications, and information services including database management, office automation, computer hardware and software, systems development, computer operations, timesharing, nation-wide telecommunications equipment and services, computer and systems security, the Information Technology Services Center, user training, document control and management, information collections, central files, records management and services, the library, graphics, and all necessary information support services to other NRC offices".

[NUREG-0325, Revision 16, March 15, 1993].

Roles of the Office of Administration

ADM is responsible for providing information resource management services in the following areas:

"Freedom of Information Act and Privacy Act requests, publication services, mail and distribution services, and access to NRC public documents through its Local Public Document Rooms"

[NUREG-0325, Revision 16, March 15, 1993].

Roles of Other Offices

NRC Headquarters and regional offices have their own mission-specific responsibilities that may require IRM activities. SIRMOS in major NRC offices have been appointed to assist the DSO in carrying out IRM responsibilities within their offices. The SIRMOS are responsible for ensuring that their organizations know and comply with Agency policies and basic Federal regulations for acquiring FIP resources and for developing and managing automated information systems. The SIRMOS also represent their organizations in reviewing aspects of NRC's IRM program and in preparing agencywide IRM plans, policies and budgets.

The NRC Deputy Chief Financial Officer and Controller (DCFO/C) is responsible for reviewing certain aspects of the design and operation of Agency financial systems to ensure that requirements of the Chief Financial Officers Act are met. The DCFO/C will review and concur in the design of information systems that provide, at least in part, financial and program performance data used in financial statements and reports.

General Services Administration Review of NRC's IRM Program

The GSA delegates certain authorities to the NRC for the acquisition of FIP resources and has an oversight role. As part of this oversight, GSA recently completed its first triennial review of NRC's Information Resources Management Program. GSA recommended that the Agency continue with activities to create and implement a strategic IRM plan connected to the Agency's Five-Year Plan.

In discussing and preparing this IT Strategic Plan, the staff considered the following recommendations from the GSA report:

- (1) Improve IRM oversight functions
- (2) Continue the strategic IRM planning process to ensure that plans are produced regularly, and that they address all aspects of planning and receive agency-wide, executive-level approval
- (3) Develop a plan to modernize information systems based on agencywide planning
- (4) Establish a centrally managed IRM Review Program that focuses attention on major information systems
- (5) Continue the revision and improvement of its FIP acquisition processes
- (6) Develop an information system architecture that is linked with the strategic IRM plan

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