

# 6—Research Management and Operations



## 6.0 Enhancing Research Management, Ensuring Operational Excellence

**During the next five years, we will create new, distinctive capabilities for leading and managing a highly productive research enterprise.**

### Status

We have broken new ground and demonstrated strong leadership in improving both operational effectiveness and efficiency at the Laboratory. Our highly engaged staff, research and operational processes, and infrastructure are clearly working together to produce outstanding results for our customers.

- ◆ We received outstanding ratings in Laboratory Operations in four of the last five years.
- ◆ We increased our research productivity using an integrated management approach. For example, we have reduced overhead rates by 20 percent since FY 1994 while increasing our investment in scientific initiatives, staff, and facilities.
- ◆ The number of research staff as a percentage of total PNNL staff has risen each year since FY 1998, showing that more of the Laboratory's funding is being directed toward research.


We are on track to maintain our record accomplishments through continued vigilance, revitalized approaches that keep staff energized around operational outcomes, and efforts to increase effectiveness and efficiency. With this strong foundation in place, we will invest in operations and new research processes to increase our research productivity.

### Challenge

Our new methods of leadership in research management will improve our ability to turn discoveries at the frontiers of science into applications critical to DOE's missions. Through managing our operations, we will improve our ability to leverage our people, processes, and infrastructure toward achieving higher levels of research productivity. New methods for improving research productivity will be focused both at the individual and the Laboratory level.

### Plan

Becoming a leader in research management demands that we improve our core research management processes for understanding our customers' needs, delivering high-value solutions, and stewarding the Laboratory's assets. Starting at the Laboratory governance level (see Module 1.4), we must set clear performance expectations for these core research processes to 1) create more explicit and stronger linkages to the Laboratory's strategies for integrating science and applied programs, and 2) translate S&T results into commercial applications. Because our staff use core



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research processes daily, we will actively engage every staff member to help them understand these strategies so they can align their actions and decisions accordingly. We will use self-assessment as a means to improve our management systems. As we progress in aligning our actions and linking the core research processes with our strategy, we will accelerate our understanding of what is and is not working, and what actions are needed to stay on track toward our vision.

To meet this challenge, we must mobilize our substantial talent and resources in ways that will:

- ◆ Further integrate our management systems and develop more intuitive operational tools.
- ◆ Increase the levels of staff engagement by proactive communications, providing talented managers, developing staff, and providing competitive compensation.
- ◆ Strengthen the processes that link basic and applied sciences/engineering, starting with our Laboratory initiatives.



PNNL will continue to find new methods to better enable science while protecting the health and safety of workers, the public, and the environment.

## 6.1 Greater Research Productivity Using an Integrated Management Approach

**We will improve operational performance in ways that increase our efficiency and effectiveness while enabling greater productivity of individual researchers.**

### Status

PNNL has a strong track record of outstanding operational performance, which includes:

- ◆ Reducing or holding steady the cost of operations while improving results that enable research.
- ◆ Obtaining highly respected external certifications, including those related to International Organization for Standardization (ISO) Environmental Management Standard 14001, the Voluntary Protection Program (VPP), and Integrated Safety Management (ISM).
- ◆ Increasing the extent that our staff are engaged in the functioning of the Laboratory. Our Gallup survey of staff engagement is showing steady progress in reaching levels maintained by the world's highest-performing organizations.

### Challenge

Our challenge is to provide revitalized approaches for continuing our outstanding record of safeguarding the Laboratory's resources and protecting the health and safety of workers, the public, and the environment.

### Plan

To meet this challenge, we will focus on the following key actions during the planning period:

- ◆ **Streamlining processes** will make additional resources available for reinvestment. By reducing low-value activities and finding ways to leverage new thinking and technologies, we can reduce the cost of administrative and operational activities to free up resources for investment of new infrastructure and capabilities.
- ◆ **Eliminating redundant, non-value-added requirements** is a powerful way to reduce the cost of administrative and operational activities. By eliminating unnecessary requirements, we can eliminate wasted effort and reduce cost while continuing to operate the Laboratory safely and efficiently.
- ◆ **Integrating operational and research processes** will allow researchers to spend more productive time on research. We will focus on improving our research processes to minimize the time technical staff spend on administrative activities so they can focus their energy on productive research. By embedding safety and compliance directly into the research processes, we can simultaneously meet both our operational and research objectives more effectively and efficiently.

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- ◆ **Maturing risk management and assurance processes** will allow us to increasingly use graded approaches to identify high-risk areas and establish appropriate risk limits. This requires a full understanding and definition of the key risks associated with achieving Laboratory goals and objectives. We will improve our approach to establish risk limits and metrics to monitor performance. Annually, we will brief the Battelle Laboratory Operations Committee (a corporate oversight committee) on our assurance results. To support this approach, we will evaluate our integrated management system to define which processes need to develop assurance plans that identify risk limits, self assessments, and other assurance resources, such as third-party reviews, that will ensure that management system objectives are being accomplished and that systems and controls are effective and efficient.
- ◆ **Sharing lessons learned and best practices** across Battelle-affiliated laboratories will keep us informed of important process improvement opportunities. Although each laboratory is unique, many opportunities still exist to share and learn from the experiences of others. With a strong history of exporting management systems and tools to these other laboratories, we will continue to emphasize the value and benefits gained from sharing best practices and lessons learned with others.
- ◆ **Safeguarding the Laboratory's resources and protecting the health and safety of workers, the public, and the environment** will continue to be a priority. We believe that continued management vigilance needs to be coupled with renewed approaches that energize staff around operational outcomes.

The figure illustrates our concept of how the traditional support functions can be linked to form an integrated management approach that supports research and delivery of results. This integration effort is long and complex. We have made good progress to date, but we have several more years of developing and refining individual processes. The following modules (6.1.1 through 6.1.5) provide more detail on the performance of and our plans for the operation and financial management elements of our integrated management approach. Other elements are addressed in the modules highlighted in the figure.

- ◆ Environment, Safety, Health and Quality (ESH&Q)
- ◆ Safeguards and Security (SAS)
- ◆ Business Support Services
- ◆ Facilities and Operations.



This figure identifies the major elements of the integrated management approach that we have implemented at PNNL.

## 6.1.1 ESH&Q Enables Research

**Continued operational excellence at PNNL will be supported by ESH&Q enhancements that anticipate and respond to change while reducing both risk and cost to the Laboratory.**

### Status

Our ESH&Q program has a strong track record of outstanding performance that provides a firm foundation for building toward the future.

- ◆ Our sustained, outstanding ESH&Q performance is built upon customer focus, commitment to enabling research, and close cooperation with our DOE and PNNL customers.
- ◆ We met or exceeded DOE's environment, safety, and health (ES&H) performance measures during the past five years.
- ◆ We received an outstanding rating in ES&H operations in four of the last five years.
- ◆ We achieved the ES&H Triple Crown, composed of highly respected external certifications including ISO 14001, VPP, and ISM.

### Challenges

Our ESH&Q program faces two challenges: 1) finding and eliminating non-value-added process steps to improve efficiency, and 2) developing new software tools to enable research. The resultant savings will be used to invest in the renewal and revitalization of the Laboratory.

In parallel, we must continue to play a Battelle-wide leadership role in the continued enhancement of ESH&Q management systems and processes that anticipate and mitigate the risks affecting the Laboratory, the environment, and the surrounding community.



### Plan

To meet these challenges, we will focus on the following actions.

- ◆ **Seamless integration of ESH&Q processes into Laboratory operational and research processes** is needed to support researchers without distracting them from research. Researchers will be able to spend more productive time on research by using tailored training and waste forecasting tools at the benchtop. We will deliver additional value-added tools that further integrate ESH&Q practices into Laboratory operations and research (e.g., enhanced Integrated

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Operations System [IOPS] architecture and the enhanced IOPS/Electronic Prep & Risk [EPR]/Job Evaluation Training System [JETS] interface).

- ◆ **Implement anticipatory risk management and mitigation tools.** We are planning ESH&Q system and tool upgrades that will anticipate and respond to risk in an environment of change. The new EPR and enhanced IOPS architecture will provide a graded approach that is integrated across all ESH&Q management systems and is transparent at the benchtop. The result will be the ability to anticipate and mitigate situations that would place the Laboratory in an unintended risk position, respond to project changes that would negatively affect our risk strategy, and manage the risk inherent in day-to-day operations.
- ◆ **Expand reliance on external requirements.** We continue to seek elimination of redundant, non-value-added internal or external ESH&Q requirements through the Requirements Integration and Tailoring process. External standards (e.g., Nuclear Regulatory Commission, Occupational Safety and Health Administration, and ISO) may be evaluated for applicability to Laboratory operations.
- ◆ **Streamline ESH&Q processes.** Work flow process techniques are being applied across management systems and PNNL Standards-Based Management System subject areas to identify specific interconnectivity improvements among work practices, information requirements, tools, and processes. To complement these efforts, we are working to improve the performance management processes used to monitor and inform us of our progress toward objectives, goals, and commitments. A new tool, PbViews, is being used to improve linkages from top-down strategies, connecting measures to strategies, facilitating timely decisions, and providing a consolidated source to determine if our performance objectives are being met. This effort will help us drive improvement in our processes and tools, minimizing their impact on research staff.
- ◆ **Ensure uniform ESH&Q management policies across Battelle-affiliated laboratories.** We are participating in the development and deployment of an ESH&Q Operations Manual that is based on the successful ESH&Q strategies, management systems, tools, lessons learned, and best practices developed across Battelle-affiliated laboratories.



PNNL will build on its tradition of operational excellence by using embedded tools and processes to increase research productivity.

## DOE Office of Science Restructure

As part of the DOE Office of Science (SE) restructure of the Laboratory, funding for SAS activities may shift from “direct” to “indirect” in FY 2005. Should this occur, actions will be taken during FY 2004 to facilitate this shift and minimize associated impacts. The possible indirect budget request for FY 2005 and beyond has been included in the Laboratory’s budget and planning activities (see Appendix D for more information).

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## 6.1.2 Responding Appropriately to the New Threat Spectrum

**PNNL will enhance its Safeguards and Security program to respond to domestic and international events.**

### Status

- ◆ A broad risk-based approach for security management practices is used to determine protection priorities.
- ◆ Our Counterintelligence program complements and supports our SAS program’s risk-based approach by countering site-specific threats by foreign controlled adversaries.
- ◆ We worked closely with DOE to develop and implement local security upgrades (Security Condition [SECON] measures) in response to terrorist threats.
- ◆ We employ appropriate SAS measures to discourage or defeat attempts to collect information or disrupt operations by threats to scientific and technological information/programs.
- ◆ Our Cyber Security program evaluates emerging technologies and also adjusts its focus based on surveys, inspections, and self-evaluations.

### Challenge

The Laboratory must find ways to quickly adapt to and effectively address changing SAS threats while minimizing impact to researchers and their work. In parallel, the SAS program must play a key role in mitigating risks affecting the Laboratory relative to the protection of information, and provide a secure but accessible environment that fosters research productivity.

### Plan

To meet these challenges, we will focus on the following actions:

#### **Security processes and systems will be continually reviewed and enhanced.**

To provide protection measures consistent with the national threat and homeland security advisory system, flexible, adaptive resources, systems, and processes to meet these evolving threats will be provided. SECON measures have been developed so DOE facilities would uniformly meet the requirements of the Homeland Security Advisory System and provide the appropriate responses and specific security upgrades for use under the different threat condition levels. We will continue to be responsive and take a proactive approach in the development and implementation of security measures to quickly adapt to and effectively address threats while minimizing impact to researchers.

**We will focus on information protection while keeping up with changing technologies.** A priority of our proactive SAS program is to employ appropriate measures that discourage or defeat attempts to collect information or disrupt operations by threats to scientific and technological information/programs. Our SAS strategy is to provide staff, collaborators, business partners, and customers a secure, but accessible, environment that enhances personal and team productivity through ready access to information, systems, and networks.



Strengthening and placing more rigors on the protection of sensitive unclassified information and cyber assets is key to the threat mitigation process. This increased emphasis will be accomplished in part through staff awareness and author accountability. As a result of expanding threats coupled with the increasing availability of information, another major focus will be the expansion of the Export Control program to identify and mitigate export control issues. Close interactions among SAS staff and the researchers will continue in order to understand and evaluate future access and protection needs.

**We will pursue timely implementation of Cyber Security solutions.** We will evaluate emerging technologies and potential applications to address the changing threats to communication and electronic information systems.

Our Cyber Security program evaluates emerging technologies and adjusts its security focus based on surveys, inspections, and self-evaluations. To address identified issues and vulnerabilities, we are providing near-term acceleration of the implementation of enclave architecture that will allow the differentiation of computing resources so that the appropriate level of security is applied based on risk and the work being conducted. Our Cyber Security program is also completing an upgrade to its primary Intrusion Detection System (IDS) to address all major traffic points. A firewall complex has been implemented to protect computing resources. A log review project that correlates information from numerous logs on the network including Firewall, IDS, Domain Servers, FTP servers, PKI servers, and web access is implemented, and additional analysis tools are being developed. A back channel network is also being implemented that will significantly increase the ability to manage the network securely and respond to incidents or threats more effectively. A software-based IDS using ZoneAlarm is also being instituted that will be installed on all systems that process sensitive information (Unclassified Controlled Nuclear Information/National Nuclear Propulsion Information).

Future solutions include development of a host-based (workstation) IDS that will continue to strengthen security of our individual workstations. A wireless rogue detection process is also being implemented that takes advantage of both the wireless and wired sides of the network. An IDS for our wireless network is also planned.

Several Cyber Security pilot programs are under way. Proximity devices for workstation access will be made available in the future for use where appropriate. An Instant Messaging Proxy server is also being piloted to allow better security and eliminate the peer-to-peer vulnerabilities. Additionally, a pilot will be run to determine the effectiveness of web appliances in the protection of web servers.



A cyber enclave architecture will allow the differentiation of computing resources in such a way that the appropriate level of security will be applied based on risk and the work being performed.

## 6.1.3 SAS Integration: Making Sure it Works

### **PNNL is recognized as a model for integrating SAS into the line organization and operations.**

#### Status

- ◆ The operating philosophy of PNNL's Integrated Safeguards and Security Management (ISSM) program was one of the first in the DOE complex. This program integrates SAS requirements into the processes of planning and conducting work at the Laboratory and assists management in addressing identified threats and associated risks. Our guiding principles as well as core functions of the ISSM program are reflected through the DOE policy that formalizes DOE's philosophy for ISSM. Continued maturity targeted at performance-based security management is a current focus.
- ◆ The ISSM program has positively changed the security culture at the Laboratory. The role of SAS has shifted from enforcer to oversight and assistance, with implementation and the commitment to line organization accountability as essential. There is an increased awareness of security threats and risks as well as mitigation activities. Line organizations are now involved in the development and implementation of security requirements. Applicable research organizations are conducting monthly security assessments jointly with SAS staff. This ownership has led to a significant reduction in security issues and incidents.
- ◆ An Integrated SAS Senior Management Council has been established and chartered to provide a senior forum for the review of new and changing security conditions that affect the Laboratory, the identification of policy issues that should be raised to the leadership team, and the identification and/or endorsement of action plans as conditions warrant.

#### Challenge


Building a system that meets the needs of both science and security environments is essential, and the Laboratory must continue to evolve the maturity of the ISSM system to effectively accommodate both.

#### Plan

To meet this challenge, our SAS program will focus on the following actions:

**Continue the seamless integration of ISSM into Laboratory operational and research processes.** Continued emphasis of ISSM will strengthen security and ingrain it in the day-to-day activities of the line organizations.

Tools provided at the benchtop will support researchers by facilitating an open and supportive research environment coupled with an economical and effective protection strategy. Integration into Laboratory systems such as the new EPR, IOPS, and JETS will continue to be pursued. Our SAS program will employ performance management practices integrating planning and assessments using a performance agenda, assessments, and improvement initiatives as deployment mechanisms to



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demonstrate the continual organizational learning process. Our SAS program will continue to concentrate on improving management practices, increasing productivity, and employing outcome-oriented performance measures to support operations contributing to the Laboratory's success.

**We will continue to identify and implement operational efficiencies, streamlining of requirements, and innovative approaches** to facilitate effective security program performance while enabling productive research and minimizing costs.

Current enhancements to several SAS request systems included making them available from a single web page. The transition to the PNNL Digital ID as an electronic credential to be used for encryption, authentication, and digital signing was completed for these online systems.

Future enhancements include pursuing employee and nonemployee access to our SAS request systems from outside the firewall. A centralized role management and role-based access control service to define roles and capabilities within SAS applications will also be pursued as well as role-based Internet portal services and flexible ad hoc reporting tools to enable easier use of information. Also planned is more efficient (shared) use of individual system information (data warehouse concept) and interconnectivity between existing systems, the redevelopment of certain antiquated request systems on modern software platforms, and a defined migration for current SAS applications to the Laboratory's predominant development platforms to minimize development and maintenance costs and increase staff productivity.

**Sharing tools and best practices throughout the DOE complex.** Collaboration with other DOE laboratories and entities will continue in the future to share best practices; enhance efficiencies across the DOE complex; and support development and implementation of effective and crosscutting protection strategies, security procedures, and measures.

Our SAS staff met with staff from ORNL and Lawrence Berkeley National Laboratory to share information about some of our programs such as the Foreign National Visits and Assignments; Foreign Ownership, Control or Influence; and Classified Matter Protection and Control. Material, procedures, and forms were provided as well as an offer to lend assistance in the future. Currently, SAS staff, along with our Information Sciences & Engineering group, are working with other Hanford Site contractors to deploy the automated Foreign National Visits and Assignments request system Site-wide.



Embedded tools are being introduced to aid line management with their SAS responsibilities.

## 6.1.4 Business Support Services at PNNL

**Our culture will be to continually improve the reliability, usefulness, and timeliness of the information and services we provide with our staff. We will cultivate an environment of integrity, teamwork, candid communication, and professional inputs based on thorough yet concise information. We will encourage individuals to be proactive and innovative. We emphasize timely and effective support, not bureaucracy.**

### Status

We have achieved significant operational efficiencies in our business management systems to date. Recent examples include:

- ◆ Efficiencies from integrating acquisition and contract professionals with our business professional teams to realize synergies in capabilities as well as eliminate roughly \$600 thousand in administrative cost.
- ◆ Web-based systems for inputting proposal pricing data, business planning data, procurement requisitions, and project risk data allow for reduced administrative effort in retrieving information and more accessible information for review both by PNNL and DOE at a detailed project level or aggregate Laboratory level.
- ◆ Master agreements with various vendors, leveraging the buying and travel volumes of Battelle-affiliated laboratories to negotiate significant cost reductions.

### Challenge

The primary challenge facing our business management systems is maintaining adequate financial and compliance-based control while being responsive to the needs of our R&D environment. This requires easy-to-use systems and tools to allow projects and staff to proceed within the appropriate compliance envelope. Examples include inventory controls, cost reports, charging guidelines, funds controls, and acquisition processes.

### Plan

A stable set of priorities guide our actions relative to adding value to our R&D environment while still meeting contractual requirements. We are planning several specific actions to address these challenges in our business management systems:

- ◆ We have a robust, compliant procurement system—our focus in the near future is to further our system through greater use of electronic commerce and web-based procurement mechanisms with master vendors, which will eliminate the administrative cost of multitudes of transactions.
- ◆ We will focus our attention on significant cost drivers as part of a cost productivity review to make \$20 million to \$30 million of resources available to reduce overhead rates and make necessary investments for the vitality of the Laboratory.

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- ◆ We will facilitate an approach to prioritizing resources across the Laboratory based on the risk reviews started within the business management systems this past year.
- ◆ We will use technology changes to improve the value, quality, communication abilities, and timeliness of our business services while moving the Laboratory to paperless systems to the greatest extent practicable. We will continue to implement of electronic process improvements in the areas of electronic routing of invoices, electronic payment of suppliers, electronic distribution of cost reports, electronic submittal of time and travel reports, and other electronic interchanges.
- ◆ We will expand and strengthen ties with strategic small businesses to continue the process of establishing web-based catalogs for commodities that are repetitively purchased. Master agreements will be established with small businesses where possible, and large businesses will be encouraged to team with small businesses. We will partner with our key small businesses to identify and implement practices that represent a win for both PNNL and the small business.



PNNL will use commercial acquisition practices and leading-edge technology to develop a single connection between multiple Laboratory organizations and strategic suppliers.

## 6.1.5 Integrated Facility Asset Management

**During the next five years, emphasis on decision-support processes for planning and executing facility maintenance and renewal, and integrating sustainable practices into facility operations will reduce the costs of operating and maintaining PNNL's infrastructure.**

### Status

Our strong record of managing facility assets with distinction underpins future efforts for improving asset management practices. We have:

- ◆ Improved overall productivity by 35 percent and reduced cycle time by 67 percent through use of integrated and efficient work processes.
- ◆ Invested better than 2 percent of Replacement Plant Value on maintenance (includes maintenance bundled with general plant projects rehabilitation and improvement projects).
- ◆ Saved \$500 thousand in annual energy costs through implementation of innovative tools, proven capabilities, and management approaches.
- ◆ Increased on-time delivery of planned jobs to above 95 percent.
- ◆ Attained more than a 99 percent on-time completion rate for preventive maintenance.
- ◆ Met over 13 percent of electricity needs from renewable power.
- ◆ Reduced energy use for laboratory and office buildings well ahead of schedule to meet DOE 2005 goals.
- ◆ Been recognized by the International Facility Management Association with the Golden Circles Award for outstanding facility management organization.
- ◆ Been recognized by the Federal Energy Management Program and Association of Washington State Businesses with multiple energy program and environmental awards for use of innovative approaches to conserve energy and reduce environmental impacts.


### Challenge

We face two challenges:

- ◆ Increased attention by DOE on the management of its physical assets, including greater demand for accountability of assets and the call for long-term plans for maintenance and operation.
- ◆ Demands by management for overhead reductions, improved energy efficiency, and greater scientific productivity.

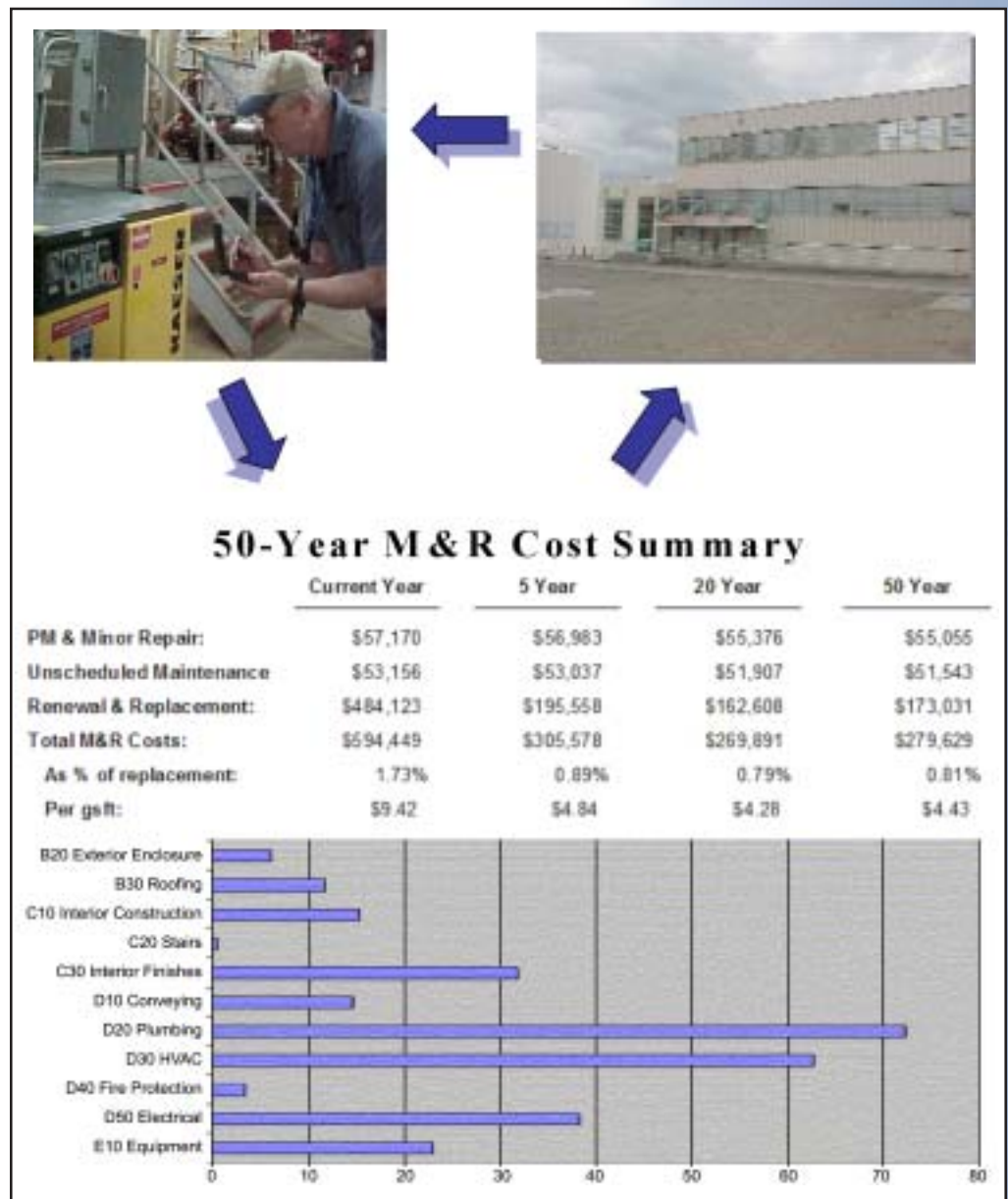
### Plans

To meet these challenges, we will focus on the use of life-cycle analysis and long-term service life prediction processes, striking a balance between the risk of deferring maintenance against mission requirements and potential environment, safety, and health impacts.



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- ◆ We will **fully** integrate Risk-Based Life-Cycle Asset Management practices into our building operations and maintenance processes. Through these efforts, we will achieve mature implementation of commercial best practices for forecasting maintenance and renewal requirements based on industry standards spanning the life of a facility (typically 50 years).
- ◆ Data collected from operations and maintenance activities will be routinely used by our system engineers to continually revalidate forecasted needs and to populate DOE corporate information systems, such as the Facilities Information Management System.
- ◆ We will set maintenance investment levels to maximize operations of critical systems (electrical, HVAC, fire protection, etc.) in 300 Area buildings targeted for closure while deferring noncritical system maintenance unless required to meet mission commitments.
- ◆ We will continue investment in energy management to achieve DOE's goals for energy reduction, maintain a diversified energy portfolio, and provide innovative low-cost solutions to infrastructure upgrades, where possible.
- ◆ We will continue to acquire more than 10 percent of our electrical power needs from nonhydro "green" power, and will seek to qualify additional buildings to the Energy Star program and certify one facility as Leadership in Energy and Environmental Design – Existing Building.



Example of maintenance forecast processes at work for Building 326.

## 6.2 Highly Engaged Staff

**We are creating a working environment that enables S&T staff to develop exceptional credentials and outcomes, promote innovation and higher research productivity, and recognize technical leaders for their abilities to translate vision into action and align people and science challenges to DOE missions.**

### Best in Class

Research has shown that a highly engaged workforce is more productive than those that are less engaged, according to the Gallup Organization. We have assessed the level of engagement of our staff during the past two years by conducting a short survey, the Gallup Q12. The results of PNNL's survey are analyzed against Gallup's database to determine a percentile indicating our engagement score as compared to other research organizations. Our goal is to attain a best-in-class rating, which is defined as 75<sup>th</sup> percentile, for 75 percent of our workgroups, which indicates a highly engaged and productive workforce. We will continue to make regular and sustained progress toward achieving this goal; PNNL's average has moved from 58 percent in 2001 to 69 percent in 2002.


Our practices are focused on creating an environment of highly engaged staff and managers who work with passion, drive innovation, and move the organization forward toward higher levels of scientific productivity. This includes a workforce characterized by staff members who are in roles that best suit their talents. We will continue to provide varied career path options and help staff identify their strengths, and then team them with great managers to create an engaging work environment.

### Staff Development

PNNL staff identified the following areas for improvement: 1) providing more consistent feedback on progress and development, and 2) providing opportunities for staff to work in areas where they consider themselves the most talented. In response, we will create greater opportunities for staff to learn and grow by developing and implementing contemporary programs that facilitate staff growth. Our first step will involve working with a group of our most talented scientists and engineers to determine what specific development activities should be made available to our more junior scientists and engineers and developing a Scientist and Engineer Development Program to provide the tools and resources to enable staff development.

### Compensation

We will provide effective total compensation programs that facilitate recruiting and retention of high-caliber staff and align performance with organization goals and outcomes. We have made significant progress in achieving a balanced compensation package of both base and variable pay programs, including programs focused



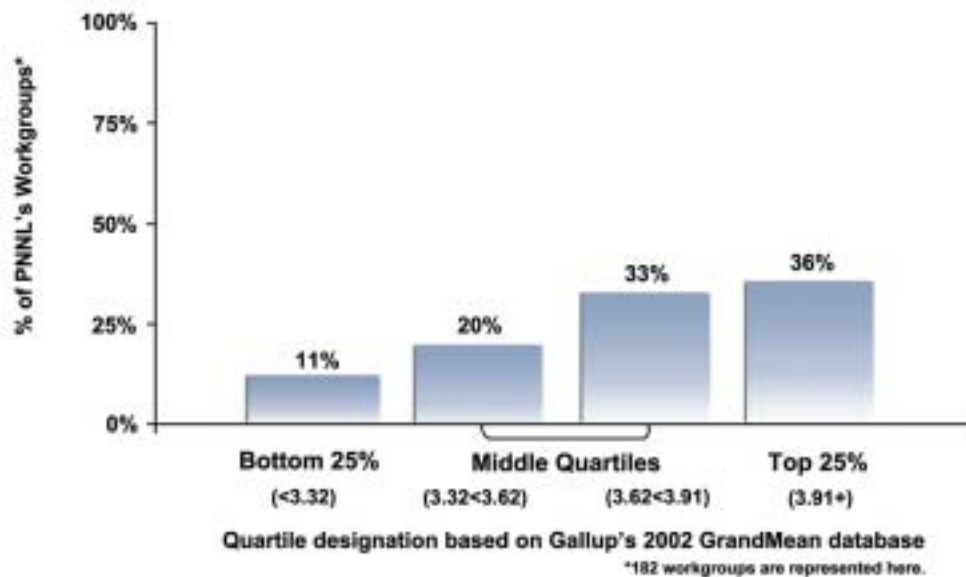
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on recruiting, retention, performance-based reward and recognition, as well as targeted equity adjustments, as necessary. In the upcoming years, we will focus on transitioning from managing base pay to a total compensation market position involving extensive communication and training for both managers and staff. We will also monitor external markets to ensure that we maintain our desired market position and remain responsive to market trends. We will periodically review job family design to ensure that we are supporting organizational goals and outcomes with our compensation system design.

## Staff Communication

We will provide staff communication and education through a variety of mediums to promote staff understanding, commitment, and ambassadorship for PNNL and DOE. We will accomplish this through progressive communications and marketing that targets delivery toward the audience experience level, interest, and availability. Priority will be given to staff interaction so that true dialogue and two-way communication are achieved. Retirees will be engaged through a specific retiree strategy that seeks to solidify and expand their ambassadorship as a strategic community resource. The desired end state for these engagements is an understanding and valuing of PNNL's commitment to its diverse talent base of current and former staff.



Quartile Performance on Q12 GrandMean. More than 3 in 10, or 36 percent, of PNNL workgroups scored in the top 25 percent and are considered "Best in Class," according to Gallup research.

## 6.2.1 Plans To Become an Employer of Choice

**PNNL will become the employer of choice among those organizations conducting advanced scientific research, which will further our efforts to attract and retain exceptional researchers by providing exciting research opportunities and directions, outstanding research colleagues, a diverse workforce, a strong research community, and modern facilities and equipment.**

### Clear and Compelling Vision

By clearly communicating the compelling S&T direction of the Laboratory, our staff will help form and realize our vision and take pride in our impact. Through such avenues as this Institutional Plan, our strategic planning process, the Management Skills Development Program, and other forums, our leadership team will clearly express the significant scientific opportunities that are available to our staff.

### Vibrant Workforce


We will ensure a vibrant and engaged workforce for the future through the delivery of integrated workforce planning systems and enhanced selection systems. We will increase our understanding of current staff demographics and capabilities and will target growth and selection decisions to ensure that workforce changes are made to meet our long-term objectives. By taking a comprehensive inventory of our available talent pool, identifying and providing growth opportunities to expand our current skill set, vigorously searching and hiring capable new talent, and planning for predicted business development, we will ensure future readiness to meet our needs. Where external talent is required, focused efforts will be made to attract the right mix of the best qualified individuals. The effectiveness of the selection and recruiting function will be measured for quality, timeliness, and efficiency.

### Research Campus of the Future

We will provide a modern research campus that supplements EMSL with new user facilities and a campus of leading-edge equipment and research facilities. This will enable PNNL research staff and the broader scientific community to drive technical innovation and work on DOE's most significant challenges (see Module 7.3.1).

### Collaborations and Partnerships

We will draw upon our connections in the community to enhance our scientific collaborations and capability through partnerships with major research institutions in the region. These collaborations will enhance our research staff's ability to deliver S&T to meet key regional and national needs, and will enhance the reputation of scientists and collaborative teams affiliated with PNNL. This will also create a pool of highly qualified and diverse candidates for employment at PNNL (see Module 7.2.3).



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Occupational Codes	Total	Pct	PhD	MS/MA	BS/BA	Other
Managers	577	15.0	117	211	188	61
S&E/Prof&Eng/SEA	1849	48.0	630	472	558	189
Specialists	474	12.3	16	84	232	142
Technicians	212	5.5	0	1	22	189
Clerical	512	13.3	0	3	43	466
Crafts/Laborers/Operatives	181	4.7	0	0	6	175
Service Workers	47	1.2	0	1	0	46
	3852		763	772	1049	1268

PNNL Staff Population by Occupation and Degree Level<sup>(a)</sup>

(a) Data as of April 2003

## 6.3 Enhancing Scientific Productivity: Researchers Doing Research

**Access to high-performance instrumentation and computational tools, opportunities for collaboration with highly skilled coworkers, and an environment in which excellence is recognized and rewarded will promote a culture of productivity and excellence in scientific research.**

PNNL must integrate different science disciplines to form effective, multifaceted, problem-solving teams. Our scientific productivity is measured by our success in achieving this integration of research capabilities. In addition to the conventional research productivity metrics (e.g., publications and intellectual properties generated) used in academia and industry, we must also consider metrics such as the degree to which information generated here is used in decision-making and deployment of discovery science to DOE problems. These outcomes can only be accomplished with quality staff, teamwork, the right tools and equipment, and a highly efficient infrastructure for performing research. This is enabled by creating the best environment for our scientists, and the ability for open communication of critical information for decision-making and creating the bases for technological applications.

PNNL's Council of Fellows, made up of top-level scientists and engineers and selected through a peer review process, promotes the integration of science disciplines to improve our research capabilities, while serving an important function in setting the science agenda of the Laboratory.

### Recognition

Peer recognition is an important factor toward ensuring that our S&T staff regard the Laboratory as an exceptional environment for their professional accomplishments and development. We must develop our staff into leaders of their fields and promote recognition by their peers—the ultimate individual metric for scientific productivity.

We will encourage our scientists to participate in high-level professional activities, such as serving in leadership roles in professional societies and participating in high-visibility working groups that provide leadership on important science issues. We will grow our staff through research opportunities on important science challenges and will communicate their findings through publications and appropriate forums, such as professional conferences and symposia.

To foster external recognition of key achievements among the scientific community, in 2003 PNNL implemented a Science and Engineering External Recognition program. Additionally, a new program for internal recognition for major scientific achievement is under development to enhance the previously established recognition program for major inventions by PNNL staff.

For our younger scientists, we must make resources available for them to test their ideas and enhance their career development. One current approach is the Fellows Initiative. Administered by the Council of Fellows, this program sets aside part of PNNL's discretionary portfolio with the specific objective of encouraging the exploration of new concepts by junior staff under the mentorship of our most senior scientists and engineers.

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## Cutting-Edge Capabilities Attract the Best and Brightest

Cutting-edge scientific capabilities, a highly competent staff, and a collaborative research environment are essential components to foster scientific productivity. We will sustain world-class scientific capabilities in our core disciplines to ensure that we are at the cutting edge in our signature areas. Simultaneously, we must create confidence that PNNL is working on high-impact science challenges and has the best tools and staff to do so in the DOE mission areas that the Laboratory supports.

To significantly impact important science challenges, we must be able to draw from our best talents across disciplines. Regional, national, and international collaborations with other leading scientists enhance the opportunities available to our staff, and complement and broaden our capabilities as a national Laboratory.

To encourage teamwork, we must consider new funding models and modern information technology infrastructure that will make it easier for our staff to have access to specialized experts and information across the spectrum of our research interests. Effective remote access to EMSL capabilities and enhanced connectivity to Internet II with the highest bandwidth available will create an environment that promotes exchange of ideas and thus enhance our ability to deliver high-quality science-based solutions to science challenges. This is an integral part of our research campus of the future and is absolutely essential for collaboration with the scientific community.

## Efficiency Leads to Productivity

Rapid access to information using electronic libraries and databases; advanced computational methods for data storage, retrieval, and analysis; and assistance in theoretical modeling and graphical presentation of data are hallmarks of the most productive institutions. For significant scientific accomplishments, support should be made available to help our staff promote their findings to the appropriate audience, with minimal impact on time to our scientific staff. The goal is to increase the time for productive engagement of our best and brightest scientific minds.

Similarly, scientists must have the best tools available to conduct their best research. Breakthrough instrumentation and computational tools that advance the state of the art are the keys to scientific leadership in chemical and related sciences in this century. We must work with our sponsors to ensure that these scientific research tools are continually upgraded and readily available to the scientists. In turn, exceptional capabilities in the tools of science are essential to attract the kinds of collaborations that sustain PNNL in an S&T leadership role. These capabilities are exemplified in EMSL, and must be maintained at the cutting edge in capabilities for molecular science.

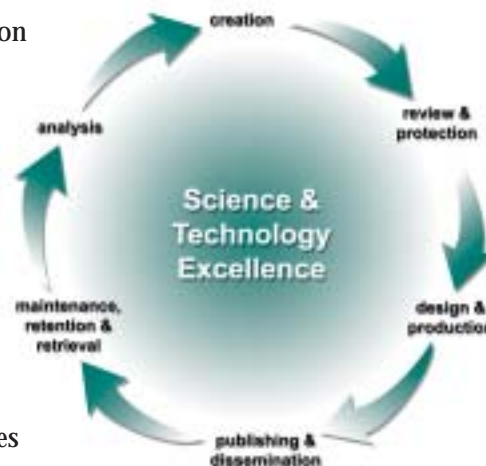


Our researchers have access to the state-of-the-art equipment, computational tools, and skilled experts necessary for conducting world-class research.

## 6.3.1 Transforming Scientific Knowledge into Information with Impact

**PNNL will optimize the impact of its primary product—information resulting from the conduct of research—through targeted enhancements in publishing and information management technologies and strategies.**

Our publishing and library and information science professionals partner with researchers to support the entire life cycle of scientific and technical information (STI). In addition, we are now focusing on ways to optimize the *impact* of our STI—to strengthen PNNL's reputation for scientific excellence and to maximize the benefits of investments in our publishing and information sciences infrastructure.



We will continue to expand our capabilities in areas that add quality and distinction to PNNL's STI products:

- ◆ Graphics and multimedia, particularly three-dimensional animation, high-end digital photography, and digital video editing and production.
- ◆ Science writing for strategic audiences.
- ◆ Delivery of full-text electronic journals, bibliographic databases, and networked information repositories.
- ◆ Reference and research services.
- ◆ In-house workshop offerings on presentation skills, grammar, facilitation, accessible web design, and specialized information databases.

We will expand disclosure of and access to PNNL's scientific and technical intellectual property by contributing original descriptive records for PNNL's publicly available technical reports to national and international research databases.

We will add new value to information through advances in bibliometrics and content management strategies:

- ◆ **Our publications, no matter how numerous, will not have impact if they are not read by the scientific community, potential clients, and other key audiences.** We have begun to analyze the trends in our placement of articles in peer-reviewed research journals. Are our articles accepted in the journals that will most likely be read by those key audiences? Which journals might these be? STI professionals are teaming with senior research staff to find answers to these questions. Once we establish our list of “high-impact” journals, we can begin to target them, working with research staff to submit their work preferentially to

DOE is placing increasing emphasis on knowledge management activities in the STI life cycle, especially with regard to creating, disseminating, and preserving scientific and engineering knowledge and fostering collaboration.

Operations

these journals for consideration. Along with the list of high-impact journals, we will develop metrics to track our progress. Not only are we interested in publishing more articles in these journals, we want to see whether this will increase the number of times these articles are cited by others—one of the most tangible measures of impact.

- ◆ **Our information is of little value to us if we are not managing it internally and leveraging it for reuse and decision support.** As the Laboratory begins to explore strategies for managing corporate knowledge, we are looking at ways to characterize and “catalog” the STI and operational information of the Laboratory. In looking at what other laboratories and companies have been doing, we are discovering that the most common mistake is a large investment being made in an information technology “solution” before the actual content is considered. We plan to start with the content: What is it about? Who uses it? In other words, what is the value of the information we propose to manage? Knowing this will help us design a content management model that merits the investment we make in it.



PNNL's research is promoted by publication in top-ranked scientific journals and by employing high-quality multimedia to illustrate its breakthrough technologies. (December 2002 *Nature Materials* cover, with PNNL cover article, reprinted with permission from Nature Publishing Group.)

## 6.3.2 Information Resource Management Supporting Science and Research Productivity

**PNNL aspires to be recognized by DOE as the model for applying and managing information technology to achieve the greatest possible value to clients, staff, and collaborators. We are aligning our information technology plans, investments, and information resource management processes to achieve this vision.**

PNNL's vision for information technology (IT) is to simultaneously excel at applying IT to solving the most challenging science and engineering problems, applying IT to managing and operating the Laboratory, and managing the information resources themselves. Attaining simultaneous excellence in these three areas requires that we achieve an appropriate balance among:

- ◆ The flexibility, ready capacity, high performance, and unfettered access sought by the open scientific community.
- ◆ The secure management of information resources that support our national security-related programs.
- ◆ The investments in IT to support efficient Laboratory operations versus investments in IT to enhance the scientific computing infrastructure.
- ◆ Achieving world-class efficient and effective management of information resources required by DOE, the DOE Office of Management and Budget, and Congress.

The challenges of simultaneous excellence are by no means unique to PNNL. Success demands creative problem-solving and outstanding relationships with the stakeholders—researchers and regulators alike.

A key element to achieving success in information resource management is our evolving IT planning framework. This framework consists of three parts:

1. **IT Strategy** - provides a high-level roadmap of how IT investments and information resource management activities will be aligned to help accomplish our mission and vision and support specific research activities and management system needs.
2. **IT Architecture** - describes in greater detail the current state and target state of our IT environment and the technology standards to be applied.
3. **IT Investment Portfolio** - refers to the total of our information resources and IT investments. The term "IT portfolio management" refers to the business processes used to select and monitor investments in IT and to prevent redundancy of existing or shared information resources.

Information resource management at PNNL relies on close cooperation and participation among Laboratory leadership, the research directorates, and management system owners to develop, approve, and maintain these plans.

Our Information Technology strategy is our implementation of the President's Management Agenda relating to "Expanded Electronic Government" and the FY 2004 DOE Annual Performance Plan, Goal 15: Information Management.

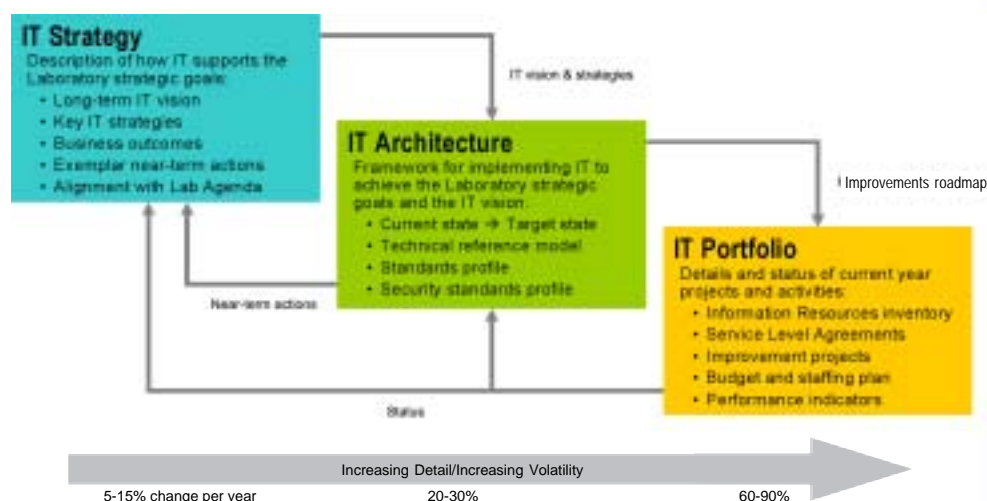
Operations



The IT strategy process is well established at PNNL with annual updates to the plan made since FY 1997. In FY 2002-2003, we invested to refresh our IT architecture document and to implement processes to keep this tool up to date. In FY 2003, we instituted a Program Management Office to monitor IT investments and provide project management support to general IT infrastructure and business information systems projects, and began to investigate best-in-class processes and automated tools for portfolio management. In FY 2004-2005, we will institutionalize the IT portfolio management processes that best fits the Laboratory's culture and other business processes, and implement automated planning and tracking tools to reduce the administrative burden.

The following key desired business outcomes from IT investments at PNNL were identified or confirmed through the IT strategic planning process for the FY 2004-2008 planning period. At the top of the list are those that are central to supporting the science mission of the Laboratory, followed by those that promote leadership in research management and operations.

- Outcome 1:** Support valued research programs that demand high-performance information resources.
- Outcome 2:** Provide research and support staff with reliable and cost-effective access to needed information resources, regardless of location.
- Outcome 3:** Foster innovation and improve problem-solving through collaboration.
- Outcome 4:** Increase individual and work group productivity.
- Outcome 5:** Reduce the life-cycle cost of information technology.
- Outcome 6:** Reduce the burden, cycle time, and cost of administrative processes.
- Outcome 7:** Provide better information and tools for proposal, project, and capability management.



PNNL's IT planning process aligns IT investments to Laboratory objectives and priorities, promotes efficiency through technical standards and by eliminating redundancy, and monitors IT project and service performance to quickly identify potential problem areas.

### 6.3.2.1 Fostering Scientific Discovery and Innovation Through High-Performance Computing


**Access to high-performance computational resources—computers, information stores, and specialized software—is essential to strategies in all PNNL research areas. The initial single-mission high-performance computational focus realized in the Molecular Science Computing Facility is being broadened to support an increasing number of smaller missions requiring high-performance computing resources for scientific discovery and analysis as well as engineering models.**

PNNL's scientific and technical computing needs are driven by a variety of missions. High-performance scientific and technical computational support is critically important to our initiatives and ongoing research in biology and environmental and computational sciences, including those supported by the existing EMSL user facility and the future the DOE Genomics:GTL Facility II, the Whole Proteome Analysis Facility. The Laboratory must also be positioned to support other valued research programs, such as those related to energy and environmental S&T, that are unable to purchase dedicated large-scale computing and data storage resources. Finally, access to classified high-performance computing resources is essential to our important contributions to the DOE National Security mission and our expanding role supporting the DHS.

Our scientific and technical computing strategy is a partnership among the Molecular Science Computing Facility (MSCF) (housed within EMSL), the Computational Sciences & Engineering Initiative (CS&EI), and the Information Resources Management System (IRMS). Combined, these three entities deliver high-performance computing resources, large-scale data storage facilities, and specialized software tools to PNNL researchers and collaborators.

World-class computational resources housed in the MSCF are available for basic and applied research in environmental molecular science. During FY 2003, the MSCF installed an 11+ teraflop Linux-based supercomputer from Hewlett-Packard. The system has 1900 Itanium-2 (Madison) processors with 7.8 terabytes of system memory and 253 terabytes of I/O storage. The computer is available for both Computational Grand Challenge Projects and smaller general research projects.

The CS&EI (see Module 2.4.1) was established to strengthen PNNL's core capabilities in computational science, build program depth with the DOE's SC Advanced Scientific and Computational Research, and drive new classes of high-end modeling and simulation that significantly advance understanding in the physical and biological sciences. To support this strategic intent, CS&EI has implemented a 0.3-teraflop cluster computer that is available through an internal proposal/review process to provide compute cycles to major research areas across the Laboratory including subsurface modeling, biology, engineering, climate modeling, chemistry, homeland security, and other mission-critical areas.



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In the next few years, the MSCF and CS&EI expect to expand their approach to high-performance computing to include tightly coupled but widely geographically distributed computing and data storage resources at other laboratories and institutions. This poses significant challenges. First, this approach will require greater bandwidth and lower latency in our Internet connectivity than is delivered by ESnet today (described further in Module 6.3.2.2). Second, we must work with our peer laboratories and DOE to resolve cyber security-related policy issues and technical challenges to establish seamless multi-institutional resource interconnectivity.

Few programs can justify and afford computational resources of the class of the MSCF. To better support valued research programs that are unable to purchase dedicated high-performance computing resources, the IRMS is working with the MSCF and CS&EI to implement and promote ways to effectively aggregate and share computational resources across programs to build larger general-purpose computing capabilities. We will continue to provide and enhance network access to shared high-performance computing resources located at other sites and facilities, such as the National Energy Research Scientific Computing Center. We intend to supplement those offsite resources by implementing capabilities locally that facilitate pooling of computing resources between smaller programs and projects. In FY 2004, we will implement a general-use Linux-based cluster computing resource by reallocating an available interconnect switch. Projects will be able to join the cluster for modest costs and add capacity in small, affordable increments. A second general-use cluster will be added in FY 2005 to support Windows-based applications.

Another way we will facilitate pooling of resources is through a subscription-based service that provides our researchers access to a broad collection of scientific and technical software tools through a centrally managed, concurrent licensing system. Introduced in FY 2002, this service has proven to be very popular with PNNL researchers and a cost savings to sponsors. We will continue to expand this service by annually adding new applications and expanding existing licenses to meet increasing demand.

Computing support for PNNL's classified work is provided using desktop workstations housed in Limited Access Areas and a secure computing facility (SCIF). The computational needs of our classified work have evolved to far exceed the space within these resources. We are taking a two-pronged approach to providing researchers with access to classified high-performance computing resources: 1) classified network access to resources located at other sites, and 2) a local classified high-performance computing cluster. Initial capabilities for both were implemented during FY 2003 with connection to a single-mission classified network and installation of a cluster computer in our existing SCIF. In FY 2004 we will implement connections to additional mission-specific classified networks. Requirements for additional classified computing room space are being included in the planning for new facilities.



Figure 6.3.2.1. PNNL supercomputer resources include an 11.8-teraflop Linux cluster housed in the MSCF.

### 6.3.2.2 Network Connectivity: A Key Enabler and Critical Challenge to S&T Excellence

**Although PNNL has greatly improved network connectivity over the past two years—benefiting the Laboratory as well as other regional research and education institutions, local businesses, and Tri-Cities residents—significantly greater bandwidth is needed to support biology and national security research initiatives.**

Improving PNNL's network connectivity is critical to establishing the new Whole Proteome Analysis Facility for the Office of Biological and Environmental Research (BER) and to making other significant contributions to SC multidisciplinary, multi-institutional research programs. Projections by researchers indicate immediate need for OC12 (622 megabytes per second [Mbps]) Internet bandwidth, increasing to at least OC48 (2.5 gigabytes per second [Gbps]) by the end of FY 2005. A minimum of OC192 (10 Gbps) Internet bandwidth will be needed to replicate massive experiment datasets to multiple collaboration sites when the proteomics facility comes online in FY 2007. In addition, implementing classified network connectivity is essential to our contribution to the DOE National Security mission and our expanding role supporting the DHS.

We are investing in network improvements to meet many of these needs. In FY 2002, we improved internal network performance by upgrading our backbone with switches capable of handling multiple 10-gigabit Ethernet paths between facilities and started to deploy 1-gigabit Ethernet to individual offices and laboratories. In FY 2003, our firewalls and border routers were upgraded to accommodate increased bandwidth to the Internet. Working with local businesses and Internet Service Providers, we have established a Local InterNetwork eXchange to keep local traffic local and provide better Internet service for PNNL, other local businesses, and Tri-Cities residents.

Providing sufficient Internet bandwidth for communications with research partners is a particular challenge due to the relatively high cost of bandwidth to eastern Washington State. Until mid-FY 2003, PNNL network connectivity with DOE, university, and industrial research collaborators was provided exclusively by an OC3 (155 Mbps) connection to ESnet. Our path for connectivity was an OC3 circuit to the Pacific Northwest GigaPOP in Seattle, funded from PNNL general and administrative overhead, and an OC3 connection from the Seattle GigaPOP to the ESnet "cloud" funded by SC. We also funded a low-speed (1.5 Mbps T1) backup path to the Internet to provide connectivity for business-essential applications during rare interruptions to ESnet service.

In FY 2003, we increased bandwidth to university research partners fourfold by upgrading our connection to the Pacific Northwest GigaPOP to OC12 and joining the Internet2 Abilene network. We also upgraded our backup path to the Internet to 10 Mbps using a commercial Internet Service Provider. By leveraging and supporting the efforts of public utility districts who are working to extend broadband network service to rural communities in Washington State,

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and by partnering with CalTech and the National Science Foundation-funded Hanford Laser Interferometer Gravitational Wave facility, these improvements have been made with very little increase in operational costs and no impact on PNNL general and administrative rates.

Despite these improvements, network connectivity to research partners at other DOE laboratories is still constrained by the OC3 ESnet connection with the Seattle GigaPOP. BER program support is needed to overcome this bottleneck and increase the ESnet circuit to at least OC12 in FY 2004, consistent with our connection to collaborating universities, and to OC48 by the end of FY 2005.

Finally, we are actively exploring options for even greater bandwidth, both within and outside of the region, to support the Whole Proteome Analysis Facility and other research programs. Multiple alternatives are available. NoaNet, which currently supplies our OC12 connection to the Seattle GigaPOP, is capable of supplying OC192 bandwidth to Seattle and Portland, where we can connect with ESnet and Abilene through one or more national telecommunications carriers. The National LambdaRail, a fiber optic research network being constructed by a consortium of universities, will pass within 30 miles of PNNL's Richland campus (see the figure). This network is capable of delivering multiple 10 Gbps wavelengths (Lambdas) to serve very high-end experimental and research applications. The ESnet technical strategy includes moving to an owned fiber-optic network similar to the National LambdaRail. Level3, the company providing fiber optics to the National LambdaRail, can also provide fiber optics to ESnet to provide connectivity to PNNL as part of future upgrades.

PNNL is initiating an effort among the DOE laboratories to define near-term and long-term network bandwidth requirements for biological research and represent these unmet needs to the ESnet steering committee.



The National LambdaRail fiber optic research network, which will pass within 30 miles of PNNL, is one alternative available for ultrahigh performance network connectivity to support proteomics research.

### 6.3.2.3 Increasing Individual and Team Productivity Through IT


**PNNL's plans for personal computing and collaboration technology for the next few years are evolutionary, not revolutionary, and are focused on reducing total cost of ownership, while continuing to increase the functionality of tools available to our staff to improve scientific effectiveness and productivity.**

Driven by our tradition of cross-disciplinary research as well as our geographic location, PNNL has long been a leader in deploying and using IT to increase the productivity of dispersed teams. "A Laboratory Without Walls" was a strategic theme at PNNL as early as 1992, and the concept of a "collaboratory" was prominent in early proposals for EMSL.

Today, our innovative electronic collaboration and information-sharing tools enable diverse teams of staff and collaborators to work together, irrespective of time or location, to deliver the maximum possible value to our customers. Our staff have ready access to a rich pallet of collaborative tools that enable more effective and efficient conduct of research and operations functions. Capabilities in use today include:

- ◆ Extensive videoconference facilities (fixed conference rooms, mobile units, and high-quality desktop systems).
- ◆ Two nodes on the worldwide Access Grid for multisite meetings and research collaborations.
- ◆ WebEx™, a commercial service for remote meetings, presentations, and demonstrations of research products.
- ◆ CollabraSuite, a collection of tools for team information-sharing, brainstorming, task tracking, discussion groups, and virtual meetings.
- ◆ CORE2000, a real-time Internet collaboration environment developed for EMSL that includes audio, video, whiteboards, shared applications, and remote instrument access.
- ◆ Electronic Laboratory Notebook, a web-based system for individual or joint authoring and recording of research activities and results.
- ◆ Broadcast of live and recorded meetings and presentations over the PNNL intranet (see the figure).
- ◆ Electronic mail featuring Entrust-PKI encryption for privacy of communications with DOE and other DOE laboratories, and effective spam controls and virus protection.

These tools allow for capturing and sharing of information, joint authoring of documents, brainstorming over long distances, and electronic meetings that reduce the cost, lost productivity, and personal "wear and tear" of travel.



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Our actions in the next few years are focused on delivering the highest possible value returned from the Laboratory's \$7+ million annual investment in personal computing equipment, software, and services. Our strategy is to lower the life-cycle cost of ownership through standardization, configuration management, electronic procurement, leveraged purchasing deals, and concurrent user software licensing. We will simultaneously improve the productivity of IT users through convenient and cost-effective support and training, including online, "just-in-time" training on commonly used software. We will continue to enhance and expand the core collaboration tools and capabilities, and replace custom-built tools with cost-effective commercial equivalents as they become available. We will expand use of the Internet as a ubiquitous and cost-effective communications transport. For instance, in FY 2004 we will begin to pilot Voice-Over-IP in place of POTS—"plain old telephone service."

Finally, and most importantly, we will aggressively educate and train our research staff on the availability and use of IT to increase their productivity, empower effective collaboration with other DOE laboratories and regional universities, and continue to leverage PNNL's strength in interdisciplinary research.

The screenshot shows a web browser window titled "InfoView - Polymeric Electrolyte Membrane (PEM) Nanocomposite". The main content area is titled "PEMFC AND DIRECT METHANOL FUEL CELLS (DMFC)". On the left, a video player shows Dr. James E. McGrath, Director of Materials Research Institute at Virginia Polytechnic Institute and State University. Below the video are buttons for "Download Presentation" and "Interactive Media Streams".

	ADVANCED PEMFC	DMFC
Characteristics	Higher power density	Simpler design
Application	Stationary power	Portable electronics
Typical operating conditions	80°C, 80-100% rh	25-60°C, 0.5 mole or higher, wet humidified air feed
Major technical challenge of PEM	Increase operating temperature (100-140°C)	Reduce methanol crossover

Researchers can view and participate in guest lectures, briefings, and meetings broadcast live over the PNNL network using streaming video technology. This allows broader participation by staff, regardless of their location. Broadcasts can be recorded and replayed on demand by travelers or other staff who are unable to view the event live.

## 6.3.2.4 Enabling Operational Excellence Through Business Information Systems

**The focus of PNNL investments in business information systems has shifted from increasing IT efficiency to optimizing business processes. The result will be even greater research staff productivity and contributions to PNNL leadership in research management.**


During the past five years, we have worked diligently to increase the value of IT to managing the Laboratory by implementing information systems that improve the efficiency and cost effectiveness of vertical business processes housed within the Laboratory's management systems, and that assist staff to protect the environment, ensure public health and worker safety, and comply with regulations and policy. We have adopted an industry best practice of incrementally implementing and integrating commercial off-the-shelf business information systems. However, when there is no appropriate commercial solution or solution developed at other federal laboratories, we have the capability to develop our own best-in-class business applications. Some of these custom applications have been adopted by other federal research facilities, and others have been commercialized. Our Chemical Management System, Assessment Tracking System, and Standards-Based Management System have all been transferred to other DOE and DoD sites. In addition, the Chemical Management System and our Purchase Card applications have been sold commercially.

We have also strived to increase the efficiency of business information systems implementation, maintenance, and operations by reducing complexity through standardization and by implementing a mature data warehouse environment that is used to capture, share, and preserve information, and to efficiently integrate business applications. This effort is a work-in-progress with changes made to existing applications only in the course of normal system life-cycle upgrades, but significant progress and favorable comparison has been noted as a benchmark of PNNL IT conducted by the Hackett Group.

In the next several years, our investments in business information systems will shift focus from improving IT efficiency to optimizing business processes, as represented in the figure. This shift will include investments in three areas: business applications, business computing infrastructure, and business data management.

### Business Applications

As previously noted, we have worked diligently to implement information systems that improve the efficiency and cost effectiveness of vertical business processes housed within the Laboratory's management systems, and that assist staff to protect the environment, ensure public health and worker safety, and comply with regulations and policy. The next evolution of PNNL business information systems are role-based workflow applications that contribute to seamless integration of management system processes—reducing the burden on researchers and enabling them to spend even more of their time on research while continuing to safeguard the Laboratory's resources and protect the health and safety of workers, the public, and the environment.



Operations

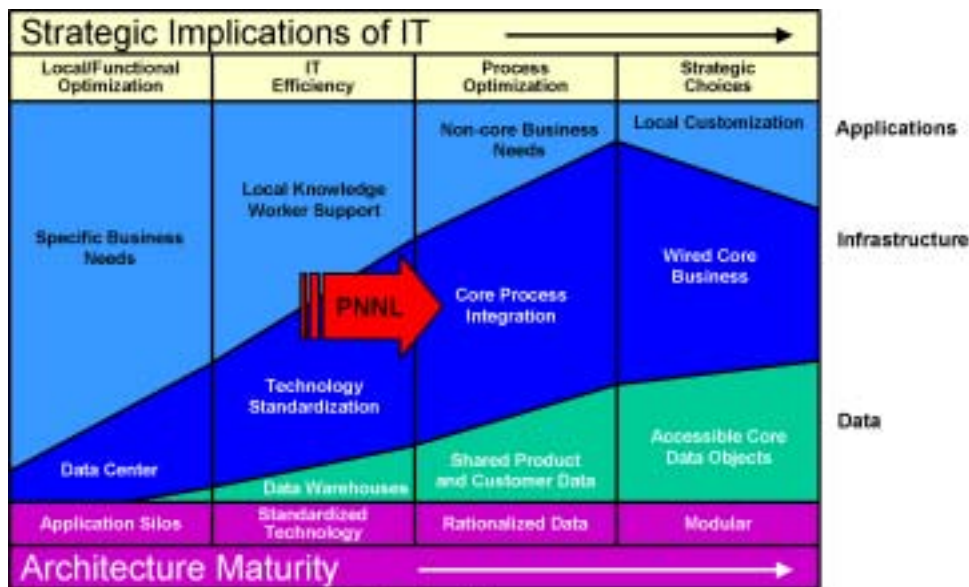


## Business Computing Infrastructure

For the past several years, we have worked to simultaneously reduce the cost and improve the performance and reliability of our business computing infrastructure by reducing complexity. With measured success in that effort, our focus has shifted to adding the infrastructure capabilities needed to seamlessly integrate existing and future business applications as described earlier. Specific capabilities being implemented now and during the next few years include a role-based access control system, an application integration workflow engine, and an intranet portal environment.

## Business Data Management

We have a very mature data architecture that supports business transaction processing and decision-making. This architecture incorporates a data warehouse that captures and stores historical transaction data, an operational data store that is used for integrating business applications, and “data marts” that are optimized for online analysis and reporting of business information. Benefits from investments in this architecture have included improved project financial performance due to the delivery of more timely and complete cost information, better management controls through the ability to audit and analyze transaction data, and reduced business application development and integration costs. Current efforts and future plans will improve the sharing of operational data using web services and will add content management functionality for capturing and sharing research capabilities, best practices, proposals, and other similar unstructured information.



Investments in PNNL business information systems have shifted focus from increasing IT efficiency to optimizing business processes. The result will be even greater contribution to PNNL leadership in Laboratory management.