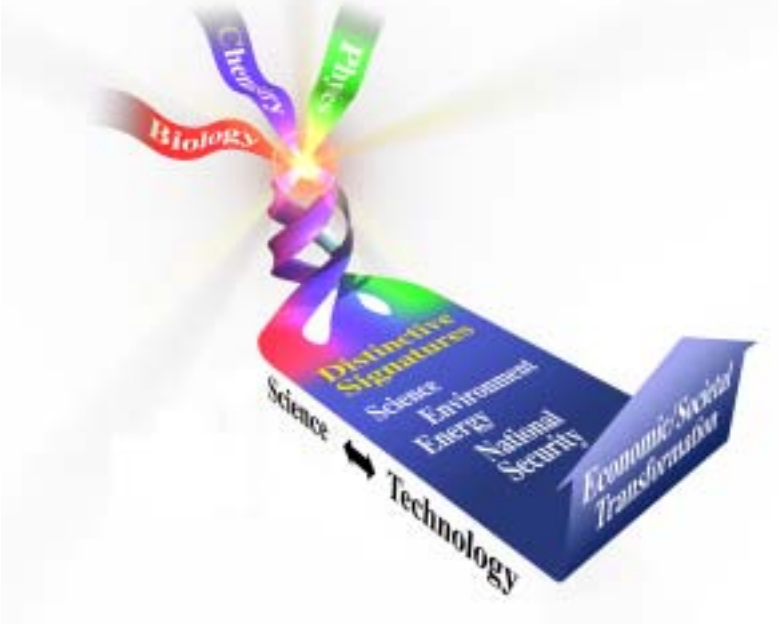
1—Laboratory Strategy



Laboratory Strategy

1.0 PNNL's Mission, Vision, and Strategy—An Overview

Our operating principle of simultaneous excellence in S&T, laboratory operations, and community service enables us to deliver on our mission and implement our strategy.

The central focus of our strategy is delivery on our mission. Our Laboratory vision and strategy, respectively, show where we intend to be in the next 20 years and what we will do during the next 5 years to make progress on getting there.

Mission

PNNL performs basic and applied research to deliver energy, environmental, and national security for our nation.

We provide science-based solutions to DOE's challenges of expanding energy, protecting national security, conducting world-class scientific research, and resolving the environmental legacy of the Cold War. We develop and maintain significant R&D capabilities to create new scientific knowledge. We deliver substantial value to our customers by fully understanding their needs, creating responsive new ideas and capabilities, and delivering exceptional results, which benefit our community, the region, and the nation. We achieve this through our outstanding staff, demonstrated excellence in research management and laboratory operations, and high-value partnerships.

Vision

PNNL will be recognized worldwide and valued regionally for our leadership in rapidly translating discoveries into solutions for major challenges in energy, national security, and the environment by integrating the chemical, physical, and biological sciences.

We intend to *advance the reputation of the Laboratory* to a degree that the best chemical, physical, and biological scientists from around the globe spend time working here. Increased leadership in professional societies, high-impact publications, hosting visits to the Laboratory by distinguished scientists, and recognition by the scientific community are some of the ways we will measure our progress.

Our *regional value* is essential to our future, as we help ensure the economic stability of our community and the broader S&T vitality of our region. We will build advocacy among university and industrial partners, resulting in economic and political environments supportive of national R&D agendas. We will gauge our contribution to the region through increased relevance and impact of our university and industrial collaborations, the success of our technology transfer programs, and our ability to attact new R&D companies to the region.

We will continue to refine and strengthen our historical expertise in *integrating science* across the various mission disciplines, as well as the integration of science to application. Our success in this area will be measured by the quality, relevance, and impact of our science-based solutions and increased roles in supporting our customers.

Laboratory Strategy

To achieve the elements of our vision, we are developing a growth strategy that meets the S&T needs of DOE while ensuring the long-term viability of PNNL and the R&D climate in our region. The top elements of our Laboratory strategy, as illustrated in the figure, reflect the value we provide to DOE.

Our principal value is the delivery of high-quality S&T solutions, which make significant impacts on DOE's (and the nation's) most critical challenges in science, energy, national security, and environmental quality. As the Laboratory owner, DOE also values effective and efficient conduct of facility and business operations that support mission delivery, while ensuring the protection of our staff and neighbors and long-term institutional stewardship. These qualities will ensure that we build the capabilities needed to meet the nation's S&T needs for the next several decades.

Modules 1.1, 1.2, and 1.3 provide summary information on each of the three strategic objectives and their associated goals. The subsequent chapters of this Institutional Plan align with these objectives and provide the remaining details on what we will accomplish.

We will deliver our Laboratory strategy using Battelle's operating principle of ensuring simultaneous excellence in all facets of Laboratory management. We are committed to ensuring that our management attention and discretionary resources are properly balanced across delivery of S&T, conducting work operations with excellence, and addressing the needs of communities and the region in which we work.

The three elements of value we deliver to DOE frame the key tenets of our strategy.

- **Mission Delivery and S&T Excellence** – As a multiprogram laboratory, we excel in creating and rapidly translating scientific discoveries into solutions to the greatest challenges faced by all of DOE's missions. Our program leadership, user facility impacts, and scientific accomplishments are widely recognized.
- **Research Management and Operational Excellence** – Our Laboratory is the most effective and efficient in the DOE system at delivering outstanding research and maintaining excellent operational practices.
- **Community and Stewardship Excellence** – We build and maintain state-of-the art facilities, valuable regional partnerships, and supportive work environments, which enable our staff to deliver innovative science and substantial benefits to the communities in which we work.

Our strategy serves as the outline to this plan and provides a balanced approach to ensuring that the Laboratory is focused on and able to deliver on our vision.

Laboratory Strategy

1.0.1 Institutional Issues and Planning Assumptions

Effective, multilateral partnerships within and across the DOE offices we serve are essential to our strategy and to successfully achieving our vision.

We Face Three Urgent Challenges

Challenge No. 1 – 300 Area

As one of DOE's Office of Science (SC) multiprogram laboratories, we provide scientific research capacity and advanced scientific knowledge to support all of DOE's high-level strategic goals as well as key interagency R&D priorities. Our core capabilities for supporting these goals are outlined in Module 1.1.2 of this document. A significant portion of the facility infrastructure needed to deliver these capabilities resides in a set of aging, Cold War legacy facilities that make up the 300 Area of the Hanford Site. These facilities compose a third of PNNL's research space and represent the majority of DOE's laboratory space dedicated to multimission programmatic research. However, they also represent a significant infrastructure liability, including tens of millions of dollars in deferred maintenance, approximately $300 million in decontamination and decommissioning costs, facilities situated over and adjacent to contaminated sites, and facilities poorly configured for future research needs. DOE's legacy cleanup responsibility encompasses these facilities and plans are under way to accelerate this activity to reduce costs and meet cleanup goals.

As part of an aggressive strategy to address 300 Area transition and reshape our campus, we are evaluating future mission needs and developing a capital asset acquisition plan to provide needed facility capabilities. This will enable us to retain and advance core research capabilities, including unique ultratrace detection, radiochemistry, and biogeochemistry capabilities that are important to DOE's cleanup, energy, science and weapons nonprofileration missions, as well as to the Department of Homeland Security (DHS), and other agencies. This also provides the opportunity to consolidate and co-locate capabilities to reduce our legacy footprint, increase operational efficiency, and enable research integration for the future.

As a result of the uncertainties associated with 300 Area building availability, the programmatic forecasts presented in this document are based on the assumption that these capabilities are available during this planning period. However, there are considerable management and timing challenges, including the need to balance an aggressive plan to reduce hazards and contain material inventories in preparation for the transition requirements associated with sustaining operating facilities and building future programmatic capabilities. We are currently seeking agreement with and support of this transition strategy from our major customers, following DOE's capital asset acquisition process, as appropriate.

Challenge No. 2 – Shared Responsibility for the Laboratory

In its leadership role to advance the nation's S&T capacity, SC closely coordinates the research activities at its multiprogram laboratories to promote the transfer of its basic research results into advances that serve all of DOE's missions. In this capacity, its laboratories serve a diverse set of science and technology sponsors from across the DOE and other funding organizations. As an SC multiprogram

laboratory, we integrate science to solve significantly challenging problems in energy, national security, and the environment. This ability to bring science to bear on problems is a strength of ours, and is key to realizing our vision; however, it presents a fundamental stewardship challenge.

To continue providing high-impact science and science-based solutions, we must sustain state-of-the-art R&D capabilities. SC has provided exceptional support to meet our upgrade, maintenance, and development requirements; however, delivering the accomplishments outlined in this plan will require significantly increased support. Achieving this support will involve broad partnerships with our major customers to help define and meet mission-driven needs for capability development, research equipment, and research facilities. The 300 Area transition is the most pressing and significant issue we must deal with in the next five years, but it certainly is not the only driver for shared responsibility, which can occur at many levels within the Laboratory's programs.

We are looking now for a commitment in principle to this concept from our major customers, and will work with SC and appropriate DOE offices on the mechanisms needed to develop a practical and valuable approach for ensuring our continued ability to deliver unique capabilities and solutions to our multiple missions.

Challenge No. 3 – Local and Regional Vitality: PNNL as an Enduring DOE Asset

This plan presents a picture of S&T growth for the Laboratory. This growth will be fueled by strong leadership within our mission and program priorities and enabled by the successful operation and stewardship of the Laboratory. However, the most critical ingredient for this growth is our staff. A vital community and a vigorous R&D environment are prerequisites to our ability to recruit and retain the numbers and quality of staff we will need to realize our vision.

As the numbers of science and engineering graduates decreases nationally, all R&D organizations are challenged to attract S&T staff. However, PNNL faces another situation that affects our ability to attract talent across the organization. As DOE's cleanup mission works toward closure at Hanford, labor projections for the local economy over the next 10 to 20 years take a significant downturn. The losses will occur in the community's high-end jobs, representing a disproporational economic impact and affecting the community's ability to maintain services and amenities that are attractors to developers and residents. As an increasingly important employer and source of stability in the community, it is critical that the Laboratory help stimulate replacement economic growth. It is also important that we catalyze R&D growth in the region around us. This growth requires higher levels of state support for R&D and will drive an active constituency for federal (including DOE) science programs and budgets. We recognize that stimulating significant growth in DOE and other federal programs consistent with our vision and core capabilities will be a challenge, as will be realizing high-end R&D growth in the region beyond the Laboratory.

To meet these challenges, we are aligning our capability and business investments, and are working closely with our DOE field office, congressional representatives, and industry and university partners in the community and the region. The research and staffing outlook described in this plan assume that these activities successfully maintain a vibrant community and regional R&D environment.

Laboratory Strategy

1.1 PNNL's S&T Excellence is Essential to DOE's Missions

We will deliver exceptional S&T results that significantly impact DOE's most important challenges.

In this module we list the most important S&T goals we intend to achieve between now and 2008. Modules 1.1.1 to 1.1.4, respectively, describe the mission drivers, S&T capabilities, current program status, and key accomplishments relevant to our vision.

This year, we have accepted three stretch goals from DOE-SC that are important drivers for this Institutional Plan. These include stretch goals for:

- significant accomplishment in environmental biology, including a measurable substantial increase in the impact of EMSL
- increased national position in condensed-phase and interfacial chemical physics, including active engagement of leading scientists and students external to the Laboratory
- significant improvements in the effectiveness of supercomputer performance as a tool for scientific discovery.

Science Mission

We will develop PNNL into a world-renowned laboratory for the scientific community, focused on critical challenges in the chemical and environmental sciences, systems biology, and atmospheric sciences and global change (Chapter 2).

Our science mission will provide new tools and state-of-the-art facilities that will be a cornerstone in the nation's scientific infrastructure, increase the fundamental understanding needed to resolve important scientific questions, and produce discoveries that provide the basis for new, mission-relevant applications. In partnership with other national laboratories and universities, we will:

- Transform how biological systems are described and understood by profoundly impacting how experiments on cellular systems are performed and how the resulting data are analyzed and interpreted.
- Establish a national position and agenda in interfacial chemical catalysis that will significantly enhance our understanding of the physical chemical processes in control of catalytic activity and selectivity.
- Deliver the foundations for the next-generation, physics-based climate models, and create next-generation models for effective climate policy decisions.
- Increase the efficiency of high-performance computing for chemistry, molecular science, biology, regional climate modeling, and subsurface science challenges.
- Optimize our operation of the William R. Wiley Environmental Molecular Sciences Laboratory (EMSL), with the goal of exceeding the scientific impact promised when EMSL was conceived and built.

Energy Mission

We will expand scientific knowledge and create breakthrough technologies for the energy system of the future, providng secure, clean, affordable energy in a carbon-constrained world (Chapter 3).

We will enhance existing energy systems to improve efficiency, security, and reliability, and to bridge the gap between these systems and tomorrow's hydrogen economy. By working with DOE and other customers and partners, and building on advancements in systems biology, catalysis, and computation, we will:

- Reduce the dollar-per-kilowatt cost of solid oxide fuel cells by 50 percent.
- Enable existing nuclear plants to safely extend their operating licenses by decades.
- Provide the means to transform agricultural byproducts into high-value chemicals and products, supporting the DOE Office of Energy Efficiency goal to create a $1 billion annual bioproducts business.
- Deliver technologies for producing both electricity and hydrogen from fossil fuel, with carbon sequestration.

- Provide new information and energy technologies that will transform today's energy system into one that is intelligent, robust, reliable, and secure. This comprehensive, intelligent grid of the future can save the nation $80 billion of its projected $450 billion investment in energy infrastructure over the next 20 years.
- Advance transportation technology through the development of lightweight materials, fuel cells, and emission management technologies for the automobile of the future.
- Apply economically feasible solutions to challenges associated with hydrogen production, storage, distribution, and safety.

National Security Mission

We will be the leader in applying fundamental and applied sciences to create innovative solutions that prevent the proliferation of weapons of mass destruction, ensure compliance with international arms control treaties, and protect the nation's critical infrastructures (Chapter 4).

PNNL's programs in national security and homeland defense are built on a strong link between our science programs and our engineering base. We have established four mission areas that align our S&T capabilities with the challenges of our major clients as follows:

- Reduce treaty violations and risks to global security by delivering advanced S&T capability to the design and leadership of U.S. government initiatives targeting the international proliferation of nuclear, chemical, and biological weapons.
- Apply advances in S&T to deliver robust detection, analysis, and decision systems that protect national assets, preclude strategic surprise, and defend against attacks on the U.S. homeland.
- Become the provider of choice for information and analytical technology products serving the U.S. intelligence community.
- Provide innovative technology solutions and leadership to facilitate transformation of the military for the 21st century.

Environmental Mission

We will be the leading S&T laboratory for expedited cleanup and sustainable processes (Chapter 5).

We will continue to provide science-based solutions to DOE's most critical national cleanup challenges and will expand the application of our capabilities to other national and international environmental challenges. We will:

- Substantially reduce the cost, time, and risks associated with restoring the environment affected by the legacy wastes from the nation's nuclear weapons production program.
- Protect ecological and human health by ensuring the safety of the workers performing cleanup activities as well as protecting the public and environment adjacent to cleanup sites.
- Generate the discoveries and develop the technologies that will help sustain the global environment through improved management of ecosystems, carbon generated from energy and other sources, and water resources.
- Provide scientific information that supports decisions around establishment of the Yucca Mountain repository.

Our core science mission and base capabilities provide the essential foundation for our interdependent mission programs.

Laboratory Strategy

1.1.1 Relevant DOE Mission Drivers and S&T Strategy

Our S&T goals in Module 1.1 and our programs in Chapters 2 through 5 are responsive to DOE's Strategic Plan.

DOE Mission and Program Priorities

Our programs are guided by DOE's Strategic Plan: "Protecting National and Economic Security with Advanced Science and Technology and Ensuring Environmental Cleanup." (September 30, 2003)

DOE's **science** strategic goal is to provide world-class scientific research capacity needed to ensure the success of DOE missions in national and energy security; to advance the frontiers of knowledge in physical sciences and areas of biological, medical, environmental, and computational sciences; and to provide world-class research facilities for the nation's science enterprise. Our programs are aligned with four out of the eight strategies that DOE has set for its science programs:

1. Advance energy-related biological and environmental research, building foundations in genomic science, climate modeling, contamination and transport modeling, and related interdisciplinary sciences (Modules 2.2.1–2.2.3). The work we will do in support of the Office of Biological and Environmental Research (BER) on this strategy, including the developments that will occur in the DOE Genomics: GTL High-Throughput Proteomics facility that we hope to secure at the Laboratory, will be beneficial to DOE's science strategy regarding development of new diagnostic and therapeutic tools and technologies for disease diagnosis and treatment, noninvasive medical imaging, and biomedical engineering (Module 2.5).
2. Advance nanoscale science built around foundations in materials, chemistry, engineering, geoscience, and energy biosciences, leading to improved energy technologies and systems (Modules 2.3–2.3.1).
3. Advance scientific simulation and computation by applying new approaches, algorithms, and software and hardware combinations to the critical science challenges of the future.
4. Provide or support access by the nation's scientific community to world-class, computational and networking facilities that support advancements in practically every field of science (Modules 2.4–2.4.1).

DOE's **energy** strategic goal is to protect our national and economic security by reducing imports and promoting a diverse supply of reliable, affordable, and environmentally sound energy. This overarching intention has two subgoals: reduce dependence on energy imports and develop new energy technologies. Our programs are aligned with 7 of 14 strategies supporting these goals:

1. Collaborate with industry to develop the FreedomCAR, a demonstration of zero-emission, hydrogen-fueled, fuel-cell-powered vehicle (Module 3.1.2).
2. Develop and bring to market technologies that advance energy efficiency, including waste heat recovery and solid-state lighting (Module 3.1.4).
3. Ensure the availability of nuclear fuel to meet potential supply disruptions (Modules 3.5–3.5.1).
4. Accelerate the shift toward the hydrogen economy by developing and improving technologies to produce hydrogen using renewable energy, nuclear energy, and fossil fuels while overcoming obstacles to hydrogen storage and distribution (Modules 3.1.1 and 3.3–3.3.1).

5. Conduct R&D programs that displace or sequester carbon and reduce emissions (Module 3.4).
6. Research renewable energy technologies and work with the private sector in developing these domestic resources (Modules 3.1.3–3.1.3.1).
7. Develop technologies to reduce the vulnerability and increase the reliability of the electricity supplies, focusing on superconducting materials and distributed generation, relatively small-scale and modular energy generation devices (Modules 3.2–3.2.1).

DOE's **defense** strategic goal is to protect our national security by applying advanced science and nuclear technology to the nation's defense. Within this overarching goal are three subgoals, one of which focuses on nuclear nonproliferation. PNNL's programs, including our work for others, are aligned with all five of the strategies that will be implemented to address the nuclear nonproliferation goal (Modules 4.1–4.1.6 and Module 4.2):

1. Prevent the spread of materials, technology, and expertise relating to weapons of mass destruction.
2. Eliminate or secure inventories of surplus materials usable for nuclear weapons, and redirect excess foreign weapons expertise to civilian enterprises.
3. Secure radioactive sources that pose the greatest threat as potential ingredients in Radiological Dispersal Devices, or dirty bombs.
4. Enhance our ability to detect weapons of mass destruction, including nuclear, chemical, and biological systems.
5. Work to reduce the risk of accidents in nuclear facilities worldwide by improving safety regimes in Russia and other countries.

In addition, we are aligning our capabilities with the priorities of the intelligence community's need for analytical technologies (Module 4.4), DHS's need for advances in S&T for next-generation tools (Module 4.5–4.5.1), and the Department of Defense's (DoD's) goal to transform the military for the 21st century (Module 4.6.1).

DOE's **environmental** strategic goal is to protect the environment by providing a responsible resolution to the environmental legacy of the Cold War and by providing for permanent disposal of the nation's high-level radioactive waste. PNNL is supporting the following strategies for these goals primarily by providing S&T to Office of Environmental Management contractors:

- Review the remaining risks in concert with regulators and stakeholders to determine the most appropriate remediation schedules and approaches (Module 5.3).
- Focus S&T to directly address specific, applied technology needs for cleanup and closure for the next 5 to 10 years (Modules 5.1–5.1.5 and 5.4).
- Establish a permanent geologic repository for high-level waste and spent nuclear fuel at the Yucca Mountain, Nevada, site (Module 5.2).
- Investigate advanced technology options to promote future waste-management alternatives, which could significantly reduce the amount of future, spent nuclear fuel requiring disposal (Module 5.2).

In addition, we are aligning the capabilities that have been developed largely in response to DOE's legacy waste management mission to anticipate and address future mission needs that require a fundamental understanding of complex environmental systems to protect and sustain global environmental security, environmental and public health, and the economy.

This Institutional Plan states the Laboratory's technical intent and accomplishments for the next five years. Our FY 2004 Performance Evaluation and Measurement Plan identifies specific S&T accomplishments to be delivered in the first year of this plan. The programmatic modules presented in Chapters 2–5 describe the five-year direction and goals. Together, these describe the Laboratory's five-year S&T work plan.

1.1.2 S&T Capabilities

Our plan for substantial S&T accomplishment requires that we sustain existing core technical capabilities, create new capabilities, and house them all in a productive modern research campus.

Our strong base of established core technical capabilities, listed below, is well aligned with our current set of programs and many of our customers' future needs. Appendix B provides summary descriptions of research facilities and equipment that are part of these capabilities.

- **Chemical science and engineering** – trace and complex analyses, including instrument design; molecular modeling, including structures; radiochemistry; interfacial catalysis and advanced separations; micro chemical and thermal systems; chemical and biochemical process design and control
- **Material science and engineering** – macro- and nano-scale synthesis; materials manufacturing; environmental and radiation degradation; glass and high-temperature oxide (fuel cell) performance
- **Biological science and biotechnology** – microbial systems; analyses and modeling of biomolecules and systems; biological effects of radiation and chemicals; dosimetry
- **Computational science and information technology** – large-scale data management; problem-solving environments; high-performance computing in molecular sciences; computer system design and security; information analytics and visualization
- **Nuclear science and technology** – trace detection and analysis; reactor safety; fuel cycle processes and related security systems; nuclear-based detectors; non-destructive evaluation
- **Environmental sciences and engineering** – atmospheric measurement and remote sensing; climate modeling; geo- and biogeochemistry; fate and transport of contaminants; ecological monitoring, management, and remediation; integrated assessments and policy
- **Engineering of integrated systems** – device and system design and control; diagnostics and prognostics; robotics; systems engineering and assessments; integrated security systems; energy codes and standards.

A complete description of our partnerships is provided in Appendix A.

Though individual disciplines or capability areas are listed, we recognize that our most important innovations come from working at the interfaces among the major capabilities. In addition, we enhance our capabilities through strategic partnerships with universities, other national laboratories, and industry.

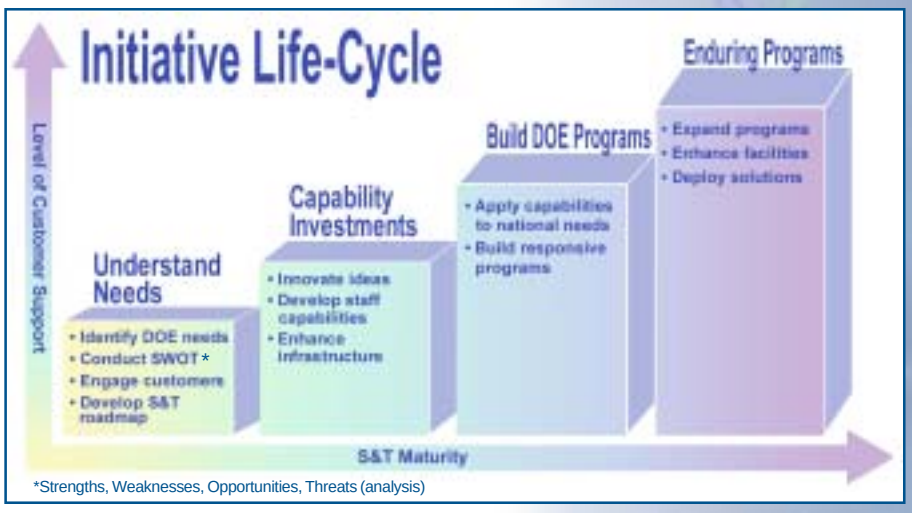
Investments to Enhance Our Capabilities

We enhance capabilities through funded R&D programs, direct DOE investment (e.g., budget line items), recruitment, and investment of internal PNNL and Battelle overhead funds. Substantial ongoing investment is required to maintain and enhance existing capabilities and create new ones to respond to future DOE needs. The drivers for making changes in capabilities (either divestment or enhancement) include the rapid pace of discovery and innovations in scientific equipment, changing customer needs, and new facility and infrastructure plans at the Hanford Site. With respect to our supporting research infrastructure, our long-term strategies for information technology and facilities are described in Modules 6.3 and 7.3, respectively.

To develop new ideas and technical capabilities to meet future program needs, we leverage program funds and make internal overhead investments, principally through

Laboratory-level initiatives and our Laboratory Directed Research and Development (LDRD) Program. We use a life-cycle approach to manage our initiatives. The figure shows the four stages:

1. Understand DOE's needs and our potential roles in meeting them.
2. Develop the new ideas, staff, and infrastructure that are needed to respond.
3. Work with DOE to build programs that leverage these capabilities.
4. Establish enduring, major programs with DOE and our other customers, which are able to produce deployable, science-based solutions.



Our life-cycle approach to managing initiatives ensures the creation of relevant, high-quality programs responsive to DOE's needs.

Following is a list of our current Laboratory-level initiatives, including the modules that contain details on each initiative. Details on our LDRD and peer review processes that support these initiatives are found in Appendix E.

- **Biomolecular Systems** (Module 2.2.1.1) – Build multidisciplinary, collaborative research programs that integrate molecular biology, biochemistry, physics, and computational science in ways that allow us to understand complex biological systems critical to DOE mission needs.
- **Nanoscience and Technology** (Module 2.3.1) – Establish foundational capabilities that enable us to contribute to key areas of nanoscience and to apply nanotechnology to needs in catalysis and biodetection.
- **Computational Science and Engineering** (Module 2.4.1) – Enhance computational science capabilities for creating multidisciplinary, computational approaches to solve complex DOE problems, create high-performance software suites, and make major advances in computational science.
- **Bio-Based Products** (Module 3.1.3.1) – Enhance capabilities that can provide DOE with innovative technologies to cost-effectively convert biomass into high-value products.
- **Energy Systems Transformation** (Module 3.2.1) – Provide new information and energy technologies that will transform the nation's energy system, from all fuel sources to domestic and industrial end uses, into a market-driven grid system, which is intelligent, efficient, reliable, and secure.
- **Carbon Management** (Module 3.4) – Provide the tools and understanding that can shape the nation's approach to addressing climate change and the capabilities needed to provide science-based solutions such as subsurface carbon sequestration.
- **Homeland Security** (Module 4.5.1) – Create major advancements in the fusion, analysis, and visualization of massive information sources and in robust, low-cost systems for collecting, concentrating, and sensing chemical, nuclear, and biological weapons to improve homeland security.

Laboratory Strategy

1.1.3 Program Status and Summary Resource Projections

Growth in our programs reflects the substantial benefits received and expected by our customers, and it will provide the additional resources essential to achieving our Laboratory strategy.

Resource Projection Story

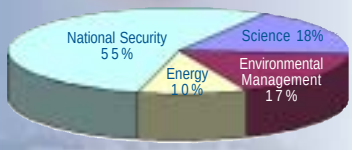
The resource level we project is an important indicator of how much our customers value our programs. The first figure shows a steady increase in our customers' investment in our staff, facilities, and programs. Our DOE programs are staying steady or growing in response to changing needs. We are providing substantial support to the DHS in response to the significantly increased terrorist threats against the U.S. homeland. (Current DHS funding in the range of $25 million to $35 million per year supports PNNL staff, and the balance is going to a large, multiyear project for establishing weapons detection systems at U.S. border crossings.) Our Work for Others (WFO) funding reflects the increasing value we deliver to other governmental agencies and is remaining at a manageable level. The second figure shows a modest but steady increase in staff deployed to our R&D programs, while our nondirect staffing level declines slightly, reflecting improved research productivity.

Details on budget and staffing changes in individual DOE and WFO programs are provided in each of the program chapters and in a consolidated table in Appendix D.

Our projections are conservative to ensure that our plans and investments can be delivered with a high degree of certainty. However, we believe that the significant and increasing challenges being faced by our customers can lead to additional programmatic growth over this time period. This growth is important because it provides additional internal resources that will accelerate our progress toward our vision. In particular, we believe there are significant opportunities for further programmatic investment in biological and environmental research, energy technologies that support administration priorities, and national and homeland security programs.

Planning Assumptions Around Federal Budgets and Policies

Our resource projections are influenced by the direction of federal budgets and policies. We assume that DOE's overarching mission of protecting national and economic security with advanced S&T will result in continued support for creating world-class scientific research capacity, advanced energy technologies, national security research and applications, and continued environmental cleanup. We believe that federal S&T budgets, including DOE R&D funding, should at least be stable and will likely increase, perhaps substantially, during the next five years.



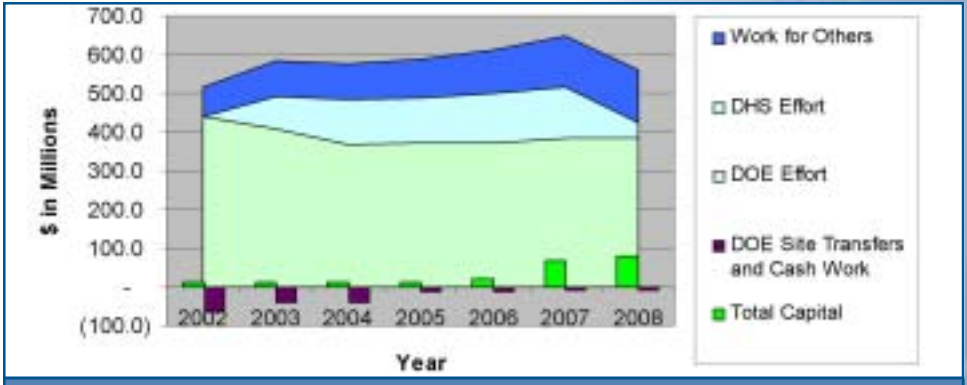
FY 2004 funding by DOE mission area (includes non-1830).

This view is based on increasing recognition by the Administration and Congress that investments in R&D underpin U.S. technological leadership, stimulate growth in the national economy, increase energy security, and provide solutions for the war against terrorism. We anticipate increased funding for advances in biological, chemical, and physical sciences; energy R&D; and homeland and national security-related programs. We expect funding for environmental R&D to continue to decline as a reflection of the progress being made in DOE's cleanup programs.

Even if optimistic projections prove accurate, the environment for allocating resources will be highly competitive, with many state governments seeking to support their research universities and attract other research investment as a means to sustain economic growth. The Office of Management and Budget guidelines for making federal investment decisions in basic and applied R&D will drive priorities in budget decisions and shape the evaluation of research programs at DOE and other agencies. DOE and the national laboratories will remain under pressure to improve management practices and to increase research productivity.

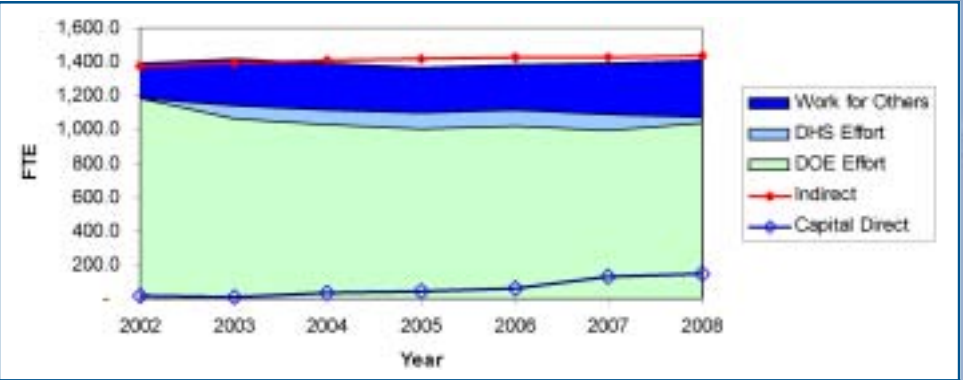
How We Develop and Present Our Data

We prepare detailed plans based on the strategy and program direction articulated in this Institutional Plan. An important step in preparing these plans is projecting the funding and staff levels envisioned during the next five years. These projections are essential for preparing investment strategies that will ensure that we have the infrastructure and capabilities needed to support DOE missions. We use standard assumptions for our projections in the Laboratory Funding Summary figure and table. R&D support to Hanford Site programs is included in the resource projections of various funding programs. R&D for other DOE sites is included in "DOE Site Transfers and Cash Work." The resource figures for FY 2002 and FY 2003 are actual values.



	2002	2003	2004	2005	2006	2007	2008
DOE Effort	441.4	409.0	369.1	371.6	371.3	384.3	385.0
DHS Effort	-	83.8	113.3	115.4	130.1	133.4	38.3
Work for Others	75.7	91.5	92.6	102.9	109.5	129.0	138.4
Total Operating	**517.1**	**584.3**	**575.0**	**589.8**	**610.9**	**646.8**	**561.7**
Capital Equipment	9.1	7.3	5.7	6.4	6.6	6.9	7.0
General Purpose Equipment-GPE	-	1.0	1.0	1.0	1.0	1.0	1.0
General Plant Projects-GPP	3.9	3.8	3.5	3.5	3.5	3.5	3.5
Construction Line Item	0.9	-	1.0	5.0	20.0	60.0	70.0
Landlord Line Item	-	-	-	-	-	-	-
Gross Laboratory 1830 Funding	**531.0**	**596.4**	**586.1**	**605.7**	**642.0**	**718.2**	**643.2**
DOE Site Transfers and Cash Work	(63.1)	(40.4)	(41.1)	(10.2)	(10.2)	(9.7)	(9.6)
Net Laboratory Funding	**467.9**	**555.9**	**545.1**	**595.2**	**631.0**	**708.5**	**663.6**

The Laboratory Funding Summary shows the levels of actual budget authority for the past fiscal year, current year projections based on formal notifications, and future expectations based on proposal and customer interactions. However, it does not include proposed construction line item funding for replacement general purpose facilities.



	2002	2003	2004	2005	2006	2007	2008
DOE Effort	1,184	1,067	1,025	1,002	1,017	991	1,039
DHS Effort	-	75	91	96	98	100	30
Work for Others	210	273	280	268	270	305	338
Total Operating	**1,395**	**1,415**	**1,397**	**1,366**	**1,385**	**1,396**	**1,407**
Capital Equipment	8	4	22	36	36	49	51
General Purpose Equipment-GPE	-	1	1	1	1	1	1
General Plant Projects-GPP	8	7	8	9	11	12	12
Construction Line Item	-	-	1	6	24	71	83
Landlord Line Item	-	-	-	-	-	-	-
Total Direct	**1,410**	**1,426**	**1,429**	**1,418**	**1,456**	**1,529**	**1,555**
Indirect	1,376	1,395	1,411	1,420	1,425	1,429	1,443
Total Laboratory Personnel (FTE)	**2,786**	**2,821**	**2,840**	**2,838**	**2,881**	**2,958**	**2,988**

The Laboratory Personnel Summary shows the levels of Laboratory personnel in Full-Time Equivalents (FTE) for the past fiscal year, current year projections based on formal notifications, and future expectations based on proposal and customer interactions. These values are based on standard assumptions including one FTE equals 1832 work hours per year.

Laboratory Strategy

1.1.4 A Record of Accomplishments

PNNL will play a major, demonstrable role in advancing DOE's reputation for delivering science-based solutions for energy, national security, and environmental challenges.

As highlighted below, our historical bias is to drive scientific advances and discovery into new approaches for solving our customers' challenges and into information that is useful to policymakers. We will continue to seek ways to apply the practical benefit of the science we conduct into all our mission programs.

Systems Biology

As a major but relatively new research thrust at PNNL, *systems biology* has already made significant impacts in various DOE programs. Systems biology focuses on how different parts of biological systems interact—from the molecular level to the whole organism level—to provide a comprehensive, quantitative, and predictive understanding of cell and organism function.

During 2003, we successfully performed the most complete analysis of the human plasma proteome, almost doubling the amount of biomarkers available for drug testing and for studying health effects, such as those related to low-dose radiation exposure. Based on these successes, we recently contracted with the National Cancer Institute to help generate chips to identify cancer biomarkers.

Because of our special expertise in high-throughput proteomics and microbial systems, we are a key contributor to the DOE Genomics:GTL Program. Staff who are developing that science base are engaging actively with staff who understand the challenges to effective solutions for cleanup, climate change, and biowarfare countermeasures and who appreciate how a better understanding of systems biology can solve those challenges. In environmental research, we are applying systems biology approaches to understand carbon sequestration, which plays an important role in global climate change. In environmental cleanup, we successfully provided comprehensive proteomics coverage of *Deinococcus radiodurans*, the most radiation-resistant organism known. We are also building projects into our Homeland Security Initiative that recognize the potential application of proteomics to the characterization of biological agents that might signal a threat to homeland security.

Our systems biology program is also leading to biotechnology R&D. We recently reported a breakthrough in single-chain antibody generation; subsequently, our new "library" contains over 10^9 distinct types of antibodies. It is now possible to create affinity-probes suitable for detecting pathogens and cancer-associated proteins at a speed far exceeding that of any previous technique.

Climate Change

For more than a decade, we have played a key role in implementing the DOE's Atmospheric Radiation Measurement (ARM) Program. ARM is specifically focused on the impact of clouds on the energy balance of the climate system, which remains one of the most important uncertainties in predicting the extent of climate change impacts.

Our senior scientists have been invited to provide information and participate in briefings to the Washington State legislators on the impacts of regional climate change.

ARM's land-based cloud observation systems allow scientists to improve models against observations for more precise climate simulations and weather predictions. This program has turned pioneering remote-sensing systems from intensively manned devices into routine, semiautonomous instruments. ARM observatories are now an integral component of international collaborations and U.S. government research programs sponsored by agencies such as the National Aeronautic and Space Administration (NASA) and the National Oceanic and Atmospheric Administration.

PNNL is also an internationally recognized leader in climate modeling and impact assessment at the regional scale. Our team of interdisciplinary scientists has developed regional scale projections of future climate change and examined its impacts

on water resources in the western United States between 2040 and 2060. These studies provide the scientific basis for showing how climate change might affect the United States and for developing energy-policy strategies to minimize its adverse effects.

Information Visualization

PNNL scientists developed a broad suite of technologies based on "data signature" visual analytics. This signature is derived from relationships within text, science, image, video, etc., with no prior knowledge of the content or structure, that scales to large information spaces. The underlying interdisciplinary science is the creation of these data signatures, the mapping of these into high-dimensional mathematical spaces, the identification of core concepts and themes, and then the visual and highly interactive paradigms. These high-dimensional relationships are projected into visual interaction paradigms closely modeled after the dynamics of the human mind that enable users to discover the unexpected in large, complex data sets.

This technology was recognized as an outstanding contribution from PNNL by the senior leadership of the U.S. intelligence community in FY 2003, along with two of our PNNL staff on assignment to the intelligence community and responsible for successful insertion of this technology into an operating environment. Recent inventions are now included as part of the core suite of technologies within the President's Terrorist Threat Integration Center and DHS. In addition, two commercial spinout companies have been created around this technology. Major commercial companies, such as Dow Chemical Co., have stated this technology has saved them millions of dollars. These technologies are also being applied within our Systems Biology Program to help manage the vast databases that are being generated as a result of our high-throughput proteomics research.

An estimated 8500 copies of various versions of our digital signature technology suite, In-Spire, are currently deployed in industry and government.

Fuel Cells

To support the nation's need for a more environmentally sustainable, efficient, and cost-competitive energy future, our fuel cell technologies apply to a wide range of uses, including distributed power for residential, commercial, and utility power plants, as well as for transportation and power for military operations. Building on 15 years of research in material properties, chemistry, and ceramic processing for fuel cells, our team of scientists is now focused on designing, modeling, and fabricating complete fuel cells systems, particularly solid oxide fuel cells. Our extensive modeling and simulation capabilities are helping to optimize individual fuel cells and fuel cell stack materials, and answer questions about the flow and thermal distribution within fuel cell stacks. In 1999, we teamed with DOE Office of Fossil Energy and its National Energy Technology Laboratory to form the Solid State Energy Conversion Alliance, which includes government agencies, commercial developers, universities, and national laboratories, with a common goal to commercialize solid oxide fuel cells within 10 years.

We are building the science foundation necessary to accelerate high-efficiency fuel cell technologies for DOE and industry clients.

Use of Catalysis in Treating Engine Exhausts

With our industry partners we developed an engine exhaust aftertreatment system that converts harmful oxides of nitrogen and particulate matter from vehicle engines into components of clean air. This system uses a nonthermal, plasma-assisted catalysis method to address industry's need for a technology to meet upcoming exhaust regulations for diesel engines. We transferred this technology to Delphi Corp., Caterpillar Inc., and the Low Emissions Partnership of USCAR. These technology advancements address a roadblock to widespread use of engines that could greatly increase fuel efficiency in vehicles, while reducing the nation's dependence on foreign oil and the amount of greenhouse gas emitted to the atmosphere.

PNNL developed a lightweight, compact fuel processor that converts traditional liquid hydrocarbon fuels to hydrogen for Proton Exchange Membrane fuel cells in electric vehicles.

1.2 Research Management and Operations: Continued Excellence, Improved Productivity

Our continued focus on excellence in research management and operations will ensure protection of DOE assets and will lead to a highly productive research enterprise.

Integrated Management of Research and Operations

We are successfully implementing an integrated management approach to the Laboratory's principal research and operations functions. By breaking down traditional operational stovepipes, we provide operational management systems that seamlessly work together to protect our staff, the public, and the environment; ensure compliance with all applicable requirements; reduce operational overhead costs; and support conduct of research that produces the outstanding results demanded by our customers. Examples of our outstanding record of operational accomplishment over the last several years are described below.

- We have received outstanding ratings on our Laboratory operations indicators over the last five years.
- We have reduced overhead rates by 20 percent since FY 1994, allowing us to increase the percentage of Laboratory funding directed toward research and investments in scientific initiatives, staff, and facilities.
- We have received and are maintaining the highly respected external certifications for Integrated Safety Management, Voluntary Protection Program, and International Organization for Standardization's Environmental Management Standard—ISO 14001.

We believe that we are on track to maintain this record of accomplishment through continued vigilance, revitalized approaches that keep staff engaged in operational outcomes, and efforts to ensure increased effectiveness and efficiency. With this strong foundation in place, we will invest in operations and new research processes to increase our research productivity. We believe that the cost of doing this will more than be repaid by the value received by our customers and the progress we will make in achieving our vision.

Defining and Measuring Research Productivity

To support this effort, which we expect to continue over the period of this plan, we have defined research productivity. As a starting point, research productivity refers to both the *amount* of new S&T created per customer dollar, and the *impact or value* of the new S&T in terms of 1) solving customers' most critical challenges, or 2) breakthrough discoveries that are broadly applicable and important S&T innovations. This definition may evolve over time, based on discussions with other laboratories and interactions with DOE Headquarters staff who are responding to the President's Management Agenda.

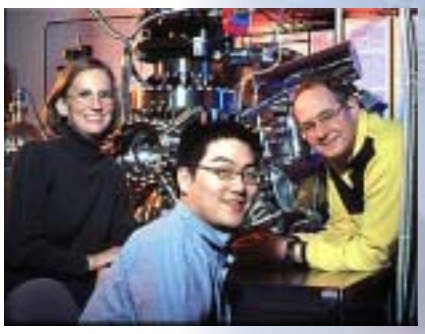
Our aspiration is to conceive and build the first-ever national laboratory system of quantitative and qualitative measures and associated measurement processes and tools, which are needed to identify the means to improve research productivity. Some of the measures we are considering include contribution to DOE and other client missions; peer-reviewed publications in the most important journals; numbers of citations, honors, and awards; intellectual property generated; and contributions to the supply of the future S&T workforce and to S&T literacy. We will test and refine this approach until we see substantial progress.

Improving Research Productivity

Many variables can have an impact on research productivity, including staff knowledge, skills, and development opportunities; new facilities and equipment; investments in developing new ideas; the number and nature of collaborations and partnerships, both with individuals and with institutions; improved operational processes; and management and administrative support, including help with proposals and publications.

We have selected what we believe are the three major drivers to simultaneously ensure managerial and operational excellence and improve research productivity. These drivers are summarized below and explained in detail in Chapter 6.

- Leverage our current outstanding operational performance to develop even more effective and efficient practices and tools that deliver scientific, technical, and economically valuable results to DOE and the nation, while simultaneously:
  - Protecting the health and safety of workers, the public, and the environment.
  - Safeguarding DOE's assets at PNNL.
  - Increasing funds available for Laboratory renewal.
- Build and retain a workforce of fully engaged managers and staff[(a)] with a mindset for continued operational excellence, the ability to substantially contribute to DOE and Laboratory outcomes, and a clear focus on scientific productivity.
- Optimize our core research management and work processes for understanding our customers' needs, integrating multiple disciplines to rapidly develop and deploy high-value solutions critical to DOE's missions, and enhancing DOE's assets at PNNL. We will enable and increase the impact of these new processes with a high-performance information management system.



Engaged staff and new work processes increase research productivity

SBMS

IOPS Home

VPP

We believe that engaged staff supported by seamless, best-in-class management systems will be safe, secure, and highly productive.

(a) Engaged staff are fully cognizant of their roles within the Laboratory strategy, are actively developing their skills, and are fully empowered to deliver high-quality work.

Laboratory Strategy

1.3 Establishing PNNL as an Enduring Regional Asset

We must sustain a modern research campus and significant, lasting, and mutually beneficial relationships with our community, state, and region to achieve our vision.

Ensuring Long-Term Viability

Over the next several decades we must be able to upgrade the human resources, equipment, and facilities needed to support DOE's important and increasingly complex research needs. One of the most important factors in doing this is a surrounding region that can provide strong economic and community support to the Laboratory and to national research agendas.

Our ability to recruit to meet future program needs will be significantly enhanced by maintaining the economic and social vitality of the Tri-Cities.

During the next two decades, most cleanup work at the Hanford Site will be completed, potentially reducing employment and the substantial economic benefit it provides to the Tri-Cities. By replacing a significant portion of these jobs, the Tri-Cities and PNNL will be competitive in retaining and attracting the best technical and operations staff. PNNL, DOE, and regional leaders are working together to diversify and grow a substantial R&D business as well as other businesses in the Tri-Cities. This means that community programs and economic development are no longer discretionary, but are strategic imperatives for PNNL and DOE.

Likewise, PNNL and DOE must also make federal and arrange third-party investments to reinvigorate and maintain the Laboratory's research campus. Finding solutions to DOE's future challenges and the future scientists and engineers engaged in finding those solutions will require state-of-the-art research facilities and equipment. The region can also play a key role in this by direct investment in the Laboratory's infrastructure by advocating sustained federal investment in the region.

The Plan

Based on current Hanford Site plans, we are a logical and promising candidate to become a primary source of economic stability in the Tri-Cities. As the most significant federal R&D organization in the Northwest, our research results, coupled with state-of-the-art facilities and equipment, can firmly establish the Laboratory as a long-term, highly valued regional asset. Thus established, we expect to continue to grow and add jobs, attract new R&D organizations to the community, and be seen by private and public entities in the region as a valuable asset worthy of support and investment. Additionally, regional support of DOE's research agendas not only helps sustain the needed programmatic support at PNNL, but provides DOE's programs with badly needed budget supplements. If over the next 10 years the Laboratory can realize growth sufficient to support 5000 plus staff, and if 2000 to 3000 new research jobs are created by others to take advantage of our resources, the economic base for the community will be significantly strengthened. Coupling this with the Laboratory's ongoing community support through financial and volunteer contributions, our ability to attract and more easily retain high-caliber researchers and other staff should be significantly enhanced.

Building and Sustaining Our Research Campus of the Future

In partnership with DOE and the region, we will create and sustain modern research facilities that will attract and keep the best staff and scientific users and support increased research productivity. We intend to pursue the following strategies:

- Clearly describe DOE's future needs for mission-critical research facilities and equipment and staff capabilities.
- Work with DOE, DHS, and other key clients to obtain funding to build and sustain research facilities.
- Work with regional entities to obtain state and commercial investment to build supporting R&D facilities, such as offices, shops, dry laboratories, and computer space.
- Commercialize DOE-developed technologies to create income streams that can be reinvested in facilities and equipment.
- Enhance the Laboratory's access to other research facilities and equipment through strategic partnerships with regional universities and research firms.
- Maintain Battelle investment in the Laboratory's research infrastructure.

Creating Income for Reinvestment in the Laboratory

We are developing technologies that provide high value to our customers, society, and the economy. However, to realize the greatest benefit from these technologies we will use our "best-in-class" technology commercialization program to get them into broad markets. These deployments will also result in income back to the Laboratory, which can be invested in the Laboratory's staff and infrastructure. These commercialization efforts also provide positive impacts to local and regional economic development. In the next five years, we will focus on:

- Creating significant and increasing cash and noncash value from DOE-derived technologies.
- Creating intellectual property to build a pipeline for commercialization, thus enhancing the relevance of our results and value to the taxpayer by placing them in the marketplace.

R&D Advocacy Through Strategic Partnerships

We are using and establishing strategic partnerships with key regional universities and industries. These partnerships allow us to leverage joint investments and collaborations that help build and sustain our critical research capabilities, while helping build the broad advocacy needed to support the Laboratory as an integral part of our community and region. We will achieve these goals in the following ways:

- Through strategic university partnerships, our science and engineering education programs will help reform and diversify educational programs to produce the next generation of scientists and engineers.
- Through continued investments and volunteerism efforts, we will improve the quality of life and business climate in our community.
- By establishing research capabilities that benefit the region's research enterprise.

PNNL's strategic investments, corporate contributions, and volunteerism are building broad advocacy needed to create and sustain modern research facilities and enhance the quality of life in the surrounding community.

Laboratory Strategy

1.4 Managing a High-Performance Laboratory

We are applying proven private-sector management techniques to the delivery of research, resulting in an effective alignment of resources to achieve our vision.

Our Accountability Model

We are implementing an accountability model adapted from a private-sector model for management, which aligns the governance, management, and performance functions within the Laboratory. The governance function provides senior management attention on the strategic future of the Laboratory. It is accountable to DOE, our other customers, and Battelle to set direction, goals, and strategy, as well as the acceptable levels of performance that management is expected to deliver. Management is accountable for translating goals into tactical objectives and deploying resources to attain those objectives while managing performance within the limits set by governance. The performance level, where the work of the Laboratory gets done, is accountable to management for performing work within the established procedures and guidelines, with attention to minimizing risk.

Governance Sets Strategic Direction

Governance, consisting of the Laboratory Director and senior management, sets the direction of the Laboratory, aligns resource allocations with goals, approves operational and business boundaries, and monitors progress toward goals. Using knowledge of our customers' strategies and data and information on our past performance, current capabilities, and corporate obligations, the senior managers determine the goals to be achieved and the strategies to employ. They set operational expectations to provide management and staff clear operating boundaries. This step will eventually include establishment of risk boundaries for key operations. They allocate resources to ensure achievement of our goals and management of associated risks. Finally, they monitor performance relative to goals and changes in the business environment, and they adjust budgets and guidance as needed to respond to significant changes.

Management Translates Strategy into Tactics

Management translates goals into tactical objectives, deploys resources to achieve the objectives and manage within risk limits, and provides feedback to governance on performance. Our mid-level managers (management systems, customer relationships, technical staff, and product delivery) perform this management function. With leadership direction on the Laboratory strategy, they develop tactical objectives within organizational business plans to align resources to goals. After governance approval, management deploys resources to execute the business plans, and monitors performance, providing feedback to governance on a regular basis.

Model adapted from The Osterio Group

In our Accountability Model, we ensure performance through communication of strategy and expectations throughout the Laboratory, setting of clear management accountabilities, managed delivery of high-quality products and services to customers, and use of processes that ensure that work is being managed within established risk boundaries.

Staff Do the Laboratory's Work

Supervisors and staff use processes, procedures, and tools to perform day-to-day project activities to accomplish our tactical objectives, while managing within established operational limits. Performance data and trends relative to the goals and objectives are gathered from this level through the use of self-assessment, and are summarized for management and governance to provide information essential for decision-making.

Assurance Processes Validate Performance Assessments

Governance and management employ means such as internal audit, independent oversight, peer reviews, and external certifications to provide reasonable assurance that goals are being achieved within approved operational boundaries. We use self-assessment to provide information on performance, and to validate that management systems are performing effectively and efficiently and that accurate and reliable data is being delivered to decision-makers and regulators. Assurance is also used to validate that our customers are being served through our relationship, product delivery, and technical capability management processes with high-quality products and services. (Additional information is provided on peer review in Appendix E.)

1.4.1 The Relevance and Quality of Our S&T Programs

We choose our S&T programs to work on the issues that really matter to DOE and the nation.

Our customers expect us to deliver high-quality, science-based solutions that are directly relevant to their needs. We ensure this by embedding proven research management and operational approaches within our programs and research activities, and by how we operate our facilities. Because these elements are fundamental to the value we deliver, they serve as the primary basis of the Performance Evaluation and Measurement Plan with DOE.

Relevance is Essential

The R&D we perform for DOE and our other customers must be relevant to the challenges they are addressing.[a] We ensure the relevance of our work by verifying that it meets three criteria:

1. **Program alignment** – We produce the S&T understanding and leadership needed to support the creation of new R&D programs that address emerging DOE challenges.
2. **Value and impact** – The work we perform results in substantial value to DOE, and often to the nation broadly.
3. **Utilization** – The science-based solutions we provide are adopted by other researchers or used by industry in commercial applications. We do this principally through strategic partnerships.

Examples of our *strategic partnerships* are contained in Chapters 2–5; a comprehensive list is provided in Appendix A.

Quality Counts!

Because of the central role the national laboratories play in the nation's R&D enterprise and the critical nature of challenges being addressed, quality must be a hallmark of our S&T programs. The aspects of quality we focus on delivering are:

- **Creation and innovation** – Using the insights from our application programs, we develop high-potential areas of scientific inquiry. We focus multidisciplinary teams on developing original advances in science and creative technological innovations.
- **Importance** – We ensure that our science outcomes make important contributions to key scientific fields, and our technologies represent substantial contributions to the nation's technology base.
- **Recognition by others** – We actively pursue recognition of our science-based solutions by others to broaden their use, increase our ability to engage scientific leaders, and enhance DOE's reputation for delivering science-based solutions.

(a) This concept is also being strongly emphasized by the Office of Management and Budget in their implementation of the Performance Assessment Rating Tool across all executive departments.

Research Management and Program Leadership

We ensure the relevance and quality of our results, and we increase our research productivity by how we manage and lead our research programs. Our program managers focus on these principles:

- **Leading and partnering** – The complexity of the challenges we address require scientific leadership and the application of resources from other national laboratories, universities, and industry. Cooperative agreements and staff interactions allow us to leverage the best possible resources in carrying out our programs.
- **Science to applications** – The urgency in addressing many national needs requires us to accelerate the translation of scientific discovery to final applications.
- **Research productivity** – In response to the President's Management Agenda and increasing competition for R&D funding, we are improving our operational and research work processes to increase research productivity.
- **Strong project execution** – We thoroughly plan our R&D projects to ensure that multidisciplinary and multiorganizational teams properly understand and manage risk. We subject critical project plans to internal and sometimes external peer reviews to ensure their adequacy, and we provide a suite of project control tools to ensure proper execution of all projects.

Our *Research Management and Operations* approach is described in Chapter 6.

Value of Research Facilities

Essential requirements for breakthrough science are state-of-the-art facilities and capabilities and supportive management systems. Our focus around enabling quality through operation of research facilities includes:

- **Outstanding staff** – The ultimate source of all our research accomplishments is our staff. We actively recruit, develop, and retain the best possible staff to support current and future Laboratory programs.
- **Research campus of the future** – We are creating a research campus of the future with leading-edge facilities and equipment to address the increasingly complex challenges of our customers and to accommodate the proposed changes in the Hanford Site research infrastructure.
- **Facility value to external users** – A central tenet of DOE's strategy is to provide world-class research facilities for the U.S. research enterprise. We are providing innovative operational and programmatic means for external scientists to add substantial value to their research by their use of EMSL and our other research facilities.
- **Safe, secure, and reliable operations** – Through our operating principle of simultaneous excellence, we ensure that adequate resources are provided to implement seamless management systems that protect our staff and DOE assets and to ensure that R&D resources are available for use to the maximum extent possible.

Chapters 2–5 each contain a module describing *facility needs* in that programmatic area. These are responded to in Module 7.3, Research Campus of the Future.

Program Checklist

- ☑ Relevance
- ☑ Quality
- ☑ Research Approach
- ☑ Capabilities and Operations

We ensure that all elements of excellent program performance are addressed before starting work.