I. Laboratory Director's Statement

As a member of the national laboratory system for more than 55 years, Argonne conducts world-class research and development in support of the long-term goals of the Department of Energy (DOE) and its Office of Science, to "position our nation for scientific and economic strength and leadership in the years to come." Our efforts focus on basic science, energy resources, environmental stewardship, and national security.

To enhance our performance in carrying out DOE's missions, Argonne and the University of Chicago — which has operated the Laboratory for its entire history — work closely together to strengthen ties and increase research collaboration between the two institutions.

Argonne manages five major DOE user facilities, and we are working to add to this roster. We work with colleagues from the other national laboratories, academia, and industry to employ these national research tools on the cutting edge of science and technology.

The key to making our discoveries useful is to move them quickly from the laboratory to the marketplace. Our current portfolio of technologies contains 185 available for licensing by private enterprise and includes substantial efforts for the Department of Homeland Security (DHS). Our support for DHS draws on our deep understanding of the nation's technological infrastructure and on application of our technologies to detect, prevent, and retaliate against terrorist attacks.

National User Facilities

Over the decades, Argonne and other members of the national laboratory system have proven highly effective at planning, designing, building, and operating user facilities. These one-of-a-kind research centers serve as engines that help maintain and advance U.S. scientific leadership by attracting the world's best scientists and providing crucial support for national communities of researchers in many fields. The following major national user facilities are currently operated by Argonne for DOE, or are in the planning stages:

- The *Advanced Photon Source* (APS) is our premier user facility. It provides researchers with the nation's brightest x-ray beams for investigations in a broad spectrum of scientific and technological areas, including materials science, structural biology, environmental studies, and applied engineering. Collaborative access teams — comprising investigators from private industry, universities, government, and other institutions — have committed a quarter billion dollars in capital investments for construction of APS beamlines.

- The *Intense Pulsed Neutron Source* (IPNS) is widely known as one of DOE's exemplary user facilities, particularly because the machine and its operators embody the professional values of its national user community and assiduously serve the community's scientific interests. In the 20 years since its inaugural run, the IPNS has become a national model for user facility operations. In recent years, the organization and its staff have committed their expertise to supporting the Spallation Neutron Source (SNS) project — soon to become the nation's premier neutron source — by designing and building instruments for the SNS and by training future SNS users.

- The *Argonne Tandem-Linac Accelerator System* (ATLAS) is the world's first superconducting linear accelerator for heavy ions and the premier accelerator for low-energy nuclear physics research. In addition to supporting an active and productive community of physicists from all over the world, ATLAS plays a key role in our conceptual design for the proposed Rare Isotope Accelerator.

- The *Electron Microscopy Center* (EMC) conducts materials research using advanced microstructural characterization methods and state-of-the-art microscopes. Research by

EMC personnel includes microscopy-based studies of high-temperature superconducting materials, irradiation effects in metals and semiconductors, phase transformations, and the structure and chemistry of thin-film interfaces.

• The *Atmospheric Radiation Measurement (ARM) Climate Research Facility* is DOE's largest research program on global climate change. ARM Program scientists focus on obtaining field measurements and developing models to better understand the processes that control solar and thermal infrared radiative transfer in the atmosphere, especially in clouds and at Earth's surface.

• The *Center for Nanoscale Materials* (CNM), one of five Nanoscale Science Research Centers sponsored by DOE, concentrates on understanding and controlling material properties at the nanometer scale. This area of scientific exploration has tremendous potential to advance science and technology. The CNM already offers advanced facilities and expertise to support independent and collaborative research efforts, and construction of a dedicated building will soon begin adjacent to the APS. The CNM focuses on six primary research themes: bio-inorganic interfaces, complex oxides, nanocarbon, nanomagnetism, nanophotonics, and theory and simulation.

In addition, Argonne will be the site of a Regional Biocontainment Laboratory funded by the National Institutes of Health to study the detection, prevention, and treatment of infectious diseases — particularly agents that could be used for bioterrorism. Argonne is also a primary candidate to host the Protein Production Facility, one of the highest-priority projects of the DOE Office of Science. These two facilities, in conjunction with the APS and CNM, would form one of the world's most complete complexes for microbiological research.

Core Competencies and Major Initiatives

Our major strategic goals are supported by our core competencies, which we constantly strengthen. Chief among our competencies are our world-class engineering and scientific expertise in producing safe, sustainable, proliferation-resistant nuclear energy and our long experience and deep expertise in developing, operating, and advancing the science and technology underpinning accelerator-based user facilities. We also have widely recognized expertise in the materials sciences; chemistry; biology; physics; high-energy and nuclear physics; cross-disciplinary nanoscience and technology; structural biology, functional genomics, and bioinformatics; applied mathematics and computer science; computational science; and environmental science. Our overall goal is to be the best in the world in many areas, a leader in others, and a responsible steward of our facilities.

To complement existing programs, we work closely with DOE and the scientific community — often in a leadership role — to develop new initiatives and scientific facilities to serve national needs. The following five Argonne initiatives represent timely opportunities to significantly enhance U.S. research capabilities in basic research and development and, hence, to advance scientific understanding and engineering achievement across a wide range of disciplines:

• *Nanosciences and Nanotechnology*. Research on nanoscale materials will lead to devices such as computers that are smaller and more efficient and to materials with exciting new properties. Argonne is well positioned to contribute to achieving these national goals and is actively developing regional collaborations to help.

• *Rare Isotope Accelerator* (RIA). DOE has given RIA its highest priority among new construction projects for the physics community. Among 28 new user facilities proposed for all fields, RIA tied for third ranking. By accelerating highly unstable nuclei at the very limits of existence, RIA will open new scientific frontiers. Examination of these isotopes and their reactions will answer important astrophysical questions, such as how stars evolve, how their evolution affects the evolution of galaxies and planets, and how much "ordinary" matter the universe contains. Physicists will study the fundamental nuclear processes by which stars generate energy and create heavy elements; discover new and unexpected phenomena; and develop new

approaches to studying nuclear decay, reactions, and structure. In collaboration with Michigan State University and other institutions, we have developed a facility concept for RIA that achieves its physics goals at reasonable cost by incorporating our existing state-of-the-art heavy-ion accelerator, ATLAS.

• *Functional Genomics*. Recent developments in genome-wide DNA sequencing, high-throughput analytical tools, and computing technologies have made feasible the genome-wide analysis of biomolecular function. Such research promises new strategies for altering cellular activities in order to improve human health, environmental management, and economic productivity. It also will help DOE pursue its homeland security mission by deepening understanding of organisms used as biological warfare agents. To address this opportunity, we are developing a major Laboratory initiative to undertake large-scale functional analyses of macromolecules and macromolecular complexes. We are also strengthening our research staff to contribute to this fast-moving field. A partnership between our Biosciences Division and our Mathematics and Computer Science Division will coordinate the efforts of experimentalists and simulation experts to develop exciting new capabilities in bioinformatics and computational cell biology.

• *Petaflops Computing and Computational Science.* We are building on our existing long-term program in mathematics and computer science to support work in the areas of mathematical software, parallel programming tools, advanced visualization systems, grid computing and distributed systems, collaboration technologies, scalable systems software, and performance analysis and modeling. Strong internal and external scientific collaborations tie this computer science research to diverse applications in biology, high-energy physics, climate modeling, computational chemistry, chemical engineering, subsurface modeling, biomedical computing, astrophysics, and other areas. Our initiative aims to accelerate progress in these areas through a Laboratory-wide computational science program, a targeted research and development program, and construction of a large-scale research facility to house a petaflops computing system and supporting programs in collaborative computational science research.

• *Nuclear Energy*. The nation's need for a secure, reliable supply of energy dictates that nuclear energy play a major role in the future. Our researchers are identifying technologies for the economical production of increasing amounts of energy while reducing burdens on the environment. This work includes addressing the problems of spent fuel disposition and nuclear nonproliferation inherent in producing nuclear energy on the required scale. In particular, we are looking at ways to return fuel to the reactor and produce more benign waste forms.

• *Hydrogen Research and Development.* In response to President Bush's national initiative to reverse growing dependence on foreign oil by developing the technology that could make hydrogen a viable and widely used fuel, we have mounted a coordinated effort integrating our state-of-the-art user facilities with our expertise in basic science and technology and in nearer-term technology development and deployment. Central to this program are two objectives that drive progress toward the hydrogen economy: (1) high-performance materials for hydrogen separation and fuel cell membranes and (2) new catalysts that improve hydrogen production and combustion. We are drawing on our broad knowledge of materials science and chemistry to orchestrate comprehensive research programs that coordinate advances across the spectrum from basic science to applications. In these efforts, the unique capabilities of IPNS, APS, and EMC will be particularly valuable, and we will rely on our extensive expertise in nuclear reactor technology to investigate the production of hydrogen from nuclear power.

The state of Illinois has provided extremely valuable support for Argonne's major research initiatives. This outstanding cooperation has fostered a highly favorable environment for accomplishing the Laboratory's missions.

Employer of Choice

The most important measure of an organization is the quality and dedication of its people. Our successes come from our staff. Many have been with Argonne for decades; more than a quarter have 20 or more years of service. Obviously, Argonne is a good place to work. To strengthen our status as an employer of choice, we are pursuing a number of initiatives in our operations. One initiative is a human resources strategy to develop strong leadership, support a creative and diverse workforce, and recruit and develop the talent we need, in an environment totally committed to equal opportunity for everyone. Our development of talent begins at the earliest possible stage, with educational programs and other efforts to convey to students from grade school to the postdoctoral level our love of science and technology and our fascination with the possibilities they offer.

Notable among our operations initiatives are the following:

- Make optimal use of the national talent pool to attract the best qualified new employees from all ethnic and cultural backgrounds.

- Ensure that line managers are responsible for achieving excellent performance over the full range of activities under their purview. Our integrated management approach requires ongoing education and training of all staff.

- Maintain a safe and healthy workplace for our employees, with close attention to protecting the environment for the benefit of both ourselves and our neighbors. A bedrock principle is the empowerment of every employee to object to any impediment to safety or security.

- Make open communications a key part of the Argonne culture, across all levels of management and staff. When communication flows unimpeded in all directions throughout an organization, resulting interactions produce fertile synergies and valuable new ideas. Line management needs this open communication to learn of all available good ideas and to help implement them.

Focus on the Ambitious

Just as DOE's Office of Science has outlined an ambitious agenda for science, so has Argonne. We, too, dream large.

The goals of the Office of Science strategic plan fire our imaginations, and we embrace this exciting quest to advance the cutting edge of science, just as we have since our earliest days.

Hermann A. Grunder
Laboratory Director