OAK RIDGE NATIONAL LABORATORY

Energy • Neutron Sciences • Biological Systems • Advanced Materials
National Security • High Performance Computing

SOLVING THE BIG PROBLEMS

OAK RIDGE
National Laboratory

Foreword

Thom Mason
Director

SOLVING THE "BIG PROBLEMS"

Oak Ridge National Laboratory's future could not be more exciting. Not since the days of the Manhattan Project has the laboratory witnessed anything approaching the scale of what is taking place today in Oak Ridge. Working on the belief that many future discoveries will lie at the intersection of nanotechnology, information technology, and biology, the laboratory has put in place the building blocks for the next generation of scientific discovery. The recently-completed $1.4 billion Spallation Neutron Source, located adjacent to the new Center for Nanophase Materials Sciences, is rapidly making Oak Ridge one of the world's foremost locations for the study of materials. ORNL's National Leadership Computing Facility now houses the world's most powerful open science supercomputer and soon will house a computer capable of a mind-boggling 1000 trillion calculations per second. Each of these facilities will work closely with ORNL's new Bioenergy Science Center, funded by the Department of Energy to develop breakthrough technologies for cellulosic ethanol.

What we sometimes call this "Nano-Info-Bio" strategy is being applied to some of the most important scientific challenges of our time. Increasingly working across scientific disciplines, ORNL researchers are developing a suite of new environmentally sensitive technologies for the generation, transmission, and conservation of energy. In similar fashion, the laboratory is a leader in the effort to understand and respond to the complexities of climate change throughout the world. Our continued leadership in materials research will provide lasting benefits for America's business, scientific, and industrial sectors. Likewise, we have developed unique capabilities that are contributing to America's security, particularly in the area of nuclear non-proliferation.

Having modernized the laboratory with some $2 billion in new facilities, our task now is to produce the kind of science that will literally change our future. I hope this brochure conveys a sense of the enthusiasm we are experiencing at Oak Ridge National Laboratory. For the 4,200 staff at ORNL, being part of solving America's "big problems" is an exciting opportunity.

Building on a History of Science and Service

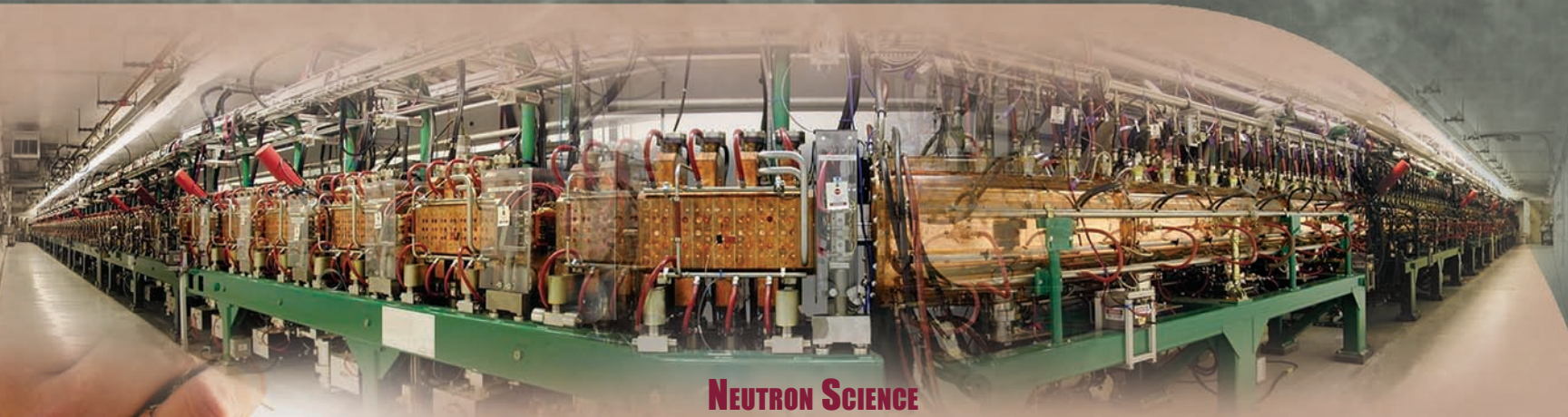
Born as part of the Manhattan Project in 1943, Oak Ridge National Laboratory was established in the dark days of World War II when American scientists feared that Germany was rapidly developing a new weapon of unimaginable power. Built seemingly overnight on isolated farm land in the mountains of East Tennessee, Oak Ridge became the "secret city" that within two years housed more than 75,000 residents. Working under assumed names in the Graphite Reactor, Enrico Fermi and his colleagues developed the world's first sustained nuclear reaction, leading to the atomic bomb that ended the war.

ORNL's involvement with nuclear weapons ended after the war. The laboratory's scientific expertise shifted in the 1950s and 1960s to peacetime research in medicine, biology, materials, and physics. The Graphite Reactor evolved from a wartime role to produce the world's first medical radioisotopes for treating cancer. Following the creation of the Department of Energy in 1977, ORNL's mission broadened to include research in energy production, transmission, and consumption. The end of the Cold War and the growth of international terrorism led to a further expansion of research into a range of national security technologies. As the laboratory entered the 21st Century, new cross-disciplinary programs in nanophase materials, computational sciences, and biology led to the term "nano-info-bio" to describe the emerging synthesis in ORNL's research agenda.

Managed today by the University of Tennessee and Battelle Memorial Institute, ORNL is the Department of Energy's largest multi-purpose laboratory. The laboratory was created with a collection of scientists brought together from every corner of America. While the new generation of scientists at Oak Ridge National Laboratory represents more than 80 countries, they remain heirs to a great history. More than six decades later, they continue a rich tradition of scientific exploration in the service of humankind.

Six Scientific Themes

Born of necessity. Inspired by our quest to know. We have always been called upon to address America's greatest scientific challenges.



Neutron Science
Leading the World

The Spallation Neutron Source and the High Flux Isotope Reactor together make Oak Ridge the world's foremost center for neutron science. **andersonian@ornl.gov**

Biological Systems
Developing New Options

Whether converting biomass to fuel or understanding the impacts of climate change, biological research at ORNL is helping develop new options for energy, environmental protection, and human health. **mannre@ornl.gov**

Advanced Materials
Strengthening American Industry

With DOE's first Nanoscience Center, the world's most powerful electron microscope, and the High Temperature Materials Laboratory, Oak Ridge plays a critical role in American industrial competitiveness. **buchananmv@ornl.gov**

"Men love to wonder, and that is the seed of science."

. . . Ralph Waldo Emerson

National Security

Guarding the Gates

From biochemical sensors to stopping the proliferation of nuclear weapons, technologies that make America safer are among the laboratory's top research priorities.

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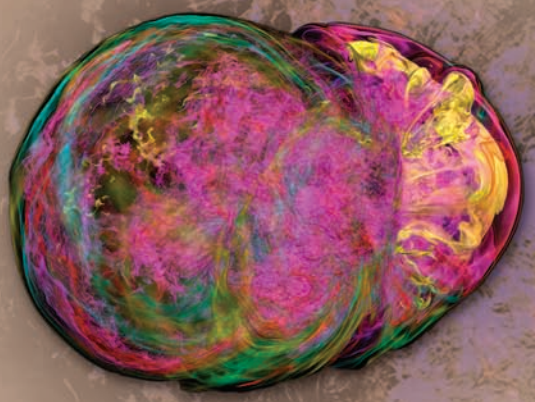

High Performance Computing

Tackling the Big Problems

With unmatched computational capacity for open scientific research, Oak Ridge is on a path by 2009 to reach a petaf op, or 1 quadrillion mathematical calculations per second, making it possible to model the most complex scientific problems.

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Energy

Providing Energy Alternatives

Increased production, improved transmission, reduced consumption: Oak Ridge is addressing our energy challenges on all fronts, from safer nuclear power to more energy-ef cient cars and homes.

christensend@ornl.gov

Solving the Big Problems

National laboratories were created to solve the scientific problems that require facilities and resources beyond the reach of most universities and private industry. Among the "big problems" we are working on at ORNL:

Climate Change: What causes climate change, and how we can respond to those changes, are among the most critical questions of the next decade. ORNL is marshalling a variety of resources, including biology and high-performance computing, in the quest for practical solutions.

Safe and Affordable Nuclear Power: Meeting a growing demand for energy without increasing carbon emissions will require an expanded role for the nuclear industry. ORNL is developing new technologies for spent nuclear fuel that could reduce the need to stockpile nuclear waste materials.

Fusion Energy: New research tools, including ORNL's supercomputers, are bringing the dream of fusion energy closer to reality. ORNL is leading the U.S. role in ITER, the international effort to build an experimental fusion reactor that could lead to an inexhaustible source of energy.

"Zero-Energy" Homes: Reducing the energy consumption of homes and of ces is a major goal of America's energy policy. Working with the Tennessee Valley Authority, ORNL has constructed five Habitat for Humanity homes with electric bills of only 40 cents per day. Researchers hope to develop a zero-energy home by 2012.

Award Winning Science

Nobel Prizes

Eugene Wigner
Clifford Shull

Shortly after World War II, ORNL researchers Ernest Wollan and Clifford Shull reported to Research Director Eugene Wigner, a Nobel laureate physicist, interesting effects with neutrons produced by ORNL's Graphite Reactor. Shull later received the Nobel prize. In 1999, he attended the groundbreaking for the Spallation Neutron Source, the world's foremost neutron scattering facility that evolved from Wollan and Shull's discoveries at ORNL.

FERMI Awards

Liane and
Bill Russell

The Fermi Award is one of America's most prestigious scientific honors. Among ORNL's seven Enrico Fermi Award recipients are ORNL Director Emeritus Alvin Weinberg and mammalian geneticists the late Bill Russell and his wife, Liane.

PECASE Awards

Dan Bardayan

The Presidential Early Career Award for Scientists and Engineers recognizes the nation's outstanding young researchers. ORNL's researchers have received 12 PECASE awards. Physics Division researchers have accounted for five of the awards.

Sometimes called the "Oscars" of scientific research, R&D 100 awards are given annually to scientists and engineers on the cutting edge of technological innovation. Oak Ridge National Laboratory ranks first among Department of Energy laboratories and second among all laboratories in the number of R&D 100 awards.

A Valued Member of the Community

Since 2000, UT-Battelle has provided more than $8 million in support of math and science education, economic development, and corporate volunteerism in the greater Oak Ridge region.

Science Education

UT-Battelle is the premier supporter of science and education in East Tennessee, providing assistance and financial support for new high school science laboratories, math and science scholarships, and science competitions. UT-Battelle contributed $2 million for the renovation of Oak Ridge High School. **hackworthbt@ornl.gov**

Corporate Volunteerism

Working through Team UT-Battelle, ORNL employees donate thousands of hours to outreach projects in the Oak Ridge region. In addition, UT-Battelle provides approximately $1.2 million annually to a variety of educational and civic initiatives. **hackworthbt@ornl.gov**

Economic Development

UT-Battelle is committed to being an active partner in the region's economic development. Working with the $150 million Battelle Ventures program and the $35 million Innovation Valley Partners venture capital fund, ORNL's Of ce of Technology Transfer and Economic Development has helped start more than 70 new technology-based companies using intellectual property developed at the Lab. For universities and existing industries, the laboratory's 20 user facilities make high-tech tools available for testing and research. **ballardt@ornl.gov**

University Partners

With an eye toward developing the next generation of scientists and engineers, UT-Battelle has established partnerships with major southeastern research universities to facilitate joint appointments, collaborative research, and graduate student opportunities.

UNIVERSITY OF TENNESSEE
VANDERBILT
VIRGINIA
VIRGINIA TECH
GEORGIA TECH
NORTH CAROLINA STATE
DUKE
FLORIDA STATE
OAK RIDGE ASSOCIATED UNIVERSITIES

At a Glance: ORNL . . .

...Is the Department of Energy's largest science and energy laboratory, managed since April 2000 by a partnership of the University of Tennessee and Battelle.

...Has 4,200 staff, 3,000 guest researchers, 20 user facilities, and a budget of approximately $1.2 billion.

...Supports the Department of Energy's mission through six major scientific competencies in energy, neutron science, high-performance computing, complex biological systems, materials research, and national security.

...Is located in Eastern Tennessee on the Oak Ridge Reservation in Anderson and Roane counties. The laboratory is near Interstates 40 and 75 and is 20 miles from Knoxville's McGhee-Tyson Airport.

...Welcomes visitors to the laboratory. Because of increased security requirements, visits must be arranged ahead of time. Contact ORNL Visitor Services (865) 574-7199, or email x10visit@ornl.gov, for information about how to arrange a visit to ORNL.

...Provides additional information at *www.ornl.gov*

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THE DEPARTMENT OF ENERGY

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