

# Oak Ridge National Laboratory - the science and the partnerships

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# The Department of Energy's national laboratories: A flair for getting after very big and difficult matters

- **Multidisciplinary R&D to solve large-scale, long-term problems of national importance**
  - National security
  - Energy
  - Environment
- **Design, construction, and operation of unique research facilities and equipment**
- **Technology transfer**
- **Education**

# ORNL is DOE's largest multipurpose science laboratory

- **\$1 billion budget**
- **3800 employees**
- **3000 research guests annually**
- **Nation's largest unclassified scientific computing facility**
- **18 user facilities**
- **Nation's largest science facility: the \$1.4B Spallation Neutron Source**
- **Nation's largest concentration of open source materials research**
- **Nation's largest energy laboratory**
- **\$300 million modernization**



# We are developing and deploying world-class tools for nanoscale R&D

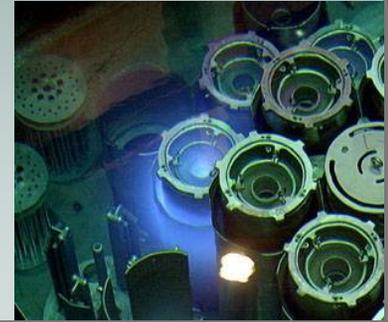
## Spallation Neutron Source

- High-intensity neutrons for materials research at the nanoscale
- 1.4 MW of beam power on target
- 16 instruments



## High Flux Isotope Reactor

- The nation's leading research reactor
- World-class instruments for neutron scattering



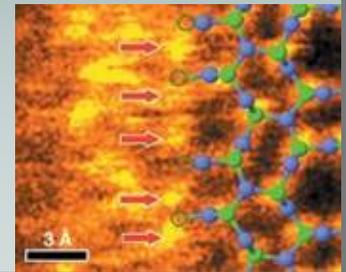
## Center for Nanophase Materials Sciences

- Construction on schedule for 2006
- User program launched with 42 projects



## Ultrahigh-resolution microscopy

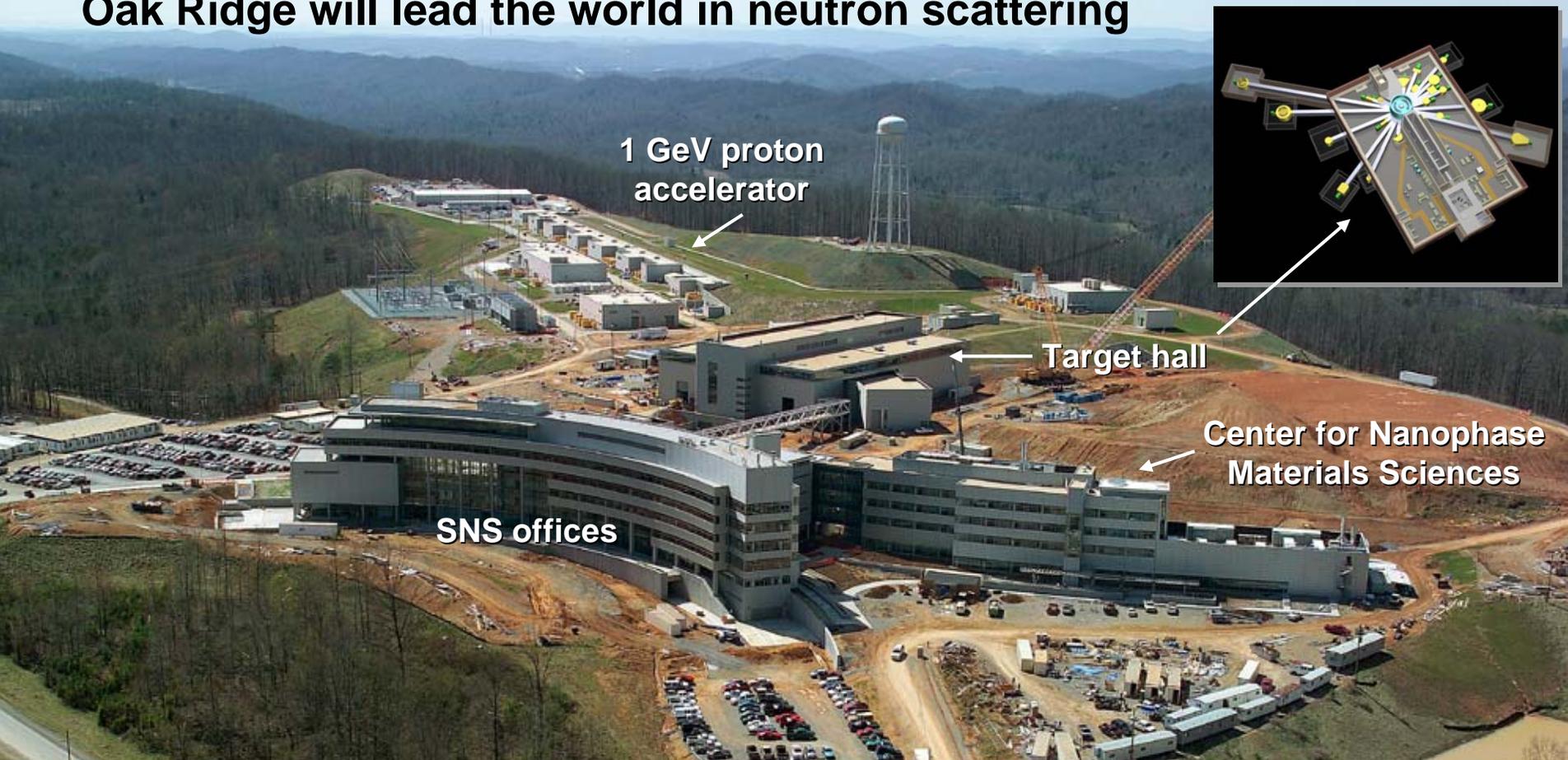
- Advanced Microscopy Laboratory
- Aberration-corrected electron microscope
- World-record resolution: 0.6 Å



# The Spallation Neutron Source (SNS)

Total cost: \$1.4 billion

- Operational in 2006
- World's most powerful pulsed neutron source
- With complementary resources at the High Flux Isotope Reactor, Oak Ridge will lead the world in neutron scattering



# A vibrant environment for nanoscience research: Center for Nanophase Materials Sciences

- **Highly collaborative, multidisciplinary center for research and education**
- **State-of-the-art tools for synthesis and characterization**
- **Ready access to the Spallation Neutron Source and other ORNL facilities**

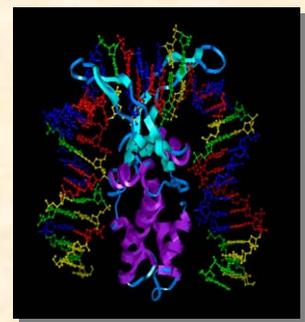
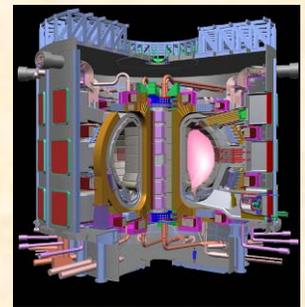
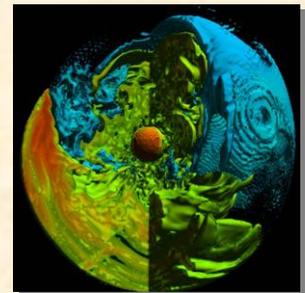
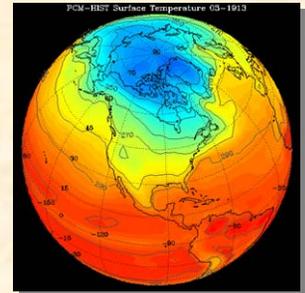
## Technical focus areas

- **Macromolecular materials**
- **Functional nanomaterials**
- **Catalysis**
- **Nanoscale magnetism and transport**
- **Theory, modeling, and simulation**



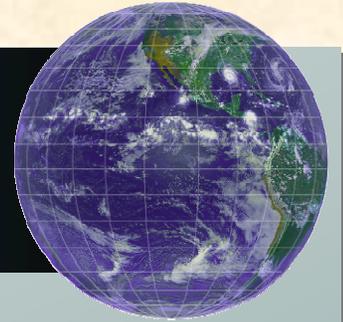
# We are at the forefront in computing and simulation

- **Leading the partnership to develop the National Leadership Computing Facility**
  - Leadership-class scientific computing capability
  - 100 teraflops by 2006; 250 teraflops by 2007
- **Attacking key computational challenges**
  - Climate change
  - Nuclear astrophysics
  - Fusion
  - Materials sciences
  - Biology
- **Providing access to our computational resources through high-speed networking**



# We are building momentum in systems biology

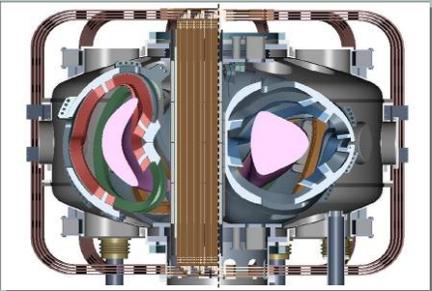
**Challenge: Integrate biology and ecology based on the foundation of understanding molecular-level interactions**



- **Identify the composition and function of “molecular machines”**
- **Use biological processes to**
  - Produce clean energy
  - Sequester carbon
  - Help clean up the environment
- **Understand how living organisms react to their environments**
- **Determine the genetic basis for complex traits**



# We address the energy challenges of the present . . . and the future

Generation	Distribution	Consumption
<p><b>Fossil</b> <b>Fission</b> <b>Renewables</b> <b>Fusion</b></p> 	<p><b>Transmission technology</b> <b>Hydrogen</b> <b>Distributed energy resources</b></p> 	<p><b>Buildings</b> <b>Industry</b> <b>Transportation</b></p> 

Supporting DOE's strategic goals for energy security and independence

# We are applying our S&T resources to national and homeland security

- Detecting, preventing, and reversing the proliferation of weapons of mass destruction
- Deploying integrated systems for incident awareness, detection, and response
- Providing technology for detecting explosives at the part-per-trillion level
- Delivering enhanced protection and new capabilities to first responders and warfighters



# We are modernizing the campus

**Computational Sciences Building  
(Private sector)**

**Research Office Building  
(Private sector)**

**Engineering Technology Facility  
(Private sector)**

**Joint Institute for Computational Sciences  
- Oak Ridge Center for Advanced Studies  
(State of Tennessee)**

**Research Support Center (DOE)**



# We are building partnerships with a broad set of national universities

The long relationship with the University of Tennessee is the model for interacting with other universities



The University of Tennessee  
Knoxville, Tennessee



Battelle  
Columbus, Ohio

The UT-Battelle partnership includes universities

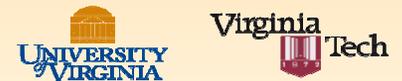
Oak Ridge  
Associated  
Universities



Seven “core university” partners:  
Duke, Florida State, Georgia Tech,  
North Carolina State, Vanderbilt,  
Virginia, Virginia Tech



New relationships  
with minority  
educational  
institutions



# Our academic partnerships take many forms

## Examples of our many collaborative programs

- **New coop program**
- **HBCU faculty summer research program:**
  - 54 faculty from 30 schools since 2001
  - Leads to ongoing research partnerships



- **Joint faculty hired:**
  - UT - 34
  - Core universities - 9
  - NC A&T - 1
- **Joint faculty with other universities planned**
- **Joint research proposals and programs**
- **Access to our user facilities**
- **Opportunities for undergrad and grad student appointments**

- **Oak Ridge Center for Advanced Studies**
- **A policy center with ORAU, UT, core universities**

