

Oak Ridge National Laboratory: Science and technology for the energy challenge

Presented to:

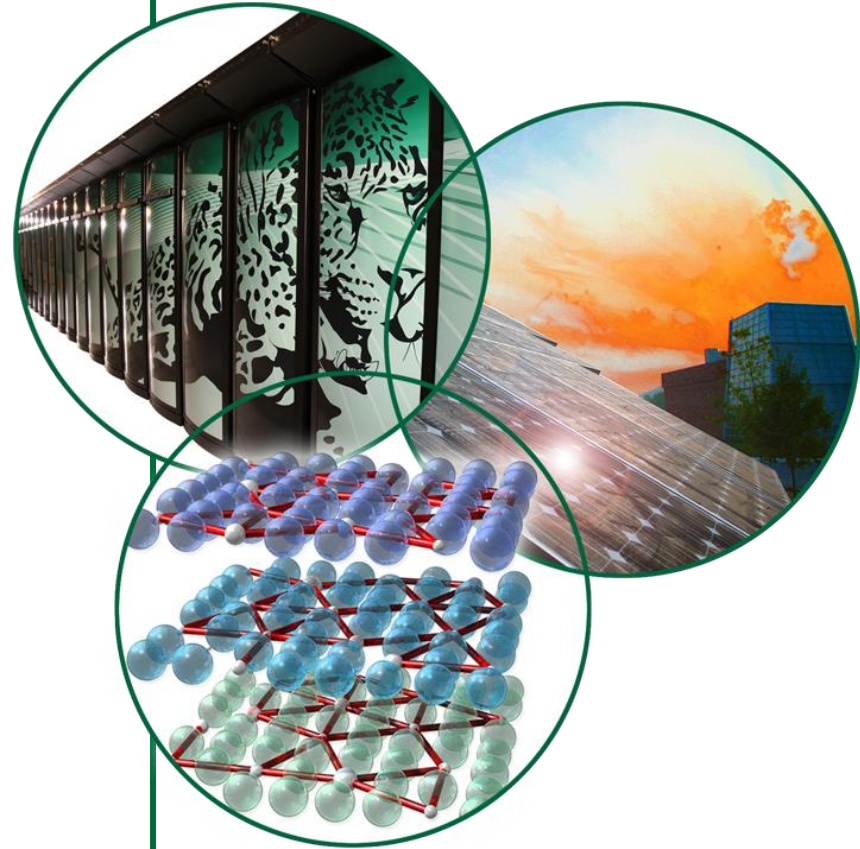
Workshop on Solar Energy and Energy Storage

Jim Roberto

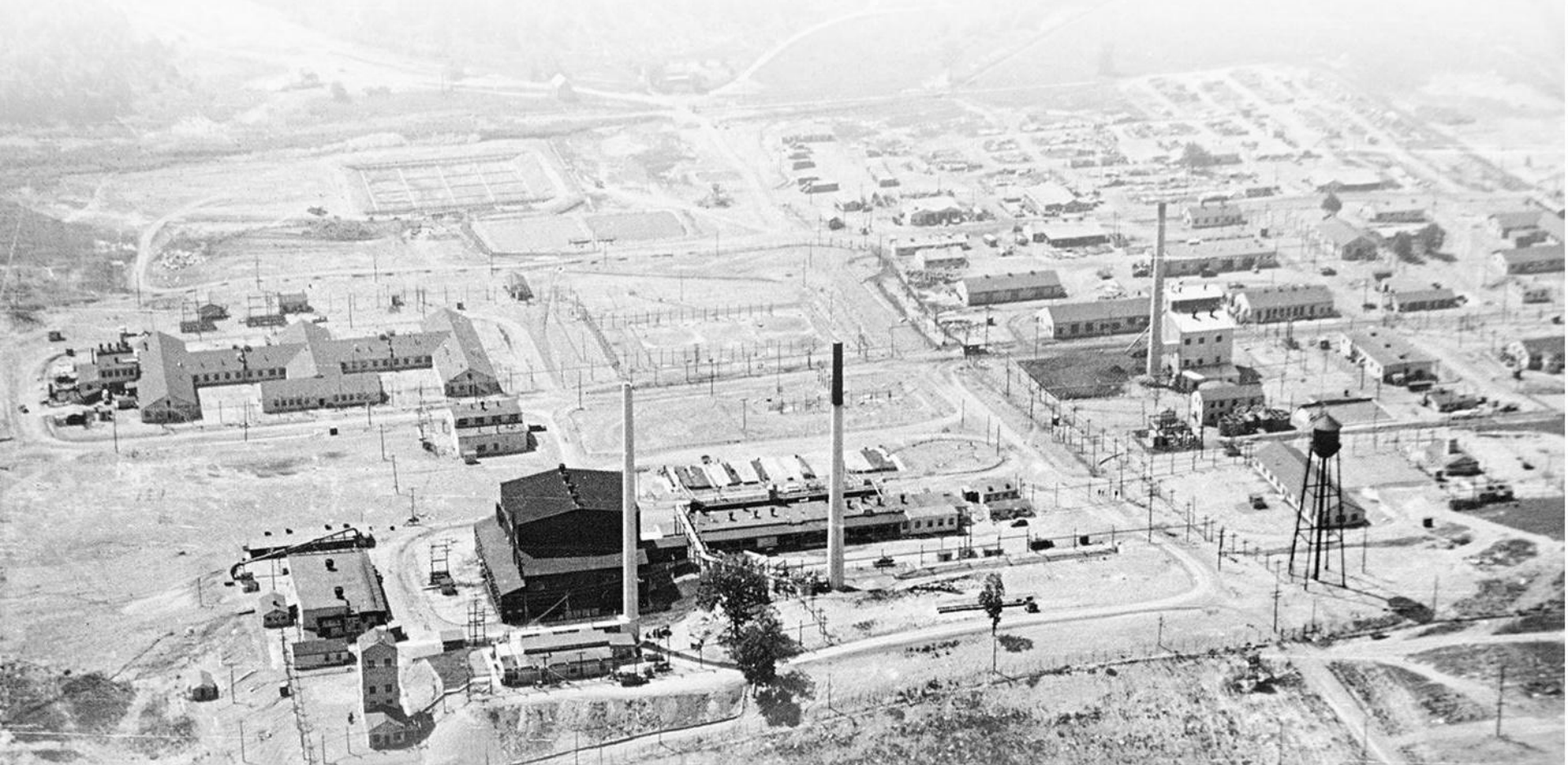
Director, Strategic Capabilities

Oak Ridge, Tennessee

September 14, 2010



Oak Ridge National Laboratory evolved from the Manhattan Project



ORNL in 1943
The Clinton Pile was the world's first
continuously operated nuclear reactor

Today, ORNL is DOE's largest science and energy laboratory



- \$1.5B budget
- 4,800 employees
- 4,000 research guests annually
- \$500M invested in modernization
- World's fastest scientific computer
- Operating the world's most intense pulsed neutron source and a world-class research reactor
- Nation's most diverse energy portfolio
- Nation's largest concentration of materials research
- Managing the billion-dollar U.S. ITER project

UT-Battelle has managed ORNL since April 2000



**The University of Tennessee
Knoxville, Tennessee**



**Battelle
Columbus, Ohio**



ORNL is uniquely positioned to deliver science and technology for energy

We have an extraordinary set of assets

- Outstanding tools for materials R&D including SNS and HFIR
- World-leading systems for open scientific computing
- BioEnergy Science Center
- Growing strength in climate change impact R&D
- The nation's broadest portfolio of energy programs
- Unique resources for nuclear technology
- Robust national security programs

**Our mission:
Use these assets
to enable science
and technology
breakthroughs
that transform
our energy future**



Studying materials with the world's best resources for neutron scattering

Spallation Neutron Source:
World's most powerful accelerator-based neutron source

High Flux Isotope Reactor:
Complementary capabilities and a world class cold neutron source

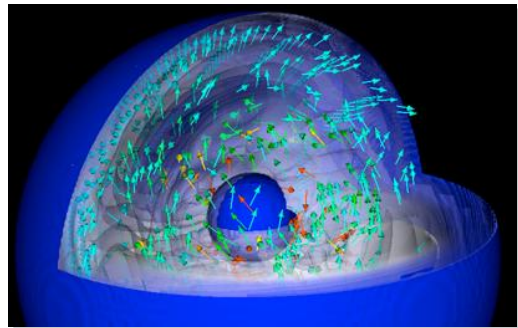
UT-ORNL Joint Institute for Neutron Sciences:
Innovation center and user gateway for SNS and HFIR

Ready to welcome thousands of researchers each year

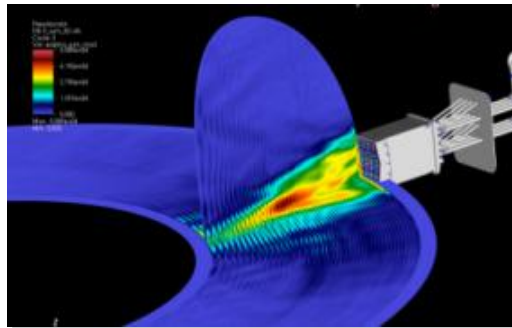


Leading the development of ultrascale scientific computing

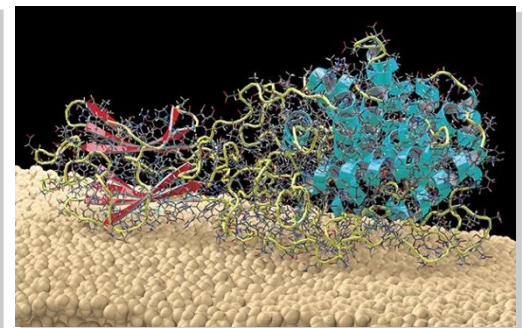
- World-leading scientific computing facility
- Operating at 2.33 petaflops (#1 on the Top 500 list)
- Focus on computationally intensive projects of large scale and high scientific impact
- Partnered with UT in an NSF petascale computing center (#4 on the Top 500 list)



Astrophysics



Fusion

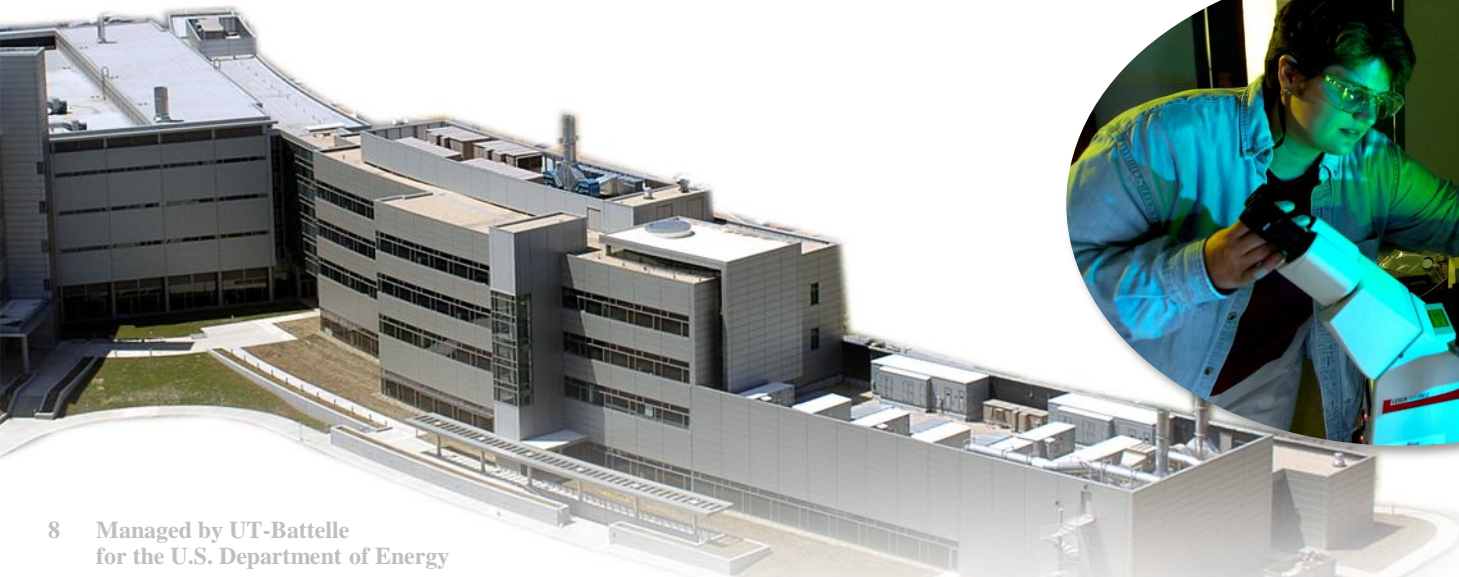
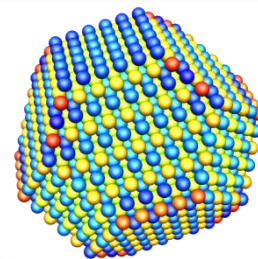


Biology

World-class capabilities for materials R&D

- DOE's first Nanoscale Science Research Center
 - Nanofabrication
 - Nanoscale characterization
 - Materials synthesis and chemistry at the nanoscale
- World leading facilities (neutron scattering, electron microscopy, High Temperature Materials Laboratory)
- Synthesis and processing (alloys, ceramics, thin films, nanofabrication, laser and infrared processing)
- Hundreds of industrial partners; thousands of university users

Understanding materials and chemistry at the length scale where properties are determined



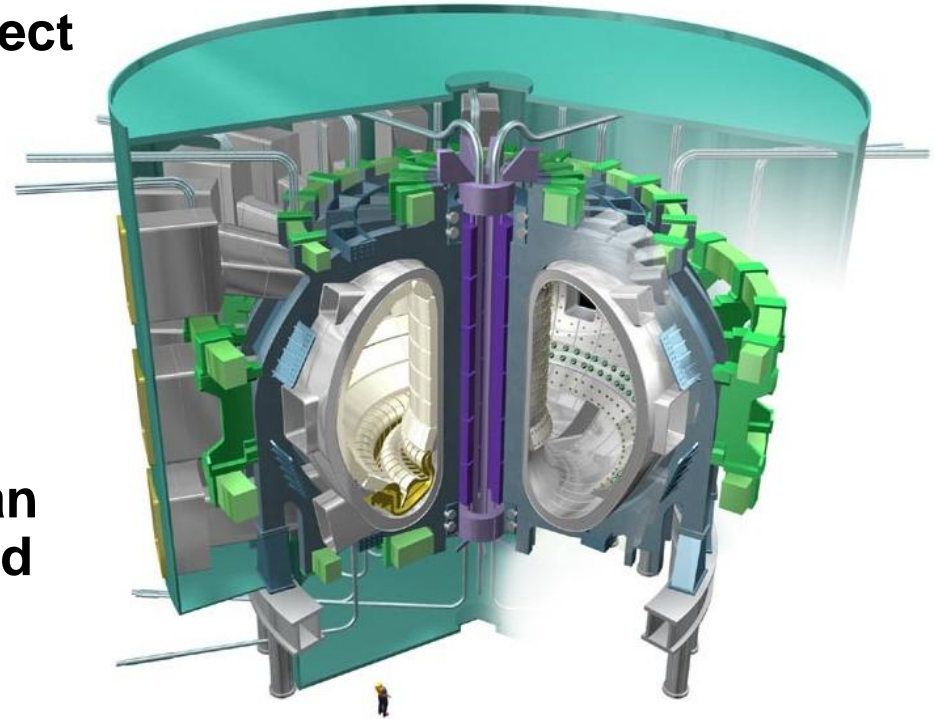
Transforming the new biology into bioenergy

- Developing bio-based solutions for energy, the environment, and carbon sequestration
- Managing the \$135M DOE BioEnergy Science Center to advance cellulosic ethanol research
- Partnered with the \$73M Tennessee Biofuels Initiative
 - Brings UT, ORNL, and industry together
 - Includes bioenergy research, a 250,000 gal/year pilot plant, and agricultural incentives for switchgrass



We are managing the U.S. ITER project for DOE

- ITER joint international R&D project aimed at demonstrating the scientific and technical feasibility of fusion power
- To be built in Cadarache, France, with operation set to begin at the end of the next decade
- The U.S. is contributing more than \$1B in key components, R&D, and design



ORNL is uniquely positioned to support advanced nuclear fuel cycle research

- DOE Center for Advanced Simulation of LWR's (CASL)
- Coupled End-to-End (CETE) demonstration for advanced nuclear fuel cycle S&T
- Fuel examination and reprocessing
- Materials irradiation at HFIR
- Reactor design and engineering
- Nuclear research facility infrastructure (REDC, HFIR, etc.): \$3B+ national asset



ORNL has a large and growing energy efficiency and renewable energy portfolio

- Over \$100M: Largest national lab effort in transportation, industrial technologies, and superconductivity
- Significant growth in solar energy, electrical energy storage, biomass, and grid visualization/modeling
- Includes new \$62M Tennessee Solar Institute at UT/ORNL
- Major facilities include High Temperature Materials Laboratory, National Transportation Research Center, and Buildings Technologies Center



Lightweight carbon fiber materials from lignin



“Zero-energy” homes



Triaxial superconducting cable installed at AEP Bixby

Strong university partnerships are critical to ORNL's success

Major projects	<ul style="list-style-type: none">• Tennessee Solar Institute• BioEnergy Science Center• NSF petascale computing facility• 4 SNS instruments led by university consortia• Partnered with universities in 13 Energy Frontier Research Centers
Collaborative research	<ul style="list-style-type: none">• More than 200 universities
Guest researchers	<ul style="list-style-type: none">• Hundreds of faculty and students
Joint institutes	<ul style="list-style-type: none">• Heavy ion research• Neutron sciences• Biological sciences• Computational sciences• Materials sciences
User facilities	<ul style="list-style-type: none">• Thousands of university users



UTK Energy Campus at ORNL: Mission statement



By combining the resources of a comprehensive research university and a major national laboratory, the UTK Energy Campus at ORNL will provide expanded opportunities for graduate students in energy-related sciences and engineering, fostering scholarship and innovation, advancing multidisciplinary research, and accelerating development and deployment of new technologies

We use our R&D assets to create technology partnerships and growth

Technology portfolios

Entrepreneurial support

Partnerships with industry and universities

Local and regional economic development

- Technology creation and translation

- 556 U.S. patent applications filed in past 5 years; 275 patents issued
- 128 active technology licenses
- 89 new companies since April 2000



- Strategic partnerships

- UT, TVA, Southern Growth Policies Board, Tech 2020, Tennessee Valley Corridor, ETEC, Battelle Ventures, Innovation Valley Partners, and many others
- S&T Park at ORNL
- Working with 600 industries annually

- 148 R&D 100 Awards (second only to GE)



Oak Ridge Science and Technology Park: New opportunities to work together

- Making ORNL expertise and innovations available for regional economic growth
- Supporting collaborations with industry and university partners
- First S&T Park within a national laboratory



Oak Ridge National Laboratory: Science and technology for the 21st century

