Tours of Oak Ridge National Laboratory

We will be offering tours of the ORNL's facilities each day. The tours will leave the Conference Center at 1pm. Registration will be available at the Conference on June 23 and 24. The tour will visit the Supercomputer Center, the EVEREST Laboratory, this historic Graphite Reactor, the Spallation Neutron Source, and the Center for Nanophase Material Science.

Supercomputer Center

The National Center for Computational Sciences (NCCS) provides the most powerful computing resources in the world for open scientific research. It is one of the world's premier science facilities—an unparalled research environment that supports dramatic advances in understanding how the physical world works and using that knowledge to address our most pressing national and international concerns.

The NCCS was founded in 1992 to advance the state of the art in high-performance computing by putting new generations of powerful parallel supercomputers into the hands of the scientists who can use them the most productively. It is a managed activity of the Advanced Scientific Computing Research program of the Department of Energy Office of Science (DOE-SC) and is located at the Oak Ridge National Laboratory.

NCCS has all the ingredients necessary to enable revolutionary science: an exciting research program led by top scientists, a talented staff, leading-edge technology, fruitful partnerships with other research institutions and industry, and state-of-the-art computing facilities and infrastructure.

The Center is host to the Cray XT4 "Jaguar" supercomputer, ranked
No. 2 on the Top500 list of the world's fastest supercomputers in 2007. Jaguar is actually the most powerful supercomputer in the world for open scientific use. Its peak performance is more than 119 trillion calculations per second (119 teraflops). To support its extraordinary concentration of computing power, the NCCS has put in place high-speed fiber-optic networks to expedite data movement, a scientific visualization center that enables researchers to analyze their simulation results quickly and comprehensively, and a high-performance data archiving and retrieval system.

The NCCS continues to aggressively expand its computing power. Steps are under way to expand the speed of the Jaguar to 250 teraflops in 2008 and in 2009 to install a petaflops computer, capable of a quadrillion calculations per second.

NCCS hosts only those projects capable of producing groundbreaking results. Each year a few research efforts that require enormous computing resources to realize their promise are rewarded allocations of computing time that reach as much as several million processor-hours. Such unprecedented levels of computational power are key to cracking fundamental questions that underlie issues of vital importance such as designing fusion reactors that provide clean, virtually unlimited energy; engineering proteins to provide new therapies for diseases and release energy from biomass efficiently; making wise choices to protect our planet and avoid runaway climate change; and designing new materials with specialized properties.

Great scientific advances will happen because of the work being done at the NCCS, and they will change our world for the better.

For more information about ORNL's computing resources visit the website:

http://www.nccs.gov/computing-resources/systems-status/

EVEREST Laboratory

Visualizing and Analyzing Terascale Datasets

Visualizing and sifting through multi-scale terabyte datasets generated from massively parallel computer simulations is similar to finding a diamond in the desert. It is necessary to see the global landscape, and to avoid the quicksand and sink holes, in addition to focusing on the details. This is difficult on commodity desktop displays.

Oak Ridge's visualization team has created an extraordinary exploratory visualization environment for research in science and technology, EVEREST, for open computing, data analysis and visualization. ORNL has leveraged the concept of massively parallel cluster computing, academic, commercial, and Open Source parallel visualization research, and the experience of the Sandia's ASCI VIEWS team, in creating the state of the art visualization facility.

The heart of EVEREST is a parallel imaging system capable of mirroring the scale of the massive data sets generated in science and engineering simulations, geographic information system, and biological simulations. Applying commercial graphics and entertainment technologies, off-the-shelf dual processor PCs are connected by a fast Quadrics and gigE network and equipped with advanced graphics cards to drive twenty-seven projectors, creating a scalable high resolution graphics imaging cluster.

EVEREST consists of a 30 ft wide and 8 ft high screen with projection provided by an array of 3 by 9 projectors. The custom-constructed screen is a nearly seamless arrangement of three 10 ft by 8 ft glass sections. The screens are coated with a special imaging surface that has been optimized for optical gain and contrast.

Each projector has high brightness (~3500 Lumens) 3-chip digital micro-mirror (DLP™) technology with a resolution of 1280 pixels by 1024 pixels (Dark Metal™) and a billion colors. Projectors are precision aligned to provide more than 35 MegaPixels of combined display resolution.

An additional pixel-rendering cluster consists of 50 dual processor PCs. Each node is equipped with a high performance commodity graphics adapter and connected by both Gigabit Ethernet and a Quadrics network. The rendering cluster and the imaging cluster together provide real time simulation and visualization capabilities as well as real-time data analysis for CCS researchers.

The Graphite Reactor

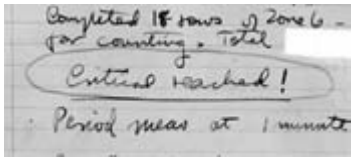
A Historic Landmark at Oak Ridge National Laboratory

`In the early, desperate days of World War II, the United States launched the top-secret, top-priority Manhattan Project...'

In the early, desperate days of U.S. involvement in World War II, American scientists began to fear that the German discovery of uranium fission in 1939 might enable the Nazis to develop a super bomb. Afraid of losing this crucial race, the United States launched the top-secret, top-priority Manhattan Project.

The plan was to create two atomic weapons--one fueled by plutonium, the other by enriched uranium. Hanford, Washington, was selected as the site for plutonium production, but before large reactors could be built there, a pilot plant was necessary to prove the feasibility of scaling up from laboratory experiments. A secluded, rural area near Clinton, Tennessee, was chosen both for the full-scale production of enriched uranium and for the pilot-scale production of plutonium.

The Graphite Reactor, designed for this second purpose, was built in only 11 months. Its job was to show that plutonium could be extracted from irradiated uranium slugs, and its first major challenge was to produce a self-sustaining chain reaction.



Workers began loading uranium into the reactor during the afternoon of Nov. 3, 1943, and progress was swift. Before dawn on Nov. 4, Enrico Fermi was summoned from a nearby guest house. The reactor ``went critical'' at 5 a.m.; less than two months later, it was producing a third of a ton of irradiated uranium a day. Two months after that, Oak Ridge chemists produced the world's first few grams of plutonium.

During the 20 years the Graphite Reactor operated--from 1943 to 1963--it continued its pioneering role. It produced the first electricity from nuclear energy. It was the first reactor used to study the nature of matter and the health hazards of radioactivity. And for years after the war, it was the world's foremost source of radioisotopes for medicine, agriculture, industry, and other purposes.

For more information about the history of the Graphite Reactor visit the website:

http://www.ornl.gov/info/news/cco/graphite.htm

Spallation Neutron Source (SNS)

SNS is an accelerator-based neutron source in Oak Ridge, Tennessee, USA. When at full power, this one-of-a-kind facility will provide the most intense pulsed neutron beams in the world for scientific research and industrial development.

Aerial view of the SNS site, part of Oak Ridge National Laboratory in Tennessee.
Click image for larger version.

SNS was built by a partnership of six U.S Department of Energy laboratories. Along with its sister facility, the High Flux Isotope Reactor, SNS makes Oak Ridge a mecca for neutron-scattering research.

Although most people don't know it, neutron-scattering research has a lot to do with our everyday lives. For example, things like medicine, food, electronics, and cars and airplanes have all been improved by neutron-scattering research.

Neutron research also helps scientists improve materials used in a multitude of different products, such as high-temperature superconductors, powerful lightweight magnets, aluminum bridge decks, and stronger, lighter plastic products.

For more information about how SNS works and the history of SNS visit the website:

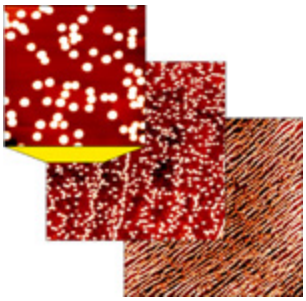
http://neutrons.ornl.gov/aboutsns/aboutsns.shtml

Center for Nanophase Materials Sciences

The Center for Nanophase Materials Sciences (CNMS) at Oak Ridge National Laboratory (ORNL) is a Department of Energy / Office of Science Nanoscale Science Research Center (NSRC) operating as a highly collaborative and multidisciplinary user research facility. The CNMS is one of five DOE NSRCs that form an integrated national user network. Each NSRC is associated with other major national research facilities at one of DOE's National Laboratories, enabling their application to nanoscale science and technology. The central organizing concept of CNMS is to provide unique opportunities to understand nanoscale materials, assemblies, and phenomena, by creating a set of scientific synergies that will accelerate the process of discovery.

To accomplish this, the CNMS integrates nanoscale science with three highly synergistic national needs:

- **Neutron Science**, using the Spallation Neutron Source, SNS, and the recently upgraded High Flux Isotope Reactor, HFIR.
- **Synthesis Science**, or what we call "science-driven synthesis," facilitated by extensive and novel synthesis capabilities in the first three CNMS Research Capabilities areas listed at the bottom of this page and by a new Nanofabrication Research Laboratory.
- **Theory, Modeling and Simulation**, through establishing a new Nanomaterials Theory Institute, with close connections to the staff expertise and computational capabilities of ORNL's Center for Computational Sciences



AFM images of Fe nanodots and nanowires on flat and stepped NaCl surfaces (edge length 750nm)

and the new national Leadership Scientific Computing Facility.

The CNMS's research capabilities provide a broad community of scientists, engineers, and students from throughout the nation, but particularly the southeastern United States, with ready access to the full range of tools and collaborative capabilities needed for nanoscale research, in a single location.

For more information about CNMS's scientific themes and research capabilities visit the website:

http://cnms.ornl.gov/