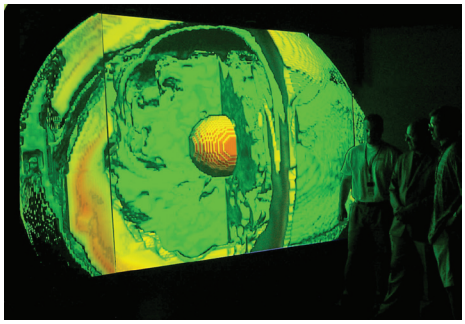
NATIONAL LEADERSHIP COMPUTING FACILITY
NATIONAL CENTER FOR COMPUTATIONAL SCIENCES

National Center for Computational Sciences

The National Center for Computational Sciences (NCCS) at the Oak Ridge National Laboratory (ORNL) was established in 1992 and in 2004 was designated by the Secretary of Energy as the Leadership Computing Facility for the nation, providing a resource 100 times more powerful than current capabilities.



Simulation results of core collapse supernovae mechanisms from John Blondin, North Carolina State University, and Tony Mezzacappa, ORNL.

The Leadership Computing Facility is building the world's most powerful supercomputer for unclassified scientific research. The facility provides researchers an unparalleled environment for new discoveries that will dramatically impact the nation's ability to produce a secure energy economy and increase mankind's understanding of our world, from the molecules in the air we breathe, to the birth and death of the stars in the sky. As a designated User Facility, the NCCS will

- deliver leadership-class computing for science and engineering
- focus on grand challenge science and engineering applications
- procure largest-scale computer systems (beyond vendors' design point) and develop high-end operational and application software
- educate and train next generation computational scientists

Today, the computing resources of the NLCF are among the fastest in the world, able to perform more than 40 trillion calculations per second. The Cray X1E system is the largest computer system of its kind and, for climate modeling and fusion simulation, it is the fastest computer available. The Cray XT3 system is the most powerful unclassified system available to DOE and university researchers. It can deliver more than 25 trillion calculations per second, and has more than 10 trillion bytes of memory.

The NCCS has an aggressive roadmap to sustain leadership for scientific computing. The plan will quadruple the performance of the Cray XT3 system in 2006 to 100 trillion operations per second. Our goal is to achieve 1,000 trillion operations per second in 2008, meeting the growing demand of scientists for faster, more powerful tools to achieve critically needed simulations that will enhance or replace more costly, less accurate experimental investigations.

In 2005, researchers were provided access to NLCF resources to initiate advanced studies in the areas of chemistry, combustion, fusion, astrophysics, and accelerator simulation. From calculations that now take weeks, rather than months or years, researchers are gaining new insight into the chemistry of extinction and re-ignition mechanisms, key components in developing combustors that use fuel efficiently and minimize harmful emissions.

Alternative energy source exploration is being aided by NCCS investigations of the physics of turbulence and plasma behavior on the design of fusion power systems. This research is 10 times faster on vector versus non-vector processors, and the NLCF Cray X1E is the only vector system of its size in the United States that is available for open research.

OAK RIDGE National Laboratory

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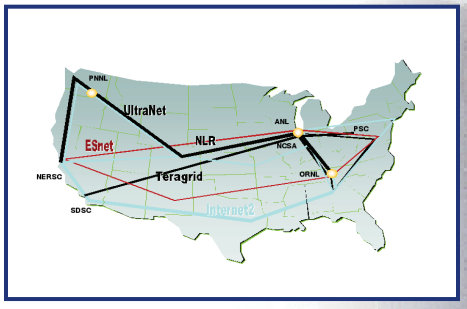
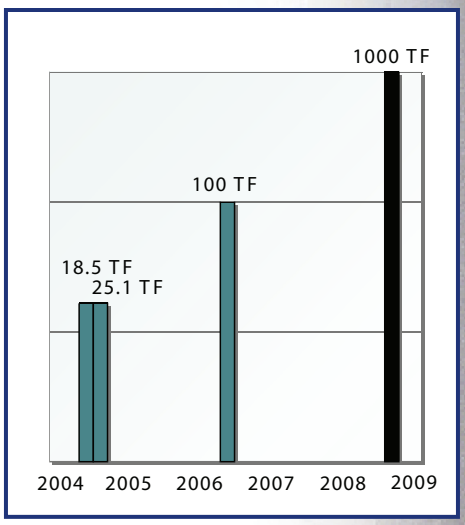
In addition to high-end computing resources, the NCCS comprises expert staff in the areas of user support, application domain specialties and high-performance computer science. The exceptional combination of human and computer resources provides a significant advantage to users of the facility, and an opportunity for collaborative investigations.



The NCCS is connected to every major scientific and research network in the country.

The NCCS is connected to major network hubs in Atlanta and Chicago, making this unique user facility accessible to academia, industry, and other laboratories. This network represents a truly world-class infrastructure, allowing the creation of on-demand, short- or long-term dedicated channels at 10 gigabits per second or more to research partners and other research networks.

The network and physical infrastructure of the NCCS is designed to be expandable so that as the demands of the scientific community for leadership computing increase, the NCCS is poised to support new systems that will enable leading-edge research.



The NCCS roadmap for delivering leadership computing.

25 TF Cray XT3

18.5 TF Cray X1E

For more information, contact:
Dr. Jeffrey A. Nichols, Acting Director
National Center for Computational Sciences
(865) 574-6224
NicholsJA@ornl.gov