

# MULTIPROGRAMMATIC AND INSTITUTIONAL COMPUTING

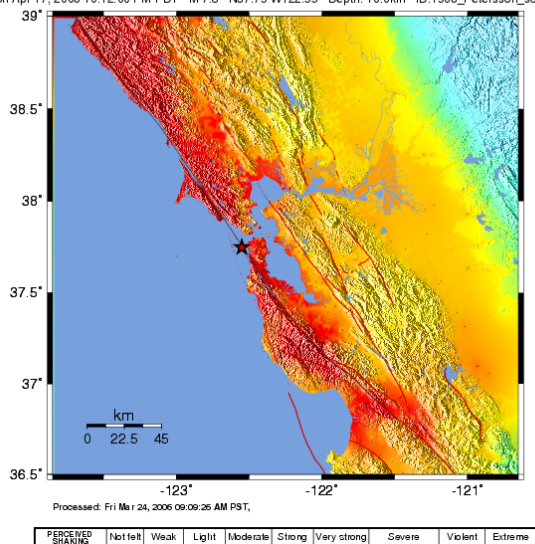


## M&IC Mission

The Multiprogrammatic and Institutional Computing (M&IC) Program at Lawrence Livermore National Laboratory (LLNL) brings tailored, cost-effective computing services to LLNL programs and scientists. The Livermore Computing Center (LC) is primarily funded through the Advanced Simulation and Computing (ASC) and M&IC Programs. Because M&IC represents a broadening of services to multiple programs and to institutional users, there are two related thrusts:

- **Multiprogrammatic Computing** provides options for any non-Laboratory Directed Research and Development (LDRD) effort, including external collaborations and work for others, to use LC in a cost-effective manner, either through purchasing a substantial block of time or investing in the equipment required to meet the effort's needs.
- **Institutional Computing** grants researchers, independent of programmatic connection, access to institutional computer time. Any LDRD researcher requiring access will be accommodated, and services are provided at no cost. A special category of institutional computing is the Grand Challenge computing campaign. These campaigns allocate significant capability resources to push the boundaries of high performance computing (HPC) and simulation.

CISN Peak Velocity Map (in cm/s) Epicenter: 1906 Petersson song2c BA synthetics  
Mon Apr 17, 2006 10:12:00 PM PDT M 7.8 N37.75 W122.55 Depth: 10.0km ID:1906\_Petersson\_song2c\_BA



Computed Mercalli intensities during the great 1906 San Francisco earthquake.

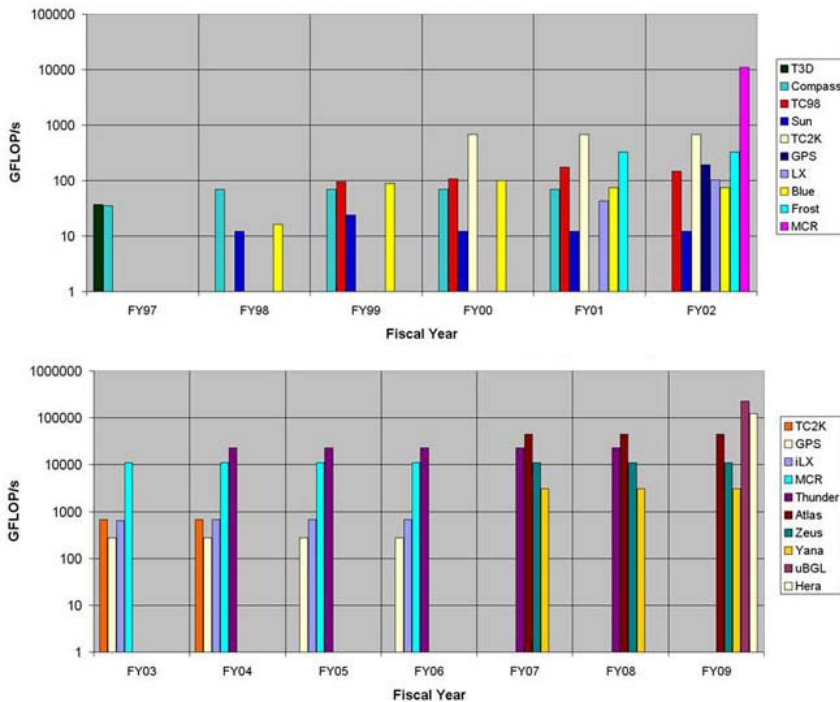
M&IC works closely with the Stockpile Stewardship Program (SSP) and together have made LLNL a premier institution for computational and simulation science. Through strong and consistent investments, M&IC meets the demand for capacity computing and provides cost-effective capability platforms. In fielding computing platforms and advanced data assessment capabilities, M&IC leverages the investments of the SSP for the mutual benefit of the SSP, M&IC, and LLNL.

M&IC's computing resources are used to push the limits of computing and its application to simulation science by providing LLNL scientists, and their collaborators across the U.S., access to world-class unclassified computing systems.

## M&IC History and Governance Model

In the latter half of the 1990s, the maturation of parallel computing technology made it possible to contemplate the development of production-level 3D scientific applications requiring super-teraflop computational capability. LLNL, as an institution, recognized that to revolutionize scientific methods in the next century, a science and technology (S&T) base that also had access to powerful ASC-class computing environments was needed. From this notion was born Multiprogrammatic and Institutional Computing.

M&IC is truly institutional. Many directorates invest, and the institution invests. The growth of M&IC since 1997 has been significant, and the total capacity currently available to M&IC scientists is about 550 TF/s.



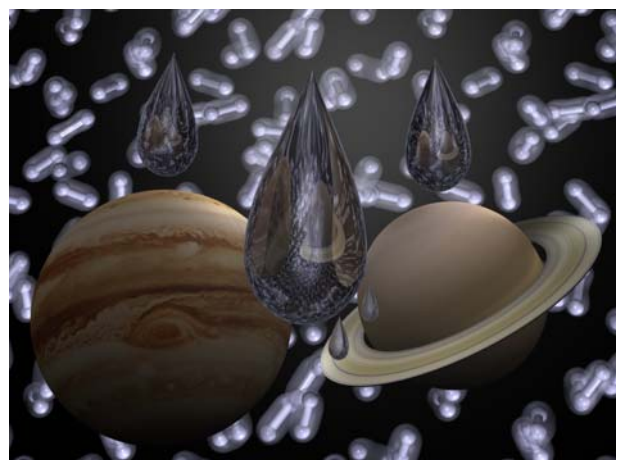
The M&IC "board of directors" (the Institutional Computing Executive Group) consists of well-known LLNL scientists qualified to identify computing deficiencies and request infrastructure improvements. M&IC management reports to the Deputy Director for S&T, who provides guidance relative to the institution's overall S&T goals and, at the highest level, manages allocations. The M&IC environment is comparable to the best unclassified environments in the U.S., and the total investment at LLNL is only about \$11M per year. Such is the power of leverage and momentum from partnering with the ASC Program.

The institution covers all operational costs and also invests in HPC hardware. Multiprogrammatic efforts invest only in the hardware. A share of the computing resource (called a bank) is

### Growth of M&IC computing power (in GF/s) from 1997–2009.

correlated to the level of investment. Access to the institution's banks is managed through an HPC request process. Smaller requests are awarded by the M&IC program office. Large requests are required to compete under the Grand Challenge process.

Because of consistent institutional and ASC investments, LLNL has the benefit of one of the most experienced and well-staffed scientific computing centers in the world. An investment in hardware is leveraged by attention from experienced integrators, operators, and services staff, and from a well-engineered foundation in networks and storage, all of which mitigates considerably the risks inherent in investing in leading-edge technologies.



Helium rain inside the Jovian planet.