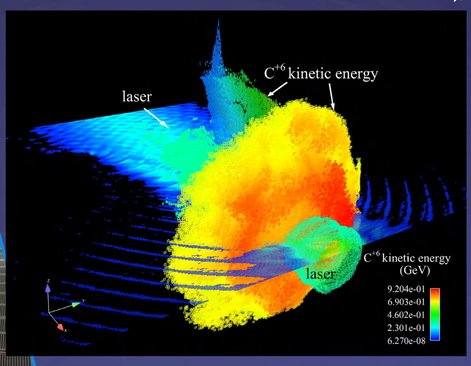
Advanced Simulation & Computing

ASC™

Working with industry, NNSA has led the way for US preeminence in high performance computing (HPC)

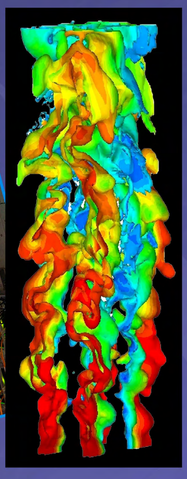
ROADRUNNER (Los Alamos National Laboratory)

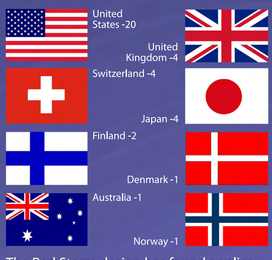


On May 26, 2008, Roadrunner set the current world record and broke the Petaflop barrier, exceeding one million billion mathematical calculations per second. The system's innovative hybrid architecture, which uses IBM PowerXCell 8i processors as powerful accelerators, opens new markets for IBM and new horizons for scientific applications such as the VPIC laser plasma interaction shown.

RED STORM (Sandia National Laboratories)

Direct Numerical Simulation of Stratified Premixed Turbulent Combustion – Three cases were run on three different Red Storm – class systems



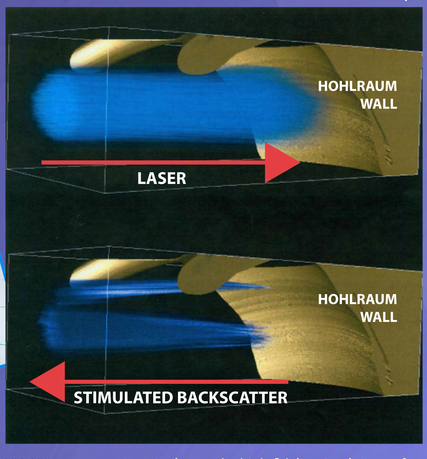


The Red Storm design has found application beyond nuclear weapons analysis to serve the broader HPC community. There are over 35 derivative systems around the world, with 20 in US.

Red Storm revitalizes a US industry increasing HPC market share: With the commercialization of Red Storm as the XT3, Cray's market share rose from 6% in 2002 to 21% in 2006*.

*Source: IDC #209251 *Technical Computing Systems: Competitive Analysis*, November 2007

BLUEGENE/L (Lawrence Livermore National Laboratory)



Concurrently using 196,608 processors in a single run, the high-fidelity simulations of a three-dimenisonal laser beam interacting with target is critical to achieving fusion ignition on the National Ignition Facility.

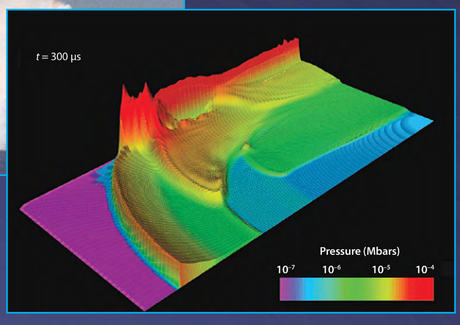
BlueGene/L is refining the design of the National Ignition Facility, scheduled to achieve fusion ignition in 2010. Obtaining controlled laboratory fusion is the holy grail of national energy independence.

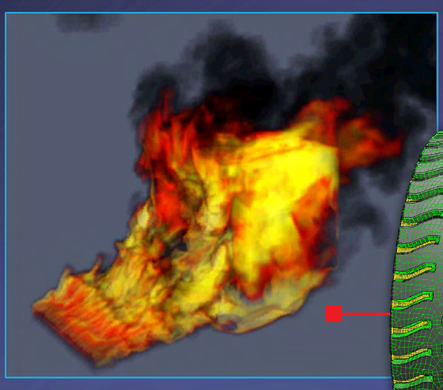
www.sandia.gov/NNSA/ASC/

National Nuclear Security Administration

America Competes

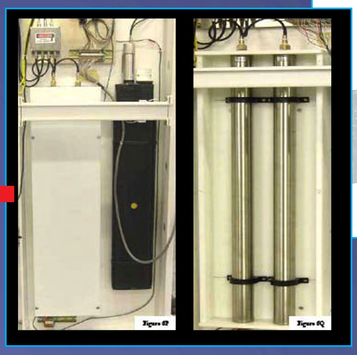
In the absence of underground nuclear testing, assessment of the US nuclear deterrence is enabled by weapons simulation codes, validated through experimentation. A simulation from a Los Alamos National Laboratory Shavano Project code shows time evolution of a shock, to be compared to an experiment.

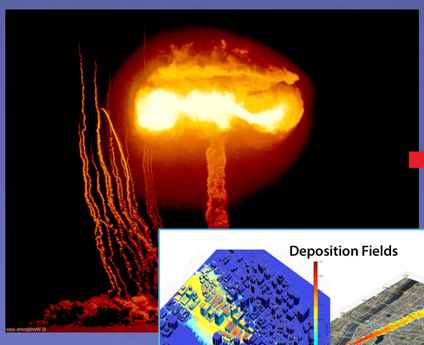


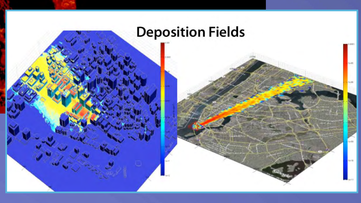


The fire simulation image is the result of the use of weapon engineering codes on Sandia National Laboratories' Red Storm supercomputer. These codes also contribute to US industrial applications such as the Goodyear tire simulation representation shown on the right.

ASC radiation transport calculations support conceptual studies enabling future development and deployment of systems capable of detecting illicit movement (i.e. smuggling) of Special Nuclear Material, particularly in difficult-to-access and difficult-to-measure situations. A TSA Vehicle Portal Monitor is shown with Neutron and Gamma Ray detectors.

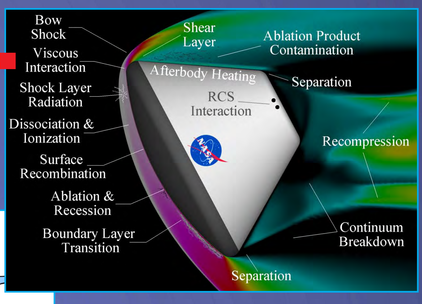


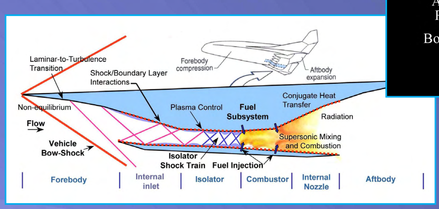




ASC codes have unique capabilities for simulating the effects from weapons of mass destruction in urban environments to assist with managing the consequences. Using evidence gathered from an actual nuclear event, ASC codes can "reverse-engineer" the design of the nuclear weapon and other details, thereby helping identify the perpetrators.

The ASC Predictive Science Academic Alliance Program (PSAAP) has collaborated with US academic institutions to establish five Centers of Excellence for validated, large-scale, multidisciplinary, simulation-based Predictive Science. This consortium maintains a steady stream of subject matter experts ready to work on issues of National Security interest.





www.sandia.gov/NNSA/ASC/

National Nuclear Security Administration