About the cover:
The Computational Physics and Methods group (CCS-2) studied effects of Pressure-Temperature equilibrium on flow hydrodynamics for Richtmyer-Meshkov (shock-driven) instability by comparing two hydrodynamic codes: the Advanced Simulation and Computing code RAGE/SAGE and the University at Stony Brook's hydro-code FronTier. See Fig. 2 on p. 35—a late-time comparison of cylindrical RM instability.

***Graphics on Title Page**:*
The Associate Directorate for Theory, Simulation, and Computation is composed of four divisions. Each graphic represents a division (L to R, top to bottom). The top photograph shows staff from the High-Performance Computing Environments group (HPC-4) in the immersive CAVE visualization. See p. 26, Fig. 1 for more details.

In the middle section of graphics, the first graphic on the left shows numerical error for different refinement criteria (p. 85, Fig. 4). The center graphic shows a late-time comparison of the Richtmyer-Meshkov instability (p. 35, Fig. 2). The graphic on the right shows a 3-D incompressible Rayleigh-Taylor instability flow in the Boussinesq regime with finite viscosity and dissipation (p. 72, Fig. 1).

The bottom graphic shows the message-passing networks or interconnect networks that provide connections for internal communications between thousands of processors within the Roadrunner cluster. See p. 194, Fig. 1 for more details.

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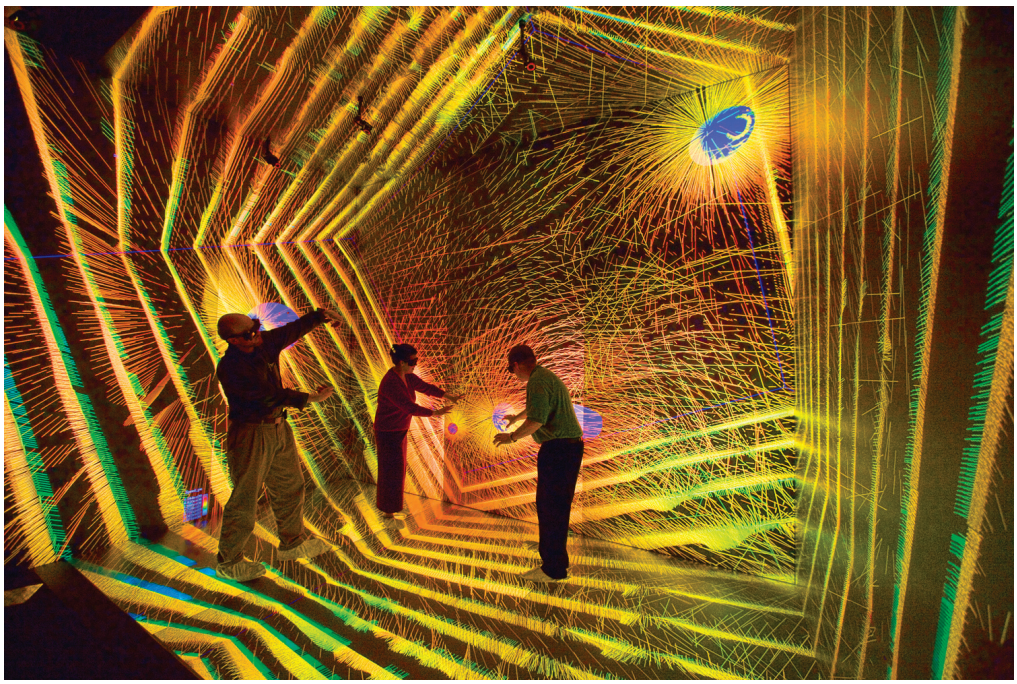

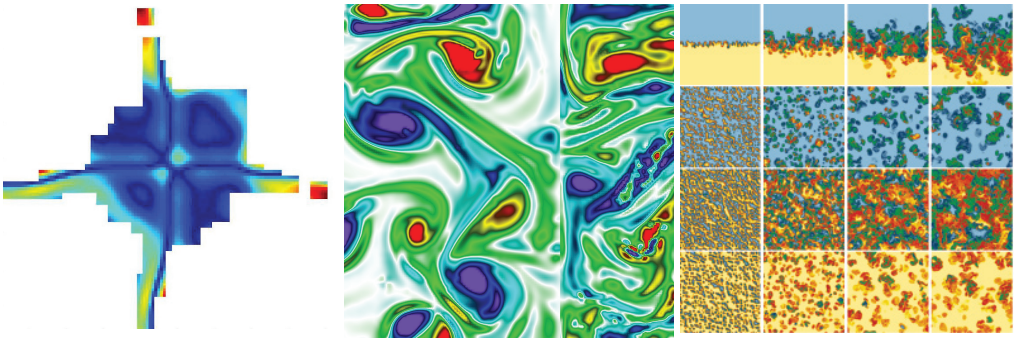

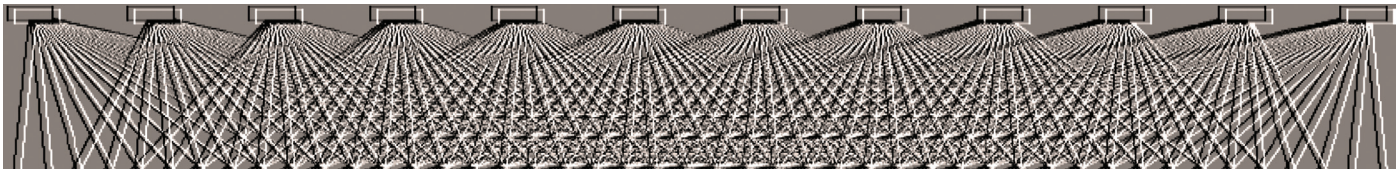

ADTSC web site: http://www.lanl.gov/orgs/adtsc

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Nuclear Weapons Highlights 2007

Associate Directorate for Theory, Simulation, and Computation (ADTSC)

Preface

The Theory, Simulation, and Computation Directorate (ADTSC) plays a pivotal role for the Nuclear Weapons (NW) Program, serving as the principal steward for the theory and modeling, simulation, high-performance computing, and computer science capabilities for the Los Alamos National Laboratory. These capability areas serve the NW program in broad areas of physics and engineering for weapons physics, fluid mechanics, and computational methods, statistical sciences and applied mathematics, and high-end computation and computer science, and are also applied to other programs at the Laboratory.

The NW program has formalized its partnership with the Laboratory as a whole by identifying ten broad areas of capability central to the NW mission, then giving division leaders the responsibility, and the resources, for managing the health and development of these capability areas. Of the ten capability areas, division leaders from the ADTSC directorate are managing four of them. These capabilities are Computational Physics and Mathematics (led by Stephen Lee), Computer Sciences (Stephen Lee), High-Performance Computing (John Morrison), and Theory and Modeling (Tony Redondo). These capability leaders are given negotiated financial authority to manage the capability areas on behalf of the NW program.

The future challenge is the more general goal of true science-based prediction, where the natural scientific partnerships among theoreticians and modelers, experimentalists, and the high-performance computing and simulation community are purposefully focused to produce validated simulation tools for a broad array of national-level security problems, on scales befitting a national laboratory.

Paul J. Dotson
Deputy Associate Director, ADTSC

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Organizational Abbreviation Legend

Computer, Computational, and Statistical Sciences Division
CCS-1 Computer Science for High-Performance Computing
CCS-2 Computational Physics and Methods
CCS-3 Information Sciences
CCS-6 Statistical Sciences
CCS-DO Division Office

Computing, Telecommunications, and Networking Division
CTN-DC Departmental Computing (CTN-1, -2, and -3)
CTN-1 Departmental Computing
CTN-2 Departmental Computing
CTN-3 Departmental Computing
CTN-4 Telecommunications
CTN-5 Network Engineering
CTN-DO Division Office

High-Performance Computing
HPC-1 Scientific Software Solutions
HPC-2 Computing Operations and Support
HPC-3 High-Performance Computing Systems
HPC-4 High-Performance Computing Environments
HPC-5 High-Performance Systems Integration

Theoretical Division
T-1 Equation of State and Mechanics of Materials
T-3 Fluid Dynamics
T-4 Atomic and Optical Theory
T-6 Theoretical Astrophysics
T-7 Mathematical Modeling and Analysis
T-8 Elementary Particles and Field Theory
T-10 Theoretical Biology and Biophysics
T-11 Condensed Matter and Statistical Physics
T-12 Theoretical Chemistry and Molecular Physics
T-13 Complex Systems
T-14 Explosives and Organic Materials
T-15 Plasma Theory
T-16 Nuclear Physics
CNLS Center for Nonlinear Studies
T-DO Division Office