

## Clinton Administration Proposes Major Computer Technology Program

The Clinton Administration proposes to spend \$366 million in Fiscal Year 2000 on a major new information technology research effort, to be supervised jointly by the U.S. Department of Energy's (DOE) national laboratories and the National Science Foundation (NSF).

The effort, formally titled the Scientific Simulation Initiative (SSI), aims at developing, within the next five years, next-generation computer modeling software, able to function at speeds of trillions of calculations per second. Such massive computer power is considered necessary to create advanced simulations to tackle some of the most challenging problems now confronting the U.S. research communities.

The initiative is the product of a year-long examination by DOE and NSF of the prospects for bringing new supercomputing technology online. The two agencies have been cooperating via a joint Workshop on Advanced Scientific Computing, which concluded that the technology is on the verge of another major breakthrough: reaching full parity with laboratory experiments and mathematical theory as a research tool.

For example, according to the most recent report produced by the two agencies' joint working group, *Report of the National Workshop on Advanced Scientific Computation*, technology already has reached the stage at which scientists can simulate detailed fluid flows and chemical reactions in engineering applications, achievements that were beyond the ability of computer technology only a few years ago. As a result, the report states, "the computer literally is providing a new window through which we can observe the natural world in exquisite detail."

At the same time, however, the report cautions about a "serious shortage" of scientists and engineers who are "able to do cutting-edge, interdisciplinary research in the expanding computation aspects of their fields." SSI represents the government's attempt to both widen the "window" and to attract more young people to scientific and engineering disciplines. The initiative's five-year plan would increase research computer speeds one thousandfold, perhaps to 40 or even 60 teraflops. In addition, SSI would attempt to make such computers accessible to the United States' entire scientific and engineering communities. Such a goal is vital, according to the working group report, because "there is now a growing lack of capacity in the U.S. for doing the important computations that

already are feasible."

At the same time, the government intends to begin "a vigorous effort to develop the software, the algorithms, the communication infrastructure, and the visualization systems" that would be necessary to use such massive computing power effectively.

While DOE and NSF will be primarily responsible for the initiative, SSI projects also will be conducted at agencies whose responsibilities include the materials research field, including the National Aeronautics and Space Administration (NASA), the Department of Defense (DoD), the National Institute of Standards and Technology (NIST), the National Oceanic and Atmospheric Administration (NOAA), and the National Institutes of Health (NIH). Together, these agencies will attempt to address three major challenges identified by the DOE-NSF working group:

- strategic problems for which the underlying scientific principles are well-understood, but whose complexities have thus far been beyond the capabilities of computer simulations, such as the combustion dynamics of motor vehicles, aircraft, and spacecraft engines;
- problems for which the underlying principles are not yet well-enough understood to justify simulations, but where advanced computing technology may improve understanding of the principles themselves; examples include structural materials performance in estimating earthquake hazards, and the behavior of biological systems; and
- fundamental problems where "there is reason to believe" that next-generation computers will produce major advances, such as lattice gauge theory in elementary particle physics.

An additional, overriding goal, according to workshop participants, is to establish a national information infrastructure for science and engineering—a techno-Internet—that will, among other functions, provide "broad access" to digital libraries and support remote use of scientific instruments, such as the light sources at the national laboratories.

Materials research will combine all aspects of SSI. The DOE-NSF report states that the challenge is not only to invent materials, but also to perfect existing ones by fabrication and processing so that they have the desired performance and environmental response. The report states, "In other words, we would like computationally to simulate 'mature materials' for specific technologies."

One example of this approach would be material evolution during processing and heat treating. Teraflops computation could "dramatically shorten the time and

cost to develop mature materials" for such applications as high-technology aircraft, automobiles, and electronic and magnetic storage devices. There also may be prime applications in microfabrication processes, nanoscale devices, and semiconductor lasers. Developing mature materials requires teams involving materials scientists, chemists, mechanical engineers, and physicists. Therefore, "integrative environments will dynamically couple computational modeling on all lengths and time scales with empirical databases," according to the report.

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## DOE Launches \$20 Million Initiative for Future Automobiles

The Department of Energy has announced a \$20 million research and development initiative to go toward electric power systems of future advanced automobiles. Under the initiative, two U.S. companies will produce the critical components needed to manage the higher levels of power in advanced hybrid and fuel cell vehicles.

Secretary of Energy Bill Richardson said, "This initiative will develop the smarter, smaller, and less expensive electric power system needed for the 'car of the future' . . . and, under this initiative, we plan to reduce the \$10,000 cost to less than \$500."

Two firms have been selected to receive about \$10 million each over three years from DOE's Office of Energy Efficiency and Renewable Energy. Silicon Power Corporation of Malvern, Pa., and SatCon Technology Corporation of Cambridge, Mass., were competitively selected during a solicitation issued in mid-August 1998 and will now begin negotiating details of the agreement under which each company will spend an additional \$10 million each.

Under this initiative, the companies will develop a family of electric power modules that will manage the generation, storage, and use of electrical power in hybrid gas-electric, diesel-electric, and fuel cell vehicles. These systems will help meet the Partnership for A New Generation of Vehicles' (PNGV) challenge of developing highly efficient, nonpolluting, and affordable passenger vehicles by the year 2004.

Earlier technological advancements achieved by the Navy's Power Electronic Building Block program helped reduce the size of the electric power systems.

Testing will be carried out at DOE national laboratories and facilities of DaimlerChrysler, Ford, and General Motors under the PNGV program to determine readiness for use in concept demonstration vehicles. □