Big Iron in the Steel City

An unprecedented system will be the most powerful in the world available for public research.

On August 3, the National Science Foundation awarded $45 million for PSC to provide "terascale" computing capability for U.S. researchers in all science and engineering disciplines. PSC will collaborate with Compaq Computer Corporation to create a new, extremely powerful system for the use of scientists and engineers nationwide.

Terascale refers to computational power beyond a "teraflop"—a trillion calculations per second. While several terascale systems have been developed for classified research at national laboratories, the PSC system will be the most powerful to date designed as an open resource for scientists attacking a wide range of problems. In this respect, it fills a gap in U.S. research capability—highlighted in a 1999 report to President Clinton—and will facilitate progress in many areas: novel computer-science applications such as tele-immersion and areas of significant social impact, such as the structure and dynamics of proteins useful in drug design, storm-scale weather forecasting, and modeling of earthquakes and global climate change.

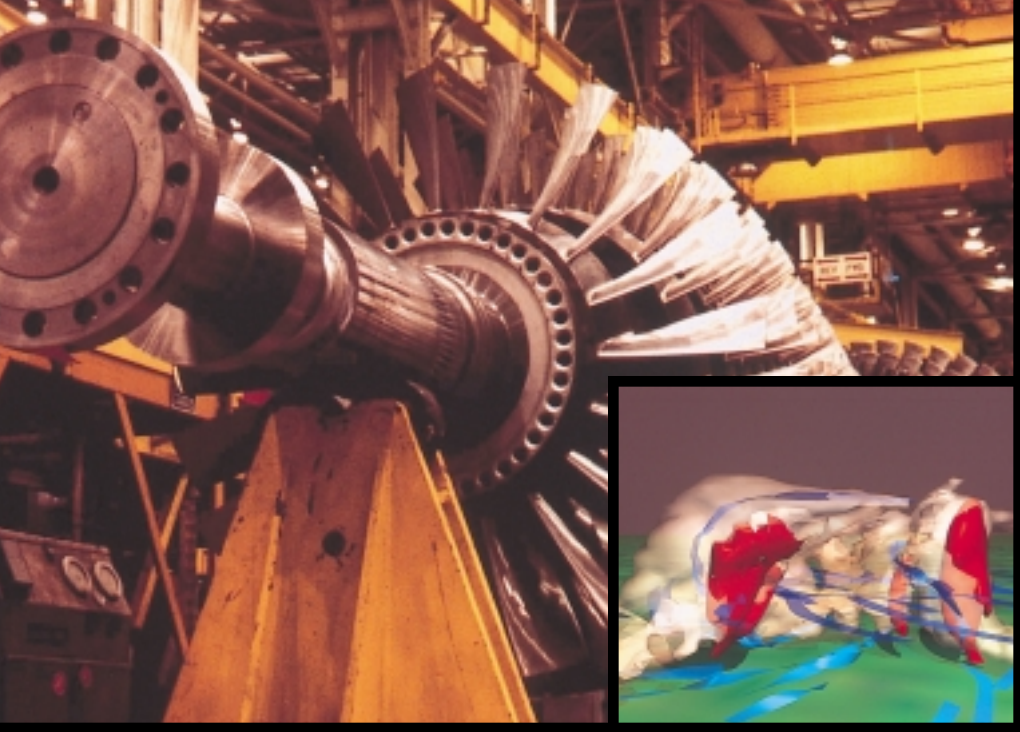
The Terascale Computing System

The three-year award, effective Oct. 1, is based on PSC's proposal to provide a system, installed and available for use in 2001, with peak performance of six teraflops. PSC and Compaq will collaborate to develop the system, which although based on existing or soon to be available components is unprecedented in scale. Its design is optimized to the computational requirements posed by a wide range of research applications, and it pushes beyond simple evolution of existing technology.

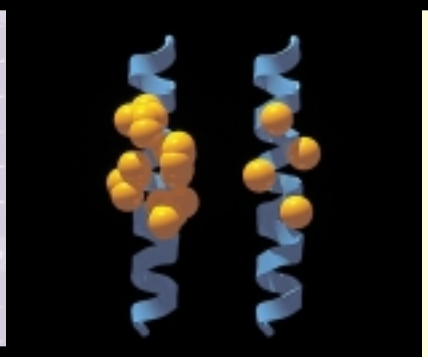
The brain of the six teraflop system will be a network of Compaq AlphaServers, 682 of them, each of which itself contains four Compaq Alpha microprocessors. Existing terascale systems rely on other processors, but extensive testing by PSC and others indicates that the Alpha processor offers superior performance over a range of applications.

Along with processing power, the terascale system will feature 2.7 terabytes of memory, high-bandwidth, low-latency Quadrics Supercomputer World interconnects among AlphaServers, and remarkable capabilities for large-scale data handling, including the ability to write memory to disk in three minutes,

"PSC has an excellent record of installing innovative, high-performance systems," said National Science Foundation director Rita Colwell, "and operating them to maximize research productivity."



682 compute nodes
2,728 Alpha processors
Peak performance: 6 TFlops
Memory: 2.7 TBytes
Disk: over 50 TBytes
MPI latency: ~5 microseconds
File-server bandwidth: ~18 GBytes/sec.



"I am pleased that the National Science Foundation is expanding its investment in supercomputing systems capable of making trillions of calculations per second," said President Clinton. "This investment will accelerate the pace of discovery in science and engineering—allowing us to better predict tornadoes, speed up the discovery of life-saving drugs and design more fuel-efficient engines."

and to write a terabyte per hour to tape. The system will also employ a tightly coupled visualization system. With these architectural features, the PSC terascale system will promote innovative applications in many areas.

The terascale system will draw on a history of collaboration between PSC and Compaq, and PSC and the computer-science and computational-science community. It represents an extension of PSC's success at installing new systems—resolving the myriad of unanticipated hardware and software glitches that come up—and turning them over rapidly to the scientific community as productive research tools. In fall 2000, PSC will install an initial system with a peak performance of 0.4 teraflops. The six teraflop system, which will use faster Compaq Alpha microprocessors not yet available, will evolve from this.

Technology in the Pittsburgh Region

The terascale system, including software and networking, highlights a significant strength of PSC: its tri-partite affiliation with Westinghouse, Carnegie Mellon, the University of Pittsburgh and the pooled computing-related expertise of faculty and staff at both universities.

"This award, which comes as the culmination of a national competition, recognizes PSC's leadership in high-performance computing and communications," said Jared L. Cohon, president of Carnegie Mellon. "And it provides another key building block for our region's technology future, enhancing our international stature in the development and application of advanced computing technology."

"A gap exists between the computing resources available to the classified world and the open scientific community," said Mark Nordenberg, chancellor of the University of Pittsburgh. "It is ideal that PSC, a world leader in acquiring and deploying early the most powerful computers for science and engineering, can contribute to filling this gap. This award also demonstrates the unique scientific strengths that exist in Pittsburgh when its major research universities partner with each other and with leaders in industry."

"Today's terascale award is one more in a long list of PSC's major achievements," said Charlie Pryor, president and CEO of Westinghouse Electric Company. "Westinghouse is proud of PSC's contribution to the nation's scientific community and is pleased to have been associated with PSC since its inception."

Carnegie Mellon
University of Pittsburgh

[pushing beyond simple evolution of existing technology]