

# Powerful computing available via HPCDC

## ONYX 2s PROVIDE FOR PARALLEL PROCESSING



**High performance computing —** Deborah Schwartz, HPCDC manager, and Mark Kolstoe, IBAR senior network and system administrator, with some of the high-performance-computing resources in the Weapons Division's HPCDC.



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Imagine if all the computing horsepower you could conceivably use—say up to 40 billion operations per second—was at your fingertips, and that it wouldn't cost you a penny. Well, it is, and it won't. One of the little known but best bargains at NAWCWD is the huge array of computing resources and services available through the High Performance Computing Distributed Center (HPCDC).

Bringing a high-performance computing center to NAWCWD was the brainchild of Eileen Shibley, then head of the Integrated Battlespace Arena (IBAR). "We knew the DOD High Performance Computer Modernization Program was looking to establish new distributed centers," said Shibley, "and we decided to go after one."

In February 1999 NAWCWD was selected as the site of a new HPCDC, which included a grant for \$4 million to buy state-of-the-art computing equipment.

### Wave of the Future

At the heart of high-performance computing is the concept of parallel processing. In parallel processing, the programmer segments the computational aspects of the problem, and these segments are distributed to different processors and run concurrently. Thus, for perfect parallelism, a fixed-size problem that would take 10 hours to run on a single processor would run in one hour on a parallel system using 10 processors. In reality, perfect parallelism is rare, but dramatic decreases in runtime are common.

"This is the wave of the future," said Dr. Merle Elson, a NAWCWD physicist who uses parallel-processing for numerical analysis. "Anyone doing serious numerical analysis would do well to take advantage of parallel processing."

### What's Available?

The HPCDC, located in the IBAR, hosts two Silicon Graphics Onyx 2 Reality Monster systems featuring eight graphics pipes and 64 parallel processors running at 300 megahertz. The systems have 24.5 gigabytes of memory augmented by a 1 terabyte on-line archive and an operating speed of 40 gigaflops.

"The graphics pipes are an important feature," said Deborah Schwartz, manager of the HPCDC. "In the IBAR's Virtual Prototype Facility, for example, we use three separate graphics pipes. These convert raw data into the changing terrain images that are displayed on each of the VPF's three screens."

Any NAWCWD employee with computing needs that exceed the ability of his or her own computing resources is welcome to use the HPCDC's computers and can set up an appointment to discuss needs and work out a schedule by calling Schwartz.

The charge for all this? "Absolutely nothing," she says. "All we ask is that you complete a two-page application telling us about your project, what science or technology area it falls into, and how you will use the computer resources."

NAWCWD has submitted a \$2.5 million proposal to the DOD High Performance Computer Modernization Program to increase the existing capabilities. If approved this will add a third Reality Monster System (64 processor, 400 megahertz, 16 gigabytes memory, and 4 graphics pipes) capable of 51 gigaflops operational speed. The proposal also calls for adding Secure Compartmented Information capabilities. The HPCDC presently can handle material at the Secret level.

### And There's More

"We are a 'real time' facility," explained Schwartz. "Many of the tasks that we carry out—supporting hardware-in-the-loop testing, for example—require that our computers be actively engaged with that support while the exercise is under way. This makes scheduling for other tasks a little more difficult. But we haven't turned anybody away yet."

That's because the HPCDC is merely the most visible part of a much larger computing network. NAWCWD's HPCDC is one of 18 distributed centers scattered across the country. Each is required by its charter to make 20 percent of the computer time available to other DOD facilities.

In addition to the distributed centers, the DOD High Performance Computer Modernization Program has four Major Shared Resource Centers. These are where the really massive computational capabilities reside. The Resource Center at the Army Research Laboratory, for example, sports 31 systems including SGI 32 CPU Origin 300s, Sun E10000s, and Cray J916s.

The Resource Center systems are also available to NAWCWD researchers and engineers at no charge. In fact, eight NAWCWD programs are currently running projects at Major Shared Resource Centers.

Each Major Shared Resource Center provides a complete high-performance computing environment including hardware, software, data storage, archiving, visualization, training, and expertise in specific computational technology areas. "If necessary, they'll work with you to write custom software that will let your programs run on their computers," said Schwartz.

As well as managing the HPCDC, Schwartz is the Service/Agency Approving Authority for the Major Shared Resource Centers. She serves as a liaison between NAWCWD users and the Centers, brokering for time on Center computers, obtaining the high-tech electronic access-code cards required for logging on, and handling requests for computer access.

"Deborah oversees all the administrative details, and she does a great job," said Elson. From his desk in the Research Wing of Michelson Laboratory, Elson uses several Cray and SGI parallel-processing systems at the Naval Oceanographic Office Major Shared Resource Center. Logging on is a simple process, and then, said Elson, "it's just like being in the same room with them."

Currently, the HPCDC is serving 24 projects. A third of these are using resources at other DOD High Performance Computing Centers. Among the beneficiaries of HPCDC services in FY00 were SLAM ER, JSOW, JDAM, DAMASK, RAM, Sidewinder AIM-9X, Sparrow, AMRAAM, and Joint Strike Fighter.

### **Kosovo Support**

In early 1999, when the wrappers were scarcely off the new Reality Monster systems at the NAWCWD HPCDC, engineer Ken Koch came to the new facility with an urgent request.

Koch had been tasked to create a georeferenced database of Kosovo imagery and digital terrain. The database would be used by Allied forces to register and correlate tactical imagery for prosecuting time-critical targets.

But Koch's task itself was time critical. On the five Sun Ultra 2 processors that were available to him, he calculated that it would take about six and a half months of 24-hour-a-day processing to complete the extremely computer-intensive project. Too slow for the fast-paced operations in Kosovo.

An HPCDC account was set up for Koch as well as a unique operating schedule. During workdays, one or two of the HPCDC processors would run Koch's programs. From 6 p.m. until 7 a.m., however, all 64 processors would run the program full-time, and on weekends, all processors would run Koch's program continuously until Monday morning.

The task was soon completed and the product sent to Kosovo, where it was used by the Allies not only for determining weapon-guidance coordinates but also for aiding intelligence operations and strike planning. "If it weren't for the HPCDC, we might still be crunching numbers," said an appreciative Koch.

