



## DoD High Performance Computing Modernization Program Nurtures Skills at SSC San Diego\*



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People are the lifeblood of an organization, and their skills, creativity, and passion define the essential ingredients that shape and move organizations to higher levels of accomplishment and success.

Technology is in the midst of advances and breakthroughs unparalleled in the history of science. Advances in computer and networking technology are moving at such an extraordinarily rapid pace that upgrades of computer systems, networking devices, and connectivity, as well as software, have become absolute necessities for organizations striving to maintain leadership at the forefront of technology. Late in August 2000, Eastman Kodak announced a chip capable of capturing digital images with 4096-by-4096 pixel resolution, about twice the resolution of 35-millimeter film. Just 2 weeks later, a Silicon Valley pioneer chip designer announced an image-sensing chip with the same resolution as the Kodak chip, but made using a cheaper technique. The competitive race is fierce, and the results are remarkable.

But how about the development of people in these rapidly evolving technological upheavals? Young and talented scientists and engineers join our ranks on a regular basis. These young people bring with them the skills and creativity needed to exploit the newly developed technologies. However, as technology moves and changes, and as the missions and goals of an organization shift, it becomes of paramount importance that an organization re-train and re-educate its most valuable asset—its human resources.

The High Performance Computing Modernization Program (HPCMP) was created in fiscal year (FY) 93 by the Department of Defense (DoD) at congressional direction in response to the collective request by senior DoD scientific and engineering leaders to modernize high performance computing (HPC) capabilities available to researchers. Since then, the DoD HPCMP has successfully put together a world-class HPC infrastructure composed of HPC Centers, a nationwide RDT&E network, and a parallel software development initiative.

The HPC Centers consist of 4 Major Shared Resource Centers (MSRCs) and 17 Distributed Centers (DCs), including ours at SSC San Diego. The Defense Research and Engineering Network (DREN) is a robust high-speed network that links the DoD user community at approximately 50 sites to all of the HPCMP computational resources and to other national networks that support high performance computing. In 8 years, the HPCMP has enabled a skilled and capable user base of over 5000 specialists in the science and technology, developmental test and evaluation, and modeling and simulation communities. With this infrastructure and user base, the DoD is in a much improved position to ensure continued military advantage and warfighting superiority on the 21st century battlefield.

One of the most novel and far-sighted initiatives of the HPCMP was to create the Programming Environment and Training (PET) Program. A key objective of the DoD HPCMP PET Program is to continuously expand and train the DoD HPC user base through innovative education and training programs, collaboration, tool development, and outreach. With the aid of this program, several hundred DoD scientists and engineers have been trained at no direct cost to their organizations.

The SSC San Diego HPC Initiative Group has long recognized the benefits of the DoD HPCMO Program as a means to improve the needed skills of the SSC San Diego technical community, and has promoted participation in the PET courses offered over the years. In 1999, Dr. Aram K. Kevorkian, HPC Outreach Coordinator, took on the task of putting together and executing a plan for on-site introductory and advanced MATLAB scientific computation PET courses that could be offered at no cost to the Center.

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\* This article was originally published in the 27 October 2000 OutLook newsletter published by the Space and Naval Warfare (SPAWAR) Systems Center, San Diego (SSC San Diego), vol 23, no. 22.

From January through August 2000, the SSC San Diego Distributed Center hosted a series of MATLAB courses taught by a team of professors from Ohio State University through the auspices of the U.S. Army Research Laboratory (ARL) MSRC PET program. A total of seven MATLAB courses have been given: four 2-day introductory courses; two 1-day advanced signal processing courses; and one 1-day advanced image processing course. The table below summarizes attendance at these courses.

Attendance at MATLAB Courses	D30	D40	D70	D80	SSC San Diego
Four 2-day Introductory	17	4	25	21	67
Two 1-day Advanced Signal Processing	5	1	13	5	24
One 1-day Advanced Image Processing	4		8		12
<b>Total</b>	<b>26</b>	<b>5</b>	<b>46</b>	<b>26</b>	<b>103</b>

To date, these intensive hands-on courses have been attended by 103 SSC San Diego scientists and engineers from four technical departments (D30: Navigation and Applied Sciences; D40: Command and Control; D70: Intelligence, Surveillance, and Reconnaissance; and D80: Communication and Information Systems). There is currently a list of over 20 people waiting to take these MATLAB courses, and additional classes will be offered in the coming year.

The benefits of the HPCMP PET program have been significant to the DoD technical community and, as evidenced by the participation in the MATLAB courses, to SSC San Diego as well. Through the courses at SSC San Diego, our scientists and engineers have improved on and advanced their numerical computation, signal and image processing skills needed to solve the increasingly challenging and complex Navy and DoD problems in our primary mission areas of command and control, communications, surveillance, and navigation & applied sciences. A corollary benefit is that these seven PET courses have been instrumental in increasing the level of interactions among our scientists and engineers and in paving the way for future interdisciplinary HPC collaborations.



Fourth Introductory MATLAB course participants.



Second Advanced Signal Processing MATLAB course.

The MATLAB courses held at SSC San Diego were given by three dedicated teachers and instructors from Ohio State University's Electrical Engineering Department: Dr. Stan Ahalt, Dr. Ashok Krishnamurthy, and Dr. Dev Prabhu.

The SSC San Diego DC and the HPC Initiative Group are indebted to the HPCMP and to the ARL MSRC for the significant contributions made by the ARL PET Program to the technical community at our Center.

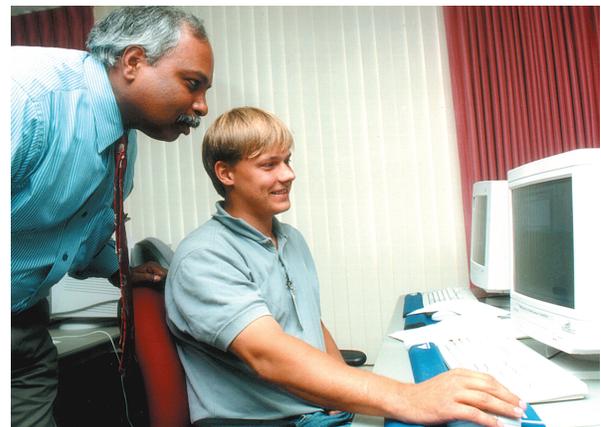
We also greatly appreciate the dedicated efforts of the instructors and all those who helped make these courses a reality.



ARL MSRC PET Team and SSC San Diego Host.



Students receive assistance from instructors at introductory MATLAB course.



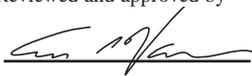
During the Advanced Signal Processing course, an instructor assists a student in the Computer Training Lab, Topside.

## ABOUT THE AUTHORS

**Aram K. Kevorkian**—Ph.D. in Applied Mathematics and B.Sc. in Engineering Sciences, both from Queen Mary College, University of London, England. From 1968 through 1980, Dr. Kevorkian was a Senior Mathematician at the Shell Research Laboratories in Amsterdam, The Netherlands. From 1980 through 1986, he was a Senior Staff Mathematician and Manager of the Technical Computing Department at GA Technologies, La Jolla, CA. From 1986 through 1987, he was invited as Visiting Scientist at the Mathematical Sciences Department of the IBM T. J. Watson Research Center at Yorktown Heights, NY. From 1988 through 1989, Dr. Kevorkian was the Associate Director of Scientific Computation Support at the Cornell Theory Center, Cornell University, Ithaca, NY. Since 1989, Dr. Kevorkian has served in a number of key High Performance Computing positions at SSC San Diego. From June 1995 until May 1996, Dr. Kevorkian worked at the DoD High Performance Computing Modernization Program Office (HPCMO), Washington, DC, on the Technical Panel for the acquisition of the four Major Shared Resource Centers. Dr. Kevorkian is currently the Chair of the DoD HPCMO Metacomputing Working Group and Coordinator of HPC Outreach, Education, and Training at SSC San Diego.

**Lynn A. Parnell**—Ph.D. in Mechanical Engineering, New Mexico State University; M.S. in Biological and Agricultural Engineering, North Carolina State University; B.S. in Mechanical Engineering, New Mexico State University. For the past 9 years, Dr. Parnell has served on SSC San Diego's senior technical staff. He is the Center's High Performance Computing and Networking (HPCN) Coordinator and program leader, acting as the principal point of contact for all HPCN activities and systems at the Center and as national liaison on HPCN issues. He is also the Director of the DoD HPC Distributed Center at SSC San Diego. He chairs the SSC San Diego HPCN Initiatives Group and was national chair of the DoD HPC Modernization Program Distributed Center Working Group from 1996 to 1998. Dr. Parnell also serves as the Navigation and Applied Sciences Department representative to the SSC San Diego Center Initiatives Group, which formulates and promulgates the Center's strategic vision documents and promotes the development of Centerwide multidisciplinary programs.

Reviewed and approved by



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SD 334, December 2000

SSC San Diego, San Diego, CA 92152-5001

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