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UNIVERSITY OF SOUTHERN CALIFORNIA

4676 Admiralty Way Suite 1001
Marina del Rey, California 90292-6695
310 822-1511 Fax: 310 823-6714

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November 9, 1993

ARPA/CSTO
3701 North Fairfax Drive
Arlington, NVA 22203-1714

AO 6417

SUBJECT: Final Technical Report Requirement Support, MDA 903-89-C-0214

ATTENTION: Lou Kallis
Program Manager

Dear Mr. Kallis,

Please find enclosed two(2) copies of the Final Technical Report for Support Agreement No. MDA 903-89-C-0214, in accordance with the reporting requirements as stated in the subject contract.

Sincerely,

This document has been approved for public release and sale; its distribution is unlimited.

Beverly Hartmeyer

Beverly Ann Hartmeyer
Contract Manager

cc: ARPA Technical Office, (1) w/ enc
ARPA/TIO, (1) w/enc
Defense Technical Information Center, (12) w/enc
Cameron Station, (2) w/enc
TACTEC, (1) w/enc
USC Department of Contracts and Grants w/o enc
File: Support

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UNIVERSITY OF SOUTHERN CALIFORNIA

4676 Admiralty Way Suite 1001
Marina del Rey, California 90292-6695
310/822-1511 Fax: 310/823-671

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DIRECTORATE FOR FREEDOM OF INFORMATION
AND SECURITY REVIEW (OASD-PA)
DEPARTMENT OF DEFENSE

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Advanced Research Projects Agency (DoD)

ARPA/CSTO

Final technical Rpt

Title of Contract:

Technical Support for ARPA Computing Research Programs

ARPA Order No. 6417

Issued by Defense Supply Services Washington D.C.

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94-S-0270

Technical Support for ARPA Computing Research Programs

Final Report

1.0 Task Objectives

Provide state–of–the–art computational resources to ARPA and to other DoD agencies that cooperate with ARPA in joint program efforts. These efforts include a number of computational research support efforts, the continued acquisition of computer resources, the continued development and support of a commercial mail system, and the continued evolution of a state–of–the–art workstation environment. They require moving aggressively into new architectures and configuring sophisticated server/workstation frameworks which provide significantly higher machine cycles to researchers at a much lower cost. Capitalizing on this experience for the government by transitioning this architecture to ISTO, thereby providing a wealth of capability to ARPA program managers, including advanced workstations that furnish powerful programming and administrative functionality, and file servers that supply large storage facilities, mail service, and file archiving.

Develop and maintain an expertise in the latest information processing technology. Purchase, install and maintain state–of–the art machines, and advanced network technology, along with developing network protocols that fully support the Internet, local area networks, and interconnected workstations.

2.0 Technical Problem

Understand the research objective to define and provide cost effective state–of–the–art prototype computer systems to program participants.

3.0 General Methodology

Optimize acquisitions from vendors. Review vendors that supply peripherals, determine the best product (reliability and cost), thus optimizing acquisition costs and performance.

Review and install field change orders (FCOs) and engineering change orders (ECOs), which may help to eliminate hardware design problems or be required for later release of software. Requires coordination with the software developers.

Provide a central point of contact for vendors thus providing reduced maintenance cost for hardware and software.

4.0 Technical Results

4.1 KL 2060 Support

ISI provided continuous operator coverage on a 24–hour/day, 7–days/week basis. The operators attended to all machine needs, including all required backups, i.e., full dumps of all systems and structures once a week; incremental dumps of changed files on all systems and structures every 24 hours; and archiving of migrated of inactive or requested–to–be–archived files once a week. Incremental dumps were maintained on–site for a two–week period, full dumps were maintained in an off–site vault for one year, and archived and migrated files were maintained on–site and in an off–site vault. The operations staff was responsible for answering user requests via telephone during non–prime time and contacting the appropriate hardware, software or action personnel if unable to provide a resolution to the request.

The Network Services (Action) group at ISI will continued to support the KL systems in the following ways: providing reports, detailed descriptions, resource allocation, and measurement information as requested by ARPA; maintained all system accounts, adding and deleting users as directed, maintained accurate user information in the WHOIS database to ensure valid TAC access, and tracked systems usage by users; kept a current list of all directories and authorized sponsors; provided support, training, and documentation to help new and existing users of the system; provided a hot–line that was manned 12 hours a day; monitored and maintained storage devices to ensure adequate working capacity to users; maintained Domain Name Servers to ensure mail access to and for appropriate users; and provided an electronic mailbox for user requests, changes to status of directories, security validation, and other support and coordination purposes. Action will also serve as a point of dissemination of introductory and continuing support documentation for new and established users.

4.2 ALBM Program Support

ISI maintained the total hardware, software and network components of ARPA's Air–Land Battle Management (ALBM) computing environment. Hardware maintenance was provided through a combination of direct support from ISI personnel and use of specialized machine support groups on a time–and–materials basis in order to maintain a 24–hour–turnaround–time for on–site problems. The choice of in–house personnel or vendor support was determined by urgency of response and greatest cost efficiency. The ISI software group provided on–site assistance as required with all installations, debugging and systems problems. The software group was also available to ALBM program managers for advice on system upgrades, application software, system tuning and generation, and maintenance of systems reporting and accounting software. New releases of operating systems software, systems utilities such as mail and remind programs, and network software was installed, tuned and maintained at all ALBM sites as these releases are installed and debugged at the ISI computer facility. With ISI being able to use systems similar to those at ALBM sites for in–house testing and experimentation,

new hardware and software upgrades installed into ALBM systems resulted in minimum on–site downtime.

4.3 ARPA/ISTO Headquarters Support

ISI maintained all computer hardware, through the expertise of the on–site technician and backed up by the ISI–located Hardware Group of the Computation Center. The on–site technician was able to effect repairs in 95% within 24 hours with spare parts stored at the ARPA facility. For those cases where parts are not directly available, and when ISI had the part within its own inventory, the part was dispatched by express mail within 24 hours. If the spare part was not readily available, ISI executed emergency purchasing procedures to provide the part in the shortest amount of time. The emergency procedures included the fastest possible response from the University purchasing system, along with personal contact with the involved vendor. In the rare case where the repair is beyond the skills of the on–site technician, a skilled hardware person was dispatched from ISI within 24 hours. There were cases where ISI personnel could not effect the repair.

4.4 ARPA/ISTO Software Support

ISI provided to the ISTO office software support for the computational facility at ARPA headquarters. ISI accomplished this by developing, maintaining or acquiring the software for this state–of–the–art local area network of highly sophisticated workstations. This support spread from the ARPA headquarters to other locations designated by ISTO.

4.5 Facilities Support

ISI provided for full preventive and corrective maintenance on all equipment that supported and monitored the facility. In some cases, this required negotiating maintenance contracts with vendors, e.g., air conditioning units. When circumstances required maintenance by third parties, ISI coordinated the scheduling and granting of access to the facility, and ensured the lowest cost possible to the government.

4.6 Computing Equipment Acquisition

ISI continued to provide support to ARPA in acquiring, evaluating, and configuring computers needed to support research projects. This included multiprocessor architectures, as well as workstations of various types. We dealt uniformly with vendors to ensure equal opportunity to all manufacturers to provide their products to participating research institutions on a competitive basis and achieved considerable cost savings for the contractual effort. As was the previous case, no overhead charges were accrued to computer hardware purchases, and no fees were charged for this service. ISI only charged the actual costs of the hardware and the direct costs for ordering, testing, configuring, and shipping of the computing resources. ISI also acted as the collecting point for machine software revisions and upgrades. By serving as the focal point and redistributing the software to participating ARPA research organizations, we was able to achieve an order of magnitude of savings in software maintenance costs.

4.7 Commercial Internetwork Mail

ISI will continued to maintain, improve and extend the CIMS relay. We will continued to act as a focal point for a variety of activities. The first activity was for ISI to be the liaison for the users of CIMS, providing on–line documentation on using the system, and help with user problems (problems such as getting started, various limitations of each Commercial Mail System etc.). ISI continued to monitor usage and resolved problems in the system's day–to–day operations. ISI also investigated a more cost effective solution which distributed cost to the users. This was implemented and the CIMS effort was terminated.

4.8 New Computing Environments

ISI conducted a survey of new computer technologies, set up demonstrations, and collected user comments which led to the acquisition of new hardware. This hardware was used to prototype a paperless office environment and utilized other software developed under ARPA direction.

4.9 Center for Advanced Systems Technology

ISI maintained and configured new innovative computer architectures as specified a by the HPCC Program. ISI accomplished this with on-site technicians and utilizing ISI's support staff, when necessary, to maintain all equipment. The on-site technicians will be able to be reached by beeper 24 hours/day, 7 days/week. The various machines that were supported at the CAST facility included parallel computers and associated peripherals; workstations and associated peripherals; laser printers; modems; and all Local Area Network (LAN) hardware. Other equipment was supported as it is acquired by ARPA.

5.0 Important Findings and Conclusions

In researching and providing the innovative computer architectures for HPCC facility ARPA has been able to demonstrate all the computer, network and software aspects of the High Performance Computing and Communications program.

The CAST facility is DARPA's demonstration center for prototype scalable parallel computing systems, capable of achieving teraflop performance, developed under the HPCC Program. Algorithm design and software technology are essential to achieving sustained teraflop performance. New and innovative algorithms and software will enable researcher to expand the boundaries of computational capabilities. These improvements in software are being demonstrated at this center since both are an integral part of obtaining teraflop performance.

Researchers have access the systems at this center via the National Research and Educational Network (NREN). The NREN is another component of the HPCC Program which dramatically expands and enhances the U.S. portion of an existing worldwide infrastructure of interconnected computer networks called the Internet. It not only provides access to this center but delivers new technologies to serve the needs of the

scientific communities and also provides valuable experience necessary for development of a broader information infrastructure.

The center not only provides for demonstrations of new hardware, software, and networks, but also training to the nation's youth. This is a formidable challenge that will have effects on the U.S. scientific and technology competitiveness. It also provides a means for technology transfer to provide curriculum development materials for supercomputer programs, and supercomputer user workshops.

6.0 Significant Hardware Development

Hardware development was not part of the statement of work. However, vendors made significate strides in developing new hardware based on the interaction from the acquisition and research efforts of this contract.

7.0 Special Comments

Providing research into new computer technologies and integrating them into the ISTO office has provided an increase in productivity and provided Program Managers ideas for new areas of research.

8.0 Implications for Further Research

ISI has provided key support in the acquisition and systems integrations of computing resources in order to strongly leverage research efforts. ISI has acquired approximately 150 advanced processors and engineering workstations, in addition to a substantial amount of other associated hardware, software, vendor maintenance, license arrangements, and other infrastructure items. To accomplish this end, ISI had to work out complicated agreements with vendors that achieved the maximum in savings to the government, while offering each vendor the same chance to provide their goods to the research community. In fulfilling this task, ISI has not only negotiated volume and academic discounts on a significant scale, but has also served a very valuable role in configuring systems, testing hardware and software, and correcting faults before they found their way to the research community at large.