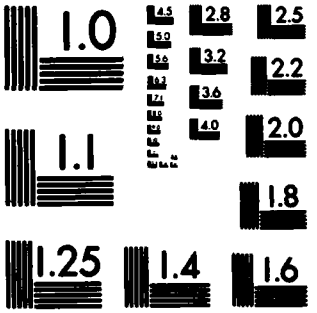
AD-A170 730 SUPPORT OF THE DESIGN DEVELOPMENT INSTALLATION AND TRANSFER OF SPECIAL OP..(U) COMPUTER SYSTEMS MANAGEMENT INC ARLINGTON VA K A OLSON ET AL. 28 JUL 86 1/1

UNCLASSIFIED CSMI/TR-86/04 MDA903-84-C-0008 F/G 9/2 NL

END

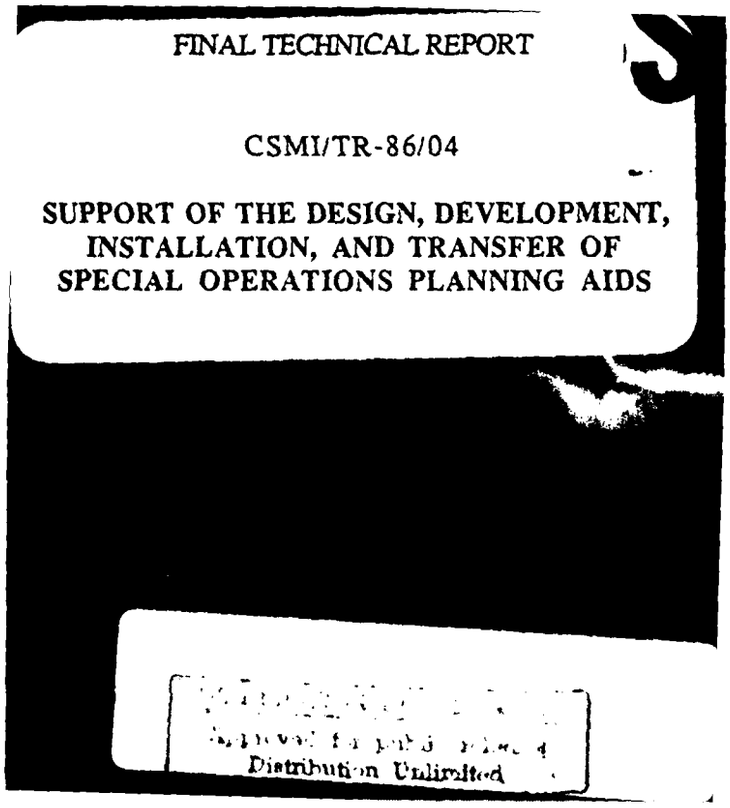
DATE FILMED 10-86



FINAL TECHNICAL REPORT

CSMI/TR-86/04

SUPPORT OF THE DESIGN, DEVELOPMENT, INSTALLATION, AND TRANSFER OF SPECIAL OPERATIONS PLANNING AIDS



(12)

July 28, 1986

FINAL TECHNICAL REPORT

CSMI/TR-86/04

SUPPORT OF THE DESIGN, DEVELOPMENT, INSTALLATION, AND TRANSFER OF SPECIAL OPERATIONS PLANNING AIDS

Prepared by

Keith A. Olson
Frances Clements

Computer Systems Management, Inc.
1300 Wilson Boulevard, Suite 100
Arlington, Virginia 22209

Prepared for
Defense Advanced Research Projects Agency
1400 Wilson Boulevard
Arlington, VA 22209

UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188
Exp. Date: Jun 30, 1986

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for Public Release-- Distribution Unlimited
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) CSMI/TR-86/04	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Computer Systems Management, Inc. 6b. OFFICE SYMBOL (If applicable) CSM	7a. NAME OF MONITORING ORGANIZATION Defense Supply Service--Washington
6c. ADDRESS (City, State, and ZIP Code) 1300 Wilson Boulevard, Suite 100 Arlington, Virginia 22209	7b. ADDRESS (City, State, and ZIP Code) Room 1D245, The Pentagon Washington, D.C. 20310-5200
8a. NAME OF FUNDING / SPONSORING ORGANIZATION Defense Advanced Research Projects Agency 8b. OFFICE SYMBOL (If applicable) DARPA	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER MDA903-84-C-0008
8c. ADDRESS (City, State, and ZIP Code) 1400 Wilson Boulevard Arlington, Virginia 22209	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT ACCESSION NO.
11. TITLE (Include Security Classification) Support of the Design, Development, Installation, and Transfer of Special Operations Planning Aids	
12. PERSONAL AUTHOR(S) Keith A. Olson, Frances Clements	
13a. TYPE OF REPORT Final 13b. TIME COVERED FROM 7/27/84 TO 7/28/86	14. DATE OF REPORT (Year, Month, Day) 1986 July 28 15. PAGE COUNT 17
16. SUPPLEMENTARY NOTATION	

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Special Operations Planning Aids (SOPA); Demonstration and Development Facility (DDF); Digital Equipment Corporation (DEC) PDP 11/70; Unix System V, Release 2.0

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

This report discusses support by Computer Systems Management (CSM), Inc., of contractors doing advanced research in computer-based Special Operations Planning Aids (SOPA) for the Defense Advanced Research Projects Agency (DARPA). This support included a fully operational computer facility, a demonstration room, a video lab, and the services of an expert technical staff. The report also covers the conversion of the older UNIX 6.0 operating system to AT&T's new system V, Release 2.0.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION Unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL Ginger Winn	22b. TELEPHONE (Include Area Code) 694-5919 22c. OFFICE SYMBOL DARPA

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

TABLE OF CONTENTS

SUMMARY

Under Contract MDA903-84-C-0008, Computer Systems Management (CSM), Inc., has supported contractors doing advanced research in computer-based Special Operations Planning Aids (SOPA) for the Defense Advanced Research Projects Agency (DARPA). CSM maintained a fully operational computer facility, a demonstration room, and a videolab for producing briefing tapes that show DARPA prototype demonstrations. CSM's experienced technical staff provided maintenance, applications programming, and other services that freed researchers for substantive work. By upgrading the UNIX 6.0 operating system to System V, release 2.0, CSM staff have produced a vastly improved tool for DARPA research. Operations since cutover have been almost trouble free; staff time for maintenance has decreased greatly; and new procedures simplify administration and maintenance.

1.0 INTRODUCTION

Under Contract MDA903-84-C-0008, Computer Systems Management (CSM), Inc., has supported the Special Operations Planning Aids (SOPA) of the Defense Advanced Research Projects Agency (DARPA), Tactical Technology Office (TTO). In doing this, CSM has maintained a physical facility for advanced research to support other contractors who design and develop computer-based SOPA systems.

CSM assisted these researchers by providing fully operational hardware and operating-system-level software, as well as staff guidance in applications programming. In general, CSM provided an eight-hour-per-day computer service that left researchers free to devote full-time to substantive work. In the course of the contract, CSM upgraded the UNIX 6.0 operating system to System V, release 2.0 to keep pace with current trends toward standardization of UNIX. CSM also provided the use of a fully equipped demonstration room, as well as a videolab, where briefing tapes of DARPA prototype demonstrations could be produced by CSM technical staff.

The following report discusses these services in detail. Section 2 describes facilities and staff support, Section 3 discusses the UNIX conversion, and Section 4 gives a conclusion.

2.0 FACILITIES AND STAFF SUPPORT

With the advice and direction of the Contracting Officer's Representative (COR), CSM provided facilities and staff to assist DARPA/TTO research, design, and develop prototype SOPA software, including dataset maintenance.

2.1 Facilities

At its Demonstration and Development Facility (DDF), CSM provided the following support for computer operations and demonstrations.

2.1.1 Computer Facilities

CSM made available its DDF computer facility, with 850 square feet of especially prepared computer space. The facility has a 600-amp service, of which 400 amps are allocated for use in the computer room and 200 amps for air-conditioning. The computer room currently includes a 200-amp power-distribution panel, connected to a 75-KVA (kilovolt amp) transformer. Because each breaker on the panel connects to hardware units via a flexible, grounded cable, equipment can be easily moved to anywhere within the area.

The computer room has a complete environmental-control system, with up to 15 tons of air-conditioning/heating. Both air conditioners are on separate power circuits to permit independent operation. The two heat-exchange units connect via copper pipe to a location in the parking garage, below the facility. The climate control system can humidify and de-humidify the room to give the equipment the best operating conditions possible and decrease the chance that

equipment will fail because of environmental problems. The total environmental-control system is maintained under subcontract for both emergency and periodic preventive maintenance.

CSM also operated government-furnished equipment (GFE)--a Digital Equipment Corporation (DEC) PDP 11/70--required for this research project. The computer has 512 megabytes (Mbytes) of metallic-oxide semiconductor (MOS) memory and two RP04 88-Mbyte disc drives, which provided enough capacity for on-line storage and program-administration space. The 11/70, with two DH-11 multiplexers, capable of up to 32 independent user-access ports, proved to be fast enough to support design and development of prototype SOPA software. Further, up-time performance was guaranteed through a maintenance subcontract with McDonnell-Douglas, a vendor who provided two-hour response to emergency maintenance requests as well as normal monthly preventive servicing.

The computer's operating system was UNIX System V, release 2.0, developed by Bell Laboratories and licensed to DOD on a nonsupport basis. Unix supports the 'C' language as its primary system-level and user compiler.

2.1.2 Demonstration Facilities

In addition to computer support, CSM provided demonstration support services in two forms. The first was use of the DDF demonstration room. This area has two 5' x 7' large-screen displays: one with a rear-projected, 35mm, random-access slide projector, the other with a PJ5050B General Electric Light Valve. The GE light valve can be switched between multiple sources and can

display both NTSC (National Television Standards Code) and RGB (red-green-blue) video formats, thereby permitting computer-generated images to be displayed directly onto one of the large screens.

The second demonstration facility was the CSM/DDF Videolab, set up for Electronic News Gathering (ENG), video-editing, and dubbing. Here prototype demonstrations of DARPA technology are captured on videotape via the ENG equipment and edited down to the desired content for use as a briefing aid. The resulting videotape production can then be mailed to remote areas to give those who could not attend local briefings an accurate picture of the research project, complete with sound and video of DARPA projects at work. Since most people are comfortable with television, this method of videotaping demonstrations and briefings has proved quite effective at both saving travel time and communicating the message.

2.2 Staff

CSM staff, with expertise in computer-systems operations, operating-systems and applications programming, and videotape production and editing, assisted development-contractor personnel by performing the operating tasks that must be performed when these facilities are used.

The staff member assigned to support the operations of the 11/70 provided weekly file-system archivals. These backups insure that no more than one week's work can ever be lost because of system problems. Also, the CSM staff member was available to restart the computer whenever necessary.

The Systems Analyst supporting the research helped with programming at both the applications and system-internals levels. His work included patching files, doing backups, modifying or upgrading shells for system support where needed, and doing system administration. His expert advice enabled the researcher/user to solve problems unique to the 11/70 and UNIX, particularly problems of transforming data into a form usable for data transfer.

Finally, a video engineer assisted in the production of videotapes and the use of video equipment. Like the other CSM/DDF staff members, he made himself available to do work that the developer staff could not do because they lacked time or were not familiar with the equipment.

2.3 Other Support Activities

CSM technical staff assisted with computer-related simulations and with hardware and software evaluations to support the needs of the COR and others involved in these research studies. In addition, CSM purchased equipment to test program-visualization tools in a working programming environment.

3.0 INSTALLATION OF UNIX SYSTEM V, VERSION 2.0

3.1 Conversion Requirements

Early in March 1985, CSM cut over from the older UNIX 6.0 operating system to UNIX System V, release 2.0. Reasons for this change were as follows:

- The trend to standardize the operating-system environment.
- The improved reliability of the new operating-system.
- The extended capabilities of the new operating system.
- Transfer requirements of the targetted computer.

The following sections of this report discuss these topics in detail.

3.1.1 Standardization

Because of its generic nature, UNIX has been used in computers from micro to mainframe; versions of UNIX now run on every computer from the IBM PC to the CRAY II Supercomputer. As UNIX proliferated, almost every user customized it to meet his or her special needs. Since 1975, when UNIX was first released, universities, corporations, and private individuals have all altered and extended this operating system.

Many of the changes made in one place were incompatible with other UNIX environments. Most of them were made with the best intentions: users who needed additional features, improved performance, or modifications to the characteristics of a given processor, altered UNIX as needed for their own environments. Unfortunately, many of these changes were made without consideration for the characteristic that made UNIX such a powerful software environment in the first place: its ability to run on almost any computer. Only standardization could insure that UNIX retained this ability.

Several generations of UNIX operating systems evolved between UNIX 6.0, the first version CSM received, and the System V, release 2.0, which was AT&T's attempt to regain its position as the standard setter for the UNIX-user community.

Under DARPA sponsorship, The University of California at Berkeley developed several variations of UNIX, culminating in Berkeley UNIX 4.2. Both AT&T's UNIX System V, release 2.0, and the Berkeley UNIX 4.2 have unique, desirable, and sometimes incompatible features: Berkeley UNIX 4.2 has a more robust file system and speedier input/output than did earlier versions; a record-locking facility; a new form of interprocess-communications facility; and integrated network support. The file descriptor has been generalized into an object descriptor (files, devices, pages of memory, hardware, etc.); the UNIX pipe capability has been modified into a "socket"; symbolic links exist for spanning file systems; and virtual memory and demand paging have been added on machines that can handle these features.

In UNIX System V, release 2.0, semaphores have been added for interprocess communications; shared memory can be used between processes; and named pipes can be used.

UNIX System V, release 2.0, does incorporate many of the applications of the Berkeley UNIX 4.2, however. In this way AT&T has attempted to standardize the UNIX operating-system environment. A System V Interface Definition (SVID) has been produced that sets a standard for future versions of UNIX. Therefore, DARPA software that conforms to the SVID will be compatible with any future versions.

An additional benefit of standardization is lower maintenance costs, which account for 90 percent of the lifecycle costs of software. Because software developed for DARPA today can be used on tomorrow's standardized versions of UNIX, the lifecycle costs of software will decrease significantly.

One of greatest advantages of standardization, however, has been the increased access to the large community of UNIX users. The older UNIX 6.0 environment used at the DDF was rapidly becoming obsolete. The number of sites using this version of UNIX was rapidly diminishing; consequently, CSM's work for DARPA was becoming less and less relevant to the universities, which do DARPA-sponsored research, and to the military, which uses the results of that research.

3.1.2 Improved Reliability

Use of the more reliable System V, release 2.0, has reduced labor costs, which account for much of the cost of operating a time-sharing environment. Under UNIX 6.0, file systems needed extensive care because this version of the operating system occasionally suffered from system crashes. When these occurred, the file systems had to be patched by hand by a person especially trained for this work. Daily and monthly backups were required to ensure that an operational system would be available at all times.

However, technical staff must still provide operational support, such as maintenance of file backup and file restoration; system administration for the scheduling of preventive maintenance and monthly accounting; and engineering manpower for cabling and for minor hardware repair not covered by maintenance contract. Technical staff expertise is also required for the system programming support, such as installing drivers, repairing the file system, fixing bugs in the operating system, modifying software, and doing custom work beyond the abilities of the operational or administrative staff.

In addition, because the 6.0 system was an early version of UNIX, it still had many of the bugs that AT&T and other UNIX users have since corrected. With the creation of UNIX System V, release 2.0, many of the difficulties associated with the earlier versions disappeared. Release 2.0 is noticeably more reliable. System crashes (for reasons other than power failure) seldom occur. When they do, the file systems can usually be cleaned up with startup system shells, which need little or no operator intervention.

With the increased reliability of the system, less system-programmer and system-administration time has been required. As a result, labor costs have decreased.

3.1.3 Extended Capabilities

Perhaps the key advantage of converting from UNIX 6.0 to System V, release 2.0, has been the extended capabilities offered by this conversion. An improved 'C' compiler, additional editing capabilities, and improved software-development tools have provided critical support to the Special Operations contractor. Without this conversion, continued DDF SOPA support would have been significantly more difficult, if not impossible.

3.1.4 Requirements of Targetted Computer

As noted earlier, the CSM/DDF exists primarily for SOPA support. When the SOPA end users upgraded both hardware and software, CSM had to implement System V. Otherwise, CSM could not have continued to provide effective software-transfer services to the other contractor who supports these end users.

3.2 Conversion Description

In early 1984, once the decision was made to upgrade the DDF operating-system environment, the licensing process began. The first software work to convert to System V, release 2.0, began in January 1985; and cutover took place by the first week of March 1985. Since that time, the system has

been modified on an ad-hoc basis: when problems occurred with the system as delivered by AT&T, when additional drivers were required, or when system-administration work was needed.

Cutover to System V, release 2.0, took only a short time because CSM staff did much of the work during non-prime time. The conversion was not without problems, however. A non-standard tape-drive controller at the DDF made the job more difficult because it prevented direct tape boot from the AT&T distribution tapes. In addition, the two operating systems had very dissimilar file systems, despite their common origin.

CSM technical staff used the older UNIX 6.0 system to build the new System V, release 2.0. They first developed a DDF-compatible tape driver and an initial kernel with file-systems similar to those in the System V. Once this driver was installed, files could be transferred between the older operating system environment and the new one.

An inventory of local routines regularly used at the DDF in the past then became the basis for developing new routines under System V. Once the two operating-system environments functioned in similar ways, CSM staff used the old system to transfer user directories of files to tape and then copied them back to the new system under similar names. A test phase followed, which allowed users to test their software for compatibility with the new system. When users were satisfied that any slight differences could be easily reconciled, cutover took place.

In the following months, CSM staff developed and implemented new operations procedures, fine tuned the system for improved performance, and solved problems as they occurred.

3.3 Results of the UNIX Conversion

Initial evaluation of the System V, release 2.0 shows it to be much more robust than the earlier UNIX 6.0. As a result, operational problems have decreased; and users have received improved support.

On the negative side, the new operating system is much more complex than the earlier version. Its extensive accounting and file management capabilities are more suited to a large timesharing environment than to a small research environment. Though this complexity has made the system more difficult to administer, it has also made it easier to operate. Once the proper operational procedures have been implemented, work proceeds quickly; but setting up these initial procedures can be very time consuming. Fortunately, the effort expended in doing this has been worth the cost. The machine has operated with relatively few problems for some time and labor needed to maintain the system has been greatly reduced. Those problems that have occurred have been solved with little or no system-programming work.

As part of the installation and on-going maintenance of System V, CSM staff have structured procedures that simplify the work of operations personnel. These procedures step through system-administration tasks, making maintenance an easier, less technically demanding exercise. To improve system

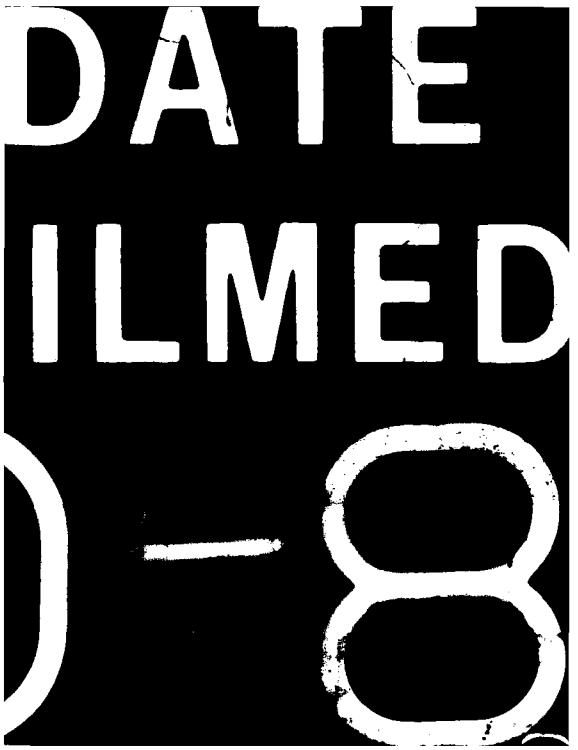
throughput, much of the accounting software more appropriate to a large production environment has been inactivated.

4.0 CONCLUSION

In its support of Special Operations , CSM has maintained a facility equipped for advanced research in the design and development of computer-based systems. The CSM/DDF provided fully operational hardware and operation-system-level software, as well as the services of staff experts in applications programming. These facilities have freed other Special Operations contractors from maintenance tasks that could distract them from basic research.

As part of its support, CSM also made available to DARPA users its fully developed demonstration room and a video lab where CSM staff produced briefing tapes of DARPA prototype demonstrations.

Perhaps the most important work performed under this contract, however, was CSM's upgrading of the UNIX operating system from UNIX 6.0 to System V, release 2.0. The new system has been almost trouble free since cutover in March 1985, and staff time for maintenance has decreased dramatically. CSM programming personnel have also structured procedures to simplify system administration and maintenance and have, in general, produced a vastly improved tool for DARPA research.


DATE
ILMED
-8