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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-208919

JULY 22, 1983

RELEASED

The Honorable Jack Brooks
Chairman, Committee on
Government Operations
House of Representatives

Dear Mr. Chairman:

Subject: The Air Force Weapons Laboratory Should Validate
Its Computer Needs and Evaluate Alternatives
Before Continuing Its Cray-1 Computer Lease
(GAO/AFMD-83-70)

In your March 4, 1982, letter (encl. I) you asked us to review the Air Force Weapons Laboratory's (AFWL's) use of a large-scale Cray-1 computer system. Specifically, we were asked to determine if continued lease of the Cray-1 is justified.

On July 28, 1982, and January 11, 1983, we furnished your office information that satisfied the questions raised, and, as requested, we are addressing this written report to two issues:

- expected versus actual use of the Cray-1, and
- the Department of Defense's (DOD's) progress in implementing total cost accounting and cost recovery systems.

SUMMARY OF FINDINGS

AFWL research programs need and benefit from large-scale computer support, but the extent to which the Cray-1 has been used may not justify its continued lease and operation because

- planned research workload of both AFWL and other projected users has been much less than expected, and
- AFWL research computer use has declined.

Also, AFWL has not validated its large-scale computer workload requirements or evaluated available alternatives since 1974.

One reason for not reaching expected workload levels is that the Defense Nuclear Agency (DNA) is satisfying its data processing needs at a Department of Energy computer facility and not using

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AFWL's computer as expected. DNA-related workload was over 40 percent of the original Cray-1 workload justification. Other reasons include cancellation or delay of research projects caused by research staff turnover and budget constraints on programs which had been expected to use the Cray-1's capabilities.

GAO also found that AFWL does not fully recover the Cray-1 computer operating costs from the users it supports. Users of the Cray-1 system only pay for operational expenses. Such expenses amount to about 55 percent of full costs. The Air Force was told by DOD to delay implementation of a full cost recovery system until it issued guidance for implementing Office of Management and Budget Circular A-121, "Cost Accounting, Cost Recovery, and Inter-Agency Sharing of Data Processing Facilities," dated September 16, 1980. DOD plans to provide this guidance in fiscal 1983.

OBJECTIVES, SCOPE, AND METHODOLOGY

The objectives of our review were to determine

--if workload projections for the Cray-1 had materialized,

--why DNA had not used AFWL's computer services,

--why the Air Force does not recover full costs from its Cray-1 computer users, and

--what progress DOD has made in providing guidance for implementing cost accounting and full cost recovery systems.

We performed our review in accordance with generally accepted government audit standards. We did not obtain official comments from DOD or the Air Force.

We performed our review primarily at the Air Force Weapons Laboratory at Kirtland Air Force Base, Albuquerque, New Mexico. We also visited and interviewed officials at the Department of Defense in Washington, D.C.; Air Force Systems Command Headquarters at Andrews Air Force Base, Maryland; Air Force Computer Acquisition Center at Hanscom Air Force Base, Massachusetts; Arnold Engineering Development Center at Arnold Air Force Station, Tennessee; Defense Nuclear Agency Headquarters in Washington, D.C.; DNA's Scientific Applications Office at Kirtland Air Force Base, New Mexico; and Cray Research, Inc., in Boulder, Colorado.

We reviewed official files and documents and interviewed officials to determine compliance with applicable laws and regulations and to obtain information on AFWL's advanced computer services, its basis for user charges, and why a full cost recovery system does not exist. We analyzed available data to determine how the Cray-1 was being used and what percentage of actual costs was being recovered from users.

BACKGROUND

The Air Force Weapons Laboratory plans and executes the Air Force development programs in nuclear weapons, advanced weapons concepts and technology, high energy laser technology, and nuclear survivability and vulnerability. It also provides technical and management assistance in support of aerospace systems and equipment.

In March 1974, AFWL began acquisition of a large-scale scientific computer. The contract to Systems Development Corporation for facility management and lease of a Cray-1 computer was not awarded until September 1979. Several factors contributed to the delay, including a bid protest and a court-ordered reopening of the procurement.

AFWL's acquisition of the Cray-1 was based on the need for improved research support. AFWL's pre-1974 computer resources were not satisfying its data processing support requirements because of two major deficiencies: computer system saturation and computer capability limitations. Use of the prior computer was consistently above 95 percent, and the number of jobs to be processed averaged 20,000 per month. These combined factors resulted in poor turnaround. Also, the central memory size and central processing speed limited the complexity of the problems which AFWL could solve and the precision of the results.

The Cray-1 computer has greatly increased the effectiveness of AFWL's research projects. Project turnaround times have been reduced and results are more reliable. In fact, some projects that could not be done on the old system with its limited capability are now possible. For example, a chemical laser project that requires 20 hours of Cray-1 time would have needed 600 to 800 hours on AFWL's previous computer system. Other examples of current research projects that could not be accomplished on the old computer are:

--Chemical reaction calculations which would have required hundreds or even thousands of hours.

--Environmental research on the effect of several bursts occurring near each other both in space and time, in order to identify M-X missile basing sites.

Such research requires computations which are very difficult, if not impossible, to accomplish on a less capable computer.

AFWL'S CRAY-1 USE DOES NOT APPEAR
TO JUSTIFY ITS CONTINUED LEASE

While some AFWL research projects require large-scale computer support such as the Cray-1, we could not validate AFWL's need for continued lease of this computer because (1) Cray-1 use has not reached projected levels, (2) DNA is not using the system as expected, and (3) AFWL has not validated its requirements since 1974

or identified and evaluated alternatives that might provide needed support more economically.

Cray-1 use by AFWL and others
has not reached projected levels

AFWL and total Cray-1 research use has fallen short of projected levels and has decreased rather than increased as expected. The projected use for fiscal 1981 was between 260 and 347 hours per month while the actual use averaged 156 hours per month. The projected level for fiscal year 1982 was between 299 and 398 hours per month, but the actual level for the first three quarters¹ averaged only 124 hours, a decline from fiscal 1981. AFWL officials stated that the loss of technical staff and research program budget cuts are major reasons for not reaching expected usage levels. Another reason is that expected DNA-sponsored workload has not materialized and sales to outside customers have not offset AFWL's declining workload.

AFWL's use of the Cray-1 has been declining

Use of the Cray-1 computer system by AFWL has been dropping. To increase the Cray-1's use and help finance its costs, AFWL has been selling excess computer time to outside users. But such sales have not compensated for AFWL's declining use. Between April 1981 and June 1982 AFWL research activities used the Cray-1 an average of 153 hours a month and outside users increased the Cray-1's workload to an average of 240 hours per month. However, total AFWL and outside customer use had dropped below April 1981 workload levels. (See encl. II for more details.)

AFWL research projects only use
16 to 28 percent of available Cray-1 time

As the tables in enclosure II show, the Cray-1's highest utilization by all users was during the prime shift (6 a.m. to 6 p.m. on weekdays). Such utilization ranged from 62 to 79 percent. Although AFWL officials state that work done by the scientists and researchers must be run while they are at work to resolve problems that might occur, only 39 to 57 percent of the total prime time available was used for such work. The remaining time the computer was used was for developing and maintaining computer programs that were not commercially available. During the prime shift, the computer was idle 21 to 38 percent of the time.

When total utilization for all shifts is analyzed, only 16 to 28 percent of the total possible computer time was used by AFWL for research projects; 20 to 40 percent of the time was used by outside

¹We were unable to obtain utilization data for the fourth quarter of fiscal 1982. AFWL changed Cray-1 computer operating software systems in July 1982 and AFWL officials said utilization information was not reliable.

customers and for development and maintenance of special computer programs. The computer was idle 32 to 49 percent of the time.

Technical staff problems have contributed to AFWL's declining use

The turnover of AFWL's technical staff has resulted in the cancellation or delay of many scheduled research projects. AFWL research projects have accounted for less than 28 percent of the Cray-1's use. When the acquisition requirements were projected in 1974, they were tied closely to the research talent at AFWL at that time. In the intervening years, AFWL projects have lost experienced researchers and scientists. AFWL however, could not give us quantifiable data on how these staff changes have affected its projected Cray-1 workload.

Another reason for the low use of the Cray-1 is that the AFWL technical staff may not be proficient in its use. AFWL officials stated that it takes at least 18 months to learn to fully utilize the Cray-1's capabilities and that use should increase as researchers and technical support staff become adept at using it.

Budget constraints reduce the number of Cray-1 projects performed

AFWL officials stated that budget constraints also keep researchers from using the Cray-1. They added that the Cray-1's use is more a function of the money available for research projects than the number of problems that would benefit from the Cray-1's capabilities. For example, in fiscal 1981, the budget of AFWL's Advanced Radiation Technology Office was cut by \$20 million, which has never been restored. Again, AFWL officials could not give specific information on how budget constraints have lowered Cray-1 utilization.

DNA did not use AFWL's system as expected

Another major reason for AFWL not reaching expected workload levels is the absence of DNA-sponsored workloads. In 1974, when the Cray-1 acquisition was justified, over 40 percent of the projected workload was directly related to work for DNA.

While DNA was using AFWL computer support, it experienced many problems with AFWL service. In September 1982, DNA's Special Assistant to the Deputy Director cited problems such as:

- AFWL was not "service oriented," that is, it was not organized or staffed to operate as a computer services facility for outside users,
- AFWL did not have the software nor technical staff DNA wanted, and
- DNA employees felt that they were treated as "third class citizens," that is, AFWL jobs had priority and AFWL technical assistance was rarely available.

AFWL officials agreed that problems existed because they did not operate a service center or provide the necessary support to outside users. If AFWL had provided responsive service, DNA might have continued its workload support at AFWL. DNA's Special Assistant to the Deputy Director estimated its present Cray-1 needs are 150 hours per month, and this could increase to 250 hours per month by 1985.

Because DNA was not pleased with AFWL's service, in 1976 it began planning to acquire other computer support. In August 1980, when the Cray-1 was installed at the AFWL facility, DNA began operating AFWL's old Cyber 176 as a temporary solution for obtaining computer support. DNA's only use of AFWL's new computer (the Cray-1) was during a brief period while it was in the process of switching DNA research work to the old computer.

DNA also continued to look for more permanent, long range computer support arrangements. AFWL offered DNA use of the Cray-1 computer system but, because of past problems, DNA dropped AFWL from consideration. DNA's work has been moved to the Department of Energy's Los Alamos National Laboratory, which DNA considers "a first class operation." Los Alamos retained its leased Cray-1 computer system, which was to be replaced by a recently purchased Cray-1, to meet DNA's workload demands.

Computer support alternatives should be evaluated

AFWL has not validated its requirements for large-scale computing needs since 1974, when the acquisition of the Cray-1 was originally justified. With AFWL's computer use declining and projected workloads not materializing, user costs should be increasing and alternative computer support could be cheaper. Among the alternatives that exist, and we believe should be evaluated, are (1) other Government Cray-1 activities, (2) commercial Cray-1 teleprocessing firms, (3) less capable (and less expensive) computer systems for projects that do not economically benefit from or require Cray-1 support, and (4) any combination that will responsively support AFWL's validated workload and mission needs.

AFWL USER CHARGES DO NOT RECOVER TOTAL COSTS

AFWL charges for use of the Cray-1 do not recover total costs. Basic AFWL customer billing rates for Cray-1 computer support recover operating expenses only, which are primarily computer equipment and software lease and maintenance costs. We estimate these expenses are about \$9 million, or about 55 percent of the total Cray-1 computer costs of \$16 million. AFWL users do not pay for costs such as the civilian and military payroll,² facility

²Military pay is paid by non-DOD users and civilian pay is similarly paid by non-AFWL organizations.

costs,³ and equipment depreciation costs for the Government-owned computer equipment used with the Cray-1.

Federal policies on full cost recovery

GAO requires that Federal agency accounting systems record the cost of specific activities, operations, or products whenever such information is needed for management control or cost recovery purposes.⁴ Our report "Accounting for Automatic Data Processing Costs Needs Improvement" (FGMSD-78-14, Feb. 7, 1978), concluded that required consistency and accuracy meant accounting for automatic data processing (ADP) costs had to be improved, including how data processing services costs were aggregated and recovered.

Guidelines⁵ for Federal agencies on accounting for ADP costs state that all significant elements of costs incurred in accomplishing ADP-related activities need to be identified and a means devised to record them. These costs include

- unfunded costs, such as depreciation and certain employee benefits; and
- items funded from appropriations or allotments other than those used to finance regular data processing operations.

In 1980, OMB Circular A-121 established these policies as required Government-wide procedures. It requires agencies to (1) account for the full cost of operating data processing facilities and (2) allocate all costs to users according to the services they receive. The cost of individual support transactions, including fixed price arrangements for a specified period of time, may be estimated. However, such costs are to be periodically reconciled to assure that the full cost of operations is equitably allocated.

DOD plans to issue implementing guidance during 1983

On February 13, 1981, the Air Force submitted its general plan for implementing Circular A-121 to DOD, noting AFWL as one of the affected data processing installations. However, the official responsible for Air Force implementation was directed to delay implementing action until DOD published its guidance. In September 1982, DOD's Director for Information Management Systems said:

³Including operation and maintenance, repair, janitorial services, heating fuels, electricity, water, and sewage.

⁴"General Accounting Office Policy and Procedures Manual for Guidance of Federal Agencies," title 2, Accounting.

⁵"Guidelines for Accounting for Automatic Data Processing Costs," Federal Government Accounting Pamphlet Number 4, U. S. General Accounting Office, 1978.

- DOD policy guidelines state GAO's Pamphlet Number 4 shall be followed in accounting for actual ADP costs.
- No DOD policy statement on implementing OMB Circular A-121 exists.
- DOD has made no significant progress in developing implementing guidance.

The director also said DOD has had difficulty in making changes to basic DOD accounting systems so that the A-121 accounting principles could be applied to other areas, including ADP cost accounting and recovery procedures. However, the DOD official stated guidance implementing OMB Circular A-121 is expected to be published during fiscal 1983.

RECOMMENDATIONS

We recognize there is a need for effective and economical support of AFWL research requirements. But, because of AFWL's declining use of its Cray-1, we recommend that the Secretary of the Air Force

- evaluate and validate large-scale computer needs at AFWL and
- identify and evaluate any available alternatives that could economically provide effective computer support for AFWL's validated needs.

If the Air Force study justifies continued lease of the Cray-1, based on AFWL's workload or if it is determined that AFWL's workload cannot be processed elsewhere, the Secretary should ensure (1) that AFWL is organized, staffed, and managed to provide responsive support to all existing and future AFWL users and (2) that a full cost accounting and recovery system is implemented in compliance with OMB Circular A-121.

If the Air Force study does not justify continued lease of the Cray-1, we recommend that the Secretary of Defense review other Defense needs in the Albuquerque area (or sites and contractors that are accessible by existing communications facilities) that may be satisfied cost effectively with AFWL support and may help justify continued lease of the Cray-1. If this additional usage potential is validated, we recommend that the Secretary of Defense charter the AFWL facility as a Defense service center. The center should follow OMB Circular A-121 cost recovery procedures in establishing the appropriate user fees, although it is possible that some potential users may find it uneconomical to pay full cost.

In the event Defense is not able to validate the needed additional usage, and it is determined that AFWL's workload can be processed elsewhere, the Secretary should direct the Air Force to seek the most economical alternative.

To ensure further delays do not occur in DOD's implementation of OMB Circular A-121 cost accounting and cost recovery procedures, we recommend that the Secretary of Defense

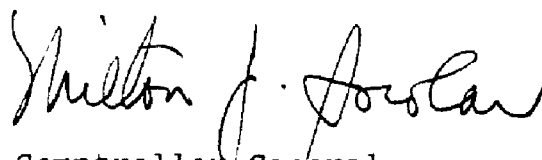
--monitor development and publication of DOD's guidance for implementing OMB Circular A-121, and

--expedite DOD-wide implementation.

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As arranged with your office, unless you publicly announce the contents of this report earlier, we will not distribute it until 30 days from its date. At that time, we will send copies to the Director of the Office of Management and Budget, the Secretary of Defense, and the Secretary of the Air Force. We will also make copies available to other interested parties.

Sincerely yours,



Acting Comptroller General
of the United States

Enclosures - 2

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NINETY-SEVENTH CONGRESS
Congress of the United States
House of Representatives

COMMITTEE ON GOVERNMENT OPERATIONS
 2157 Rayburn House Office Building
 Washington, D.C. 20515
 March 4, 1982

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The Honorable Charles A. Bowsher
 Comptroller General
 General Accounting Office
 441 G Street, N.W.
 Washington, D.C. 20548

Dear General:

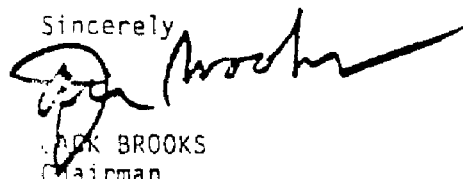
The Air Force Weapons Laboratory (AFWL) at Kirtland Air Force Base, New Mexico, has acquired and operates a large scientific processor for its research work. It is my understanding that the Weapons Laboratory does not have enough work to fully utilize the processor and has instituted a policy of promoting its use by outside users.

Serious allegations have been raised concerning this policy, particularly the transfer of certain functions from the Arnold Engineering Development Center near Tullahoma, Tennessee, to the Air Force Weapons Laboratory. Specifically, these allegations encompass the significant under-utilization of the computer, the use of a government facility by commercial firms at substantially reduced rates and the violation of certain federal regulations.

I request that GAO undertake an investigation as to the validity of these allegations. GAO should determine (1) if all applicable federal policies and regulations have been followed by the Weapons Laboratory; (2) the extent of past or present usage of the facility by commercial firms and the propriety of such usage; (3) the charges associated with the commercial firms and whether such costs were proper and reasonable; and (4) if the historical utilization of the weapons lab justifies the operations of its large-scale computer. Further, GAO should determine if the Weapons Laboratory is following a policy of promoting outside usage merely to justify a continuing need for newer and larger computers for itself.

With best wishes, I am

Sincerely,



JACK BROOKS
 Chairman

QUARTERLY CRAY UTILIZATION (note a)
(All Shifts Combined)

	<u>Apr.-June 81</u>		<u>July-Sept. 81</u>		<u>Oct. & Dec. 81</u> (note b)		<u>Jan.-Mar. 82</u>		<u>Apr.-June 82</u>	
	<u>Hours</u>	<u>Percent</u>	<u>Hours</u>	<u>Percent</u>	<u>Hours</u>	<u>Percent</u>	<u>Hours</u>	<u>Percent</u>	<u>Hours</u>	<u>Percent</u>
Hours possible	2184		2040		1488		2160		2184	
Maintenance	135	6	161	8	121	8	158	7	167	8
Customer use:										
AFWL (note c)	601	28	538	26	289	19	366	17	343	16
Other DOD	155	7	332	16	139	9	225	10	269	12
Other	42	2	36	2	5	1	4	-	9	-
Development (note d)	236	11	319	16	213	14	533	25	612	28
Idle	1014	46	645	32	722	49	873	41	785	36

^a The data in these charts were discussed with AFWL officials who stated they appear reasonable.

^b Utilization data were not available for November due to hardware failure.

^c Average monthly use (April 1981 through June 1982) by AFWL was 153 hours while the average monthly use by outside users was 87 hours, for a total average use of 240 hours per month.

^d Development time represents efforts devoted to developing and maintaining software not commercially available.

QUARTERLY CRAY UTILIZATION (note a)
(Prime Shift Only)

	<u>May & June 81</u>		<u>July-Sept. 81</u>		<u>Oct. & Dec. 81</u> (note b)		<u>Jan.-Mar. 82</u>		<u>Apr. & June 82</u> (note c)	
	<u>Hours</u>	<u>Percent</u>	<u>Hours</u>	<u>Percent</u>	<u>Hours</u>	<u>Percent</u>	<u>Hours</u>	<u>Percent</u>	<u>Hours</u>	<u>Percent</u>
Hours possible	540		744		540		780		528	
Customer use	306	57	597	80 ^e	259	48	341	44	206	39
Development (note d)	120	22	84	11	74	14	168	21	203	38
Idle	113	21	62	9	207	38	271	35	119	23

^a The data in these charts were discussed with AFWL officials who stated they appear reasonable.

^b Utilization data were not available for November due to hardware failure.

^c Report for May 1982 was not available.

^d Development time represents efforts devoted to developing and maintaining system software not commercially available, hardware maintenance, and classified processing.

^e This figure was not included in our analysis because it contains time used by Systems Development Corporation for testing.