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STATEMENT OF

KENNETH A POLLOCK

DEPUTY ASSOCIATE DIRECTOR

BEFORE THE

DEFENSE SUBCOMMITTEE

COMMITTEE ON APPROPRIATIONS

UNITED STATES HOUSE OF REPRESENTATIVES

Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to appear here today to discuss opportunities for improving the management of the Defense Department's computer systems. I have with me today Mr. Greg McDonald from our Dallas office, and Mr. Fred Chasnov from our National Security and International Affairs Division. At the conclusion of my prepared remarks, we will address any questions you may have.

The Department of Defense is the largest consumer of computer hardware and services in the Government. During the past fiscal year DOD spent more than $4.3 billion to acquire and operate general purpose computer systems and an estimated $ 7.4 billion on embedded systems, which are integrated into and form a part of a larger system, such as a weapons system. Expenditures for both general purpose and embedded computer systems are expected to experience continued growth in coming years and the costs for embedded systems will be substantial.

Our message today in both areas, is that, through greater management attention to its computer resources, DOD can reduce its costs and increase the effectiveness of its computer support. Let me first address the area of general purpose computer systems.

The Department of Defense will account for almost 60 percent of the $1.1 billion the Government will spend to lease general purpose computer equipment this year. Our work indicates that millions of these dollars can be saved if managers will seek and apply existing alternatives to current computer leasing practices.

The Federal Government retains computers, whether they are owned or leased, longer than the private sector. As a result, agencies tend to retain costly, obsolescent equipment and, when that equipment is leased for such prolonged periods, to pay rents that have exceeded original purchase prices, in some instances by 300 to 400 percent.

Leasing is an appropriate acquisition method under a variety of circumstances, but managers must evaluate each acquisition or renewal -- whether for computers or other property -- on its own merits, considering

--Advancements in technology,
--Intended systems life, and
--Sound financial management principles.

Just as we would not advocate purchase as the only appropriate acquisition alternative in all types of procurements, we would also suggest that on-going leases should be periodically analyzed and evaluated, and changed when necessary, to insure that agencies are continuing to meet their data processing needs at the lowest overall cost to the Government. In our work, both within DOD and elsewhere, we have not found this kind of systematic, recurring evaluation of installed equipment leases.

For example, at eight Defense data processing installations, we found

--Known savings opportunities that were bypassed because purchase funds were not readily available,

--Excessive rents paid and ownership opportunities that were missed because leased equipment contracts were not monitored

--Obsolete equipment that continued to be leased when it could have been bought for a fraction of a single year's rent.

When we analyzed the leases on more than 225 computer components installed at these installations, we found, in 93 % of the cases, that outright purchase, refinancing the existing lease through a third party, or acquiring a used substitute in the open market, would be less expensive than continuing the equipment's present lease. Savings expectations generally ranged between 30 and 60 percent, but in several instances they were dramatic--reducing cash flows by as much as 90 percent.

Continuing the current lease arrangement was most economical in only 7 % of the cases. These 7% fell into the following categories:

--Exceptionally low lease prices,
--Short term projects, and
--Lease-to-ownership plans.

I would like to briefly share with you some examples from our work at Defense installations which, I feel, will illustrate the problems we are finding:

--Between 1974 and 1982 the Air Force paid more than $29 million in rent on a Burroughs system at its Manpower and Personnel Center that sold new for $10 million. A communications controller at the San Antonio Data Service Center has been paid for 5 times over in rent and an 11-year old optical page reader at Ft. Lee, Virginia, has been paid for more than 3 times over. Similar conditions existed at each of the eight sites we visited.

--The Air Force Systems Command, Armament Division, Directorate of Computer Sciences, Eglin AFB, Florida, spent $241,000 more than necessary on its CYBER 176 computer because it did not have purchase funds allocated for this purpose in 1981 and had to lease until 1982 rather than buy at an optimum time.

--The Army has paid almost $13,000 in unnecessary rent on an Ampex memory increment installed on a Ft. Lee, Virginia, computer under a GSA mandatory requirements contract. The Army was unaware that it could have owned the equipment with no additional charge by exercising an option in March 1981. The Navy paid more than $100,000 in unnecessary charges for a similar Ampex unit under the same contract.

--The Military Airlift Command is spending about $230,000 annually to lease old IBM punch card equipment that could be bought for a few months rent. At the same time GSA is excessing government-owned like machines, in prime condition, to non-government users. Six of the Defense installations we visited were leasing old punch card machines, some of which nad been under lease for up to 23 years.

There are a variety of cost effective alternatives to continuing the present leasing contracts, and in our analysis we considered:

--exercising purchase options, taking advantage of accrued purchase option credits

--acquiring title to the equipment, as above, but selling the equipment to a third party and leasing it back (at a lower monthly lease cost than paid at present)

--buying similar equipment on the used market, and terminating the present lease

--leasing similar equipment from a dealer in used equipment, and terminating the present lease

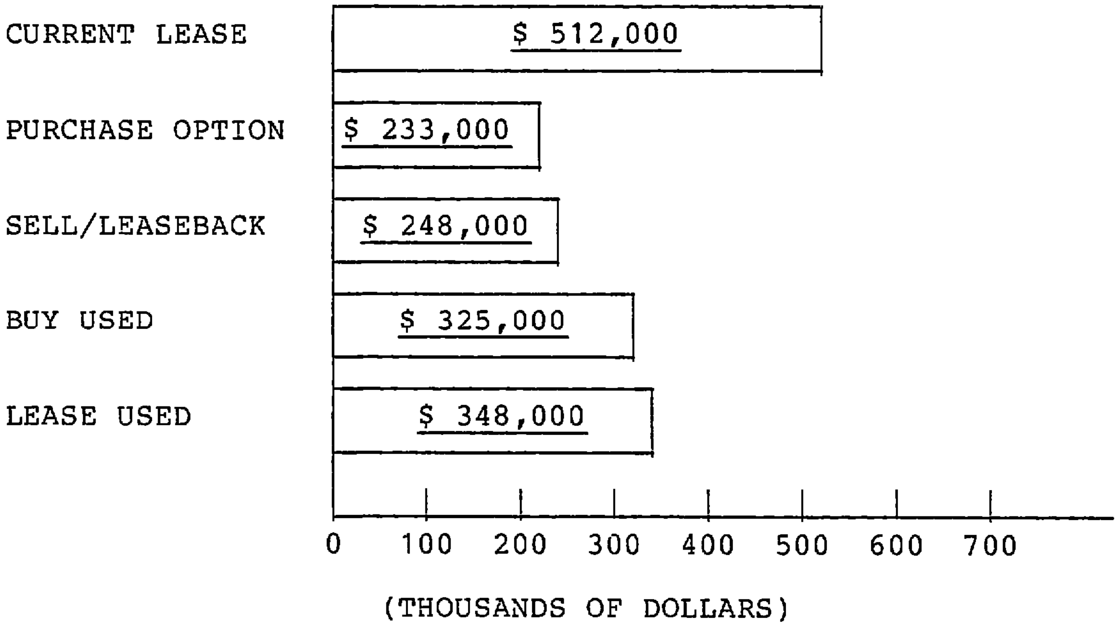
These alternatives were little known or little used at the installations we visited. The most obvious of these alternatives is converting leased equipment to purchase, where appropriate. This could involve additional appropriations, but should result in economies.

Notwithstanding installation managers' perceptions that purchase monies were generally not available within DOD, the Office of the Secretary of Defense has been somewhat successful in budgeting purchase money for lease conversions when requested. This fiscal year, OSD honored Army requests for $8.6 million to buy leased ADP equipment. The General Services Administration's ADP Revolving Fund may be used for purchase opportunities if money is available within the Fund and certain eligibility criteria are met.

Sell/Leaseback, a transaction where the government's purchase option is exercised by a third party who then leases the equipment back to the government, has resulted in substantial savings in the few instances in government where it has been used. For example, in 1980 the Department of Energy's Livermore Labs refinanced a leased CRAY computer through a sell/leaseback transaction that resulted in both a two-year saving of more than $2 million and government ownership of the computer at the end of the lease term.

Substantial savings can also be realized if agencies will give greater consideration to acquiring equipment in the used computer market or substituting a lower cost used item for installed, leased equipment. For example, a Digital RP-06AA disk drive would cost $34,000 if purchased new under GSA schedule contract and more than $15,000 per year to lease. The same drive, used, is advertised for sale at about $12,000.

This chart (below) provides a graphic comparison of the three-year costs for one component--an IBM 4341 computer.



As you can see, in this instance, any available alternative selected results in a lower overall cost than continuing the present lease. We found this to be the case for 159 of the 225 leased components we reviewed, about 70%. For 210, or 93% of the components reviewed, there was at least one lower cost alternative. Only 15 of these components (7% of the 225 reviewed) did not have at least one available alternative at less cost than their present rental contracts.

Alternatives such as these could be immediately pursued by the Services. They were not doing so because (1) the installations we visited were not systematically analyzing their leased computer inventory for cost effective alternatives, (2) the information necessary to perform such analyses was not readily available (and in some instances was impossible to reconstruct from existing records), or (3) purchase was perceived as the only opportunity and money may not have been available.

We found unreliable equipment inventory records at all but one of the Defense installations we visited. For example, we found discrepancies in recorded model numbers, serial numbers, purchase prices, rental rates and installation dates. In some instances, contract terms and conditions were not available. None of the installations or command elements we visited tracked the Government's accumulated purchase option credits, and the accounting records needed to accurately reconstruct credit information on equipment more than 5 years old were not retained.

In December 1980 we reported [1] on the state of obsolescence in Federal Government computer installations and urged immediate actions to reduce the Government's use of old computer technology. In recommending lease restructuring, purchase conversions, or used replacements we are not suggesting that installations retain old

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[1] Continued Use of Costly, Outmoded Computers in Federal Agencies Can Be Avoided, AFMD-81-9, December 15, 1980.

equipment any longer than necessary. Rather, we are saying that managers should periodically evaluate equipment costs and attain the most economic arrangements possible for the remaining period of the systems life.

To recap, we believe that the Services are paying far more than necessary for leased general purpose computer hardware. There are available lower cost options for retaining installed leased equipment, but those alternatives are not being aggressively pursued.

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I would like to switch gears at this point, and turn from the subject of leasing general-purpose computers to the subject of acquiring embedded computer systems. Embedded computers are specially designed or configured and (1) acquired as part of a total weapons package, or (2) integrated into a command center, and thus are "embedded" in such a structure.

Chart 1 shows the estimated 1980 and forecasted 1985 and 1990 annual costs for DOD's general purpose and embedded computers. Much of the growth in DOD computer usage that I mentioned at the beginning of my statement is expected to take place in the embedded systems area. We prepared this chart from an October 1980 study by the Electronic Industries Association, which used DOD budget data, interviews with experts in industry and Government, market surveys, periodicals, and other reports for its 10 year forecast of DOD computer hardware costs and the cost of labor-intensive software and services. Analysis of this chart shows that:

--DOD computer costs will increase substantially in all categories, although embedded computer costs will become increasingly dominant; and

--software costs for embedded computers will increase to more than two-thirds of total computer costs.

Chart 2 shows hardware and software percentage cost trends from 1955 to 1985 for computers in general. This chart was developed from a widely published graph by a recognized software expert. Notice that the hardware cost percentage is decreasing while the software cost percentage is increasing, particularly the maintenance portion which is expected to make up about 60 percent of total costs by 1985.

Software maintenance consists of modifying existing operational software while leaving its primary functions intact. Software maintenance costs are expected to eventually contribute roughly 70 percent of the overall cost of software. The lower percentages shown in this chart for software maintenance reflect the fact that additions to the inventory of code via development will occur at a greater rate than code will become obsolete for some time.

Chart 3 applies and extrapolates development and maintenance software percentage cost trends (chart 2) to the forecasted costs of hardware and software for DOD embedded computer systems (chart 1) to show possible cost trends of DOD's embedded computers.

Assuming these trends apply, an analysis of the chart shows that

--hardware costs will increase but continue to decline as a percentage of total costs,

--software development costs will increase while remaining nearly constant as a percentage of total cost, and

--software maintenance costs will increase rapidly and continue to increase as a percentage of total cost.

Let me turn now to the area of computer system development, in particular the development of command and control systems which for the most part are embedded systems. Command and control is "the exercise of authority and direction by a properly designated commander over assigned forces in the accomplishment of his mission" (JCS Publication 1). Automation provides a means of augmenting a commander's capability to direct and control resources in today's complex, high-speed military world. Other automated systems can also be used for control, such as embedded control elements of individual weapons. The embedded control elements of weapons are generally not involved in human control, but in physical control. In fact, their very purpose is to eliminate the human from the loop as much as possible rather than further his role in it.

Command and control systems which provide information to aid commanders in reaching decisions have proven difficult to develop and effectively implement. I would like to describe four examples of command and control system development efforts which indicate some of the problem areas, including:

--Identifying user needs,
--Responsive system designs,
--Software development techniques, and
--Inserting new hardware technology.

We believe that substantial improvements in the command and control system development process are required to efficiently provide commanders the information necessary to more effectively direct military forces to deter and counter potential adversaries.

The four examples I will describe include the World Wide Military Command and Control Information System (or WIS, formerly known as WWMCCS ADP) intended to support the National Command Authorities (the President and Secretary of Defense), Joint Chiefs of Staff, and Commanders-in-Chief of the unified and specified commands. The other examples are system development efforts by each of the Services for automated tactical operations centers to support field commanders. All of these efforts to date have been unsuccessful in fielding systems which satisfy operational users.

The first example is the WWMCCS ADP program which completed installation of 35 standard systems at 26 sites in 1973. The use of standard computers in this system permitted the development of standard software, procedures and training. However, as early as 1974, DOD realized the standard computers selected would be unable to provide many of the capabilities desired and would need to be replaced. After many studies, DOD started planning for the replacement system in 1978. Currently, after nearly 5 years, a definitive set of objectives, comprehensive plan and effective systems architecture or blueprint have not been completed. Consequently, the modernized WIS is not expected to be operational until 1990 at the earliest, 16 years after this need was first identified.

The second example is an Army command and control development effort. In 1958, the Army established a project office to develop an Army Tactical Operations Center intended for use in Europe. A prototype was assembled and delivered to Ft. Leavenworth in 1963, where it was tested for 2 years. Following this effort, several otner developments were attempted in succession to meet the need for a Tactical Operations System (TOS). In 1972, a new TOS project was started primarily using existing hardware. Tests in 1977 revealed substantial software and system design problems.

Also in 1977, the Commander-in-Chief of the U.S. Army Europe expressed an urgent operational requirement for a TOS, so development of a division level TOS continued. By 1979, the Defense Systems Acquisition Review Council approved initiation of engineering development for the division level TOS. GAO strongly criticized this development effort in 1979, which led to a reduction in funding for the division level TOS. By 1979, about $93 million had been spent on TOS and major defects remained. Currently, the SIGMA project, employing several by-products from the recent TOS effort, is under development, 25 years after the initial need was identified.

My third example is the Navy's Tactical Flag Command Center (TFCC) which is a shipboard command and control system intended to provide the tactical commander at sea with information from on-shore and task force sources, pertaining to the state of U.S. forces and the location and probable intention of enemy forces. In 1972, the Navy began to prepare a Request-for-Proposal, using the results of a large number of analytical studies as a basis for requirements. An Interim TFCC was then evaluated in 1975 but the results were not conclusive. Following a lengthy competition, the Navy awarded a development contract for TFCC in 1977. After the design phase was completed, initial operating capability cost estimates had tripled. Cost increases, schedule delays, and disagreement within the Navy over TFCC functional requirements, all combined to cause rejection of the proposed development.

The Chief of Naval Operations approved a development program but encouraged that it be revised to accelerate deployment to the fleet. In response, the Navy restructured the development to use an existing testbed developed as a 1975 proof-of-concept demonstration in over-the-horizon targeting called OUTLAW SHARK. A limited procurement of six shipboard and two shore-based systems was approved and these systems should be installed by 1984.

Because OUTLAW SHARK employed non-standard computers and software, the Navy started a parallel activity to redesign the hardware and software for TFCC using Navy standard computers and a high order language. This would reduce future software maintenance costs and enable addition of new capabilities. Although partial fielding of TFCC will have been accomplished within 12 years from initial needs identification, evaluations of engineering development models have indicated that these systems do not have many of the the command and control decision aids needed to support the embarked flag staff.

The fourth example is an Air Force effort to develop a similar system, Tactical Air Control Center Automation (or TACC AUTO), for its mobile tactical air control systems. The requirement for TACC AUTO was based on a required operational capability statement approved in 1967. Delays in the development project were caused by uncertain specifications, software development problems, cost overruns and eventually, disenchantment with computer hardware which was deemed obsolete before the TACC AUTO software could be developed. Although the system was judged a conditional success after testing, the serious problems encountered in the program led to its termination. The Air Force had spent about $80 million on this development. After 16 years, this required operational capability statement remains unfulfilled in the field.

The case histories I have just outlined illustrate the difficulty and complexity in providing automated assistance to support command and control. Every major command and control software development project is likely to experience problems at some stage, and the earlier these problems are diagnosed, the less costly the solution will be. What can we learn from these examples?

First, it is important to more completely identify objectives and user needs before beginning software development.

Second, system designs need to be more responsive to user needs and have the flexibility to incorporate new capabilities.

Third, the software development process needs to be improved by capitalizing on proven state-of-the-art software development techniques and tools such as high order languages and modular and structured programming.

Finally, we believe that provisions should be made during development for inserting new hardware technology for growth potential, and to postpone or avoid obsolescence during the system lifecycle.

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In closing, we appreciate this opportunity to participate in these hearings, and at this time, we will try to answer any questions you may have.

CHART 1

ESTIMATED AND FORECASTED COSTS OF DOD COMPUTERS

ALL COMPUTERS

	1980		1985		1990	
	COST (BILLIONS)	PERCENTAGE	COST (BILLIONS)	PERCENTAGE	COST (BILLIONS)	PERCENTAGE
GENERAL PURPOSE						
HARDWARE	$ .8	12	$ 1.5	8	$ 2.7	6
SOFTWARE	1.8	27	2.9	16	5.1	11
EMBEDDED						
HARDWARE	1.3	19	2.8	15	5.9	13
SOFTWARE	2.8	42	11.2	61	32.1	70
TOTAL	$ 6.7	100	$18.4	100	$ 45.8	100

CHART 2

HARDWARE-SOFTWARE COST TRENDS

ALL COMPUTERS

PERCENT OF TOTAL COST

	1955		1970		1985	
HARDWARE		83		30		13
SOFTWARE						
DEVELOPMENT	11		33		24	
MAINTENANCE	6		37		63	
SUBTOTAL		17		70		87
TOTAL		100		100		100

CHART 3

COST TRENDS APPLIED TO FORECASTED

RISING ANNUAL DOD EMBEDDED COMPUTER COSTS

	HARDWARE		SOFTWARE					
			DEVELOPMENT		MAINTENANCE		TOTAL	
YEARS	COST (BILLIONS)	PERCENTAGE	COST (BILLIONS)	PERCENTAGE	COST (BILLIONS)	PERCENTAGE	COST (BILLIONS)	PERCENTAGE
1980	$1.3	32	$ .8	19	$2.0	49	$ 4.1	100
1985	2.8	20	3.1	22	8.1	58	14.0	100
1990	5.9	15	8.7	23	23.4	62	38.0	100