Report to The President and the Secretary of Defense on the Department of Defense

BY THE

Blue Ribbon Defense Panel

APPENDIX I

Staff Report on

Automatic Data Processing

July 1970

PREFACE

During its consideration of the utilization of automatic data processing within the Department of Defense, the Blue Ribbon Defense Panel was fortunate to receive an independent analysis submitted in February, 1970, by two consultants from the private sector.

The substantive portions of their report are considered to be of sufficient importance to top-management personnel of the Department of Defense to be included as an Appendix without necessarily implying endorsement by the Panel of each finding or recommendation.

The Panel is grateful to Mr. John P. Malbrain and Mr. David B. Breedon for their report, and to their respective companies, North American Rockwell, and Westinghouse Electric Corporation, for donating the services of these two consultants.

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1.0 INTRODUCTION

During the decade of the '50's the Department of Defense was the recognized leader in the application of Automatic Data Processing (ADP) equipment and the Department of Defense (DoD) was responsible for many of the early advances in computer systems development. Since about 1960 the position of the Department has steadily deteriorated until, at the present time, it owns large numbers of computers in various stages of obsolescence, and spends at least $500 million per year more for computers and ADP support than is necessary. The justification and selection process for upgrading present equipment or for new applications currently requires millions of dollars and years to carry to a conclusion. By the time this process is completed for a particular application, the computer requirements in the majority of cases will have changed and the equipment to be installed will not be the best configuration to perform the actual workload. When compared to the major industrial users of computers, the Department derives much less benefit from its ADP dollar. No industrial user could afford the procurement procedures and delays inherent in the present DoD process.

The accounting process used by the Department, although it satisfies the Department, Bureau of the Budget, and General Accounting Office requirements, does not provide the data required for procurement, usage, or disposition of computer hardware or software. The Department has effectiveness criteria for aircraft, missiles, tanks, and other weapons systems, but there are no such effectiveness criteria for computers. Therefore, the most effective method available to the Department in evaluating the efficiency of ADP operations is to compare the Department's cost to industry's costs.

Major cost structure changes in the field of computers and data processing are currently underway. For the last few years most computer users leased a service from the manufacturer, which included the use of ADP equipment, software, maintenance, and technical support. Policy changes in the computer industry are separating these elements and the user will no longer be allowed to contract for a "package deal". These changes place much more urgency on the development of more sophistication and technical capability within the Department. Decisions which were dictated by the manufacturers will now be under the control of the user. At the present time the Department does not have sufficient technical capability to make decisions that are in the best interest of the Department.

The lack of effective ADP support and the lack of management information is hampering decisions and limiting the effectiveness of management within the Department. This need for more effective support cannot be satisfied under the current ADP policies and management guidelines.

This report provides information concerning the current procedures, DoD's inventory and usage of ADP equipment, a discussion of the environment of the time period 1970 to 1980, and makes recommendations for changes which will provide the Department with more ADP capability at a lower cost and provide the information required for management decisions.

1.1 Study Procedures

This study was based on the general charter of the Panel but with its own charter (Figure 1). A list of 21 areas for consideration (Figure 2) was developed.

Figure 1 - Charter for ADP Study Group

1. Collect information concerning the applications, selection, justification, management, and procurement of computer equipment.

2. Collect information concerning the approval of ADP applications and the approval cycle for equipment purchase or lease.

3. Determine the cost of ADP activities, including the cost of hardware, software, and operation.

4. Determine the interface between each of the services, the Office of Secretary of Defense, and the General Services Administration.

5. Based on the findings above, determine if changes in the procedures used by the Department can result in significant savings.

6. Make recommendations to implement any changes that will result in significant improvements in the operation of the Department.

7. Determine if the Department should consider the use of remotely located computers and communications to solve local computer requirements.

This list was used as an interview guide in discussions with personnel in each of the Military Departments, Assistant Secretary of Defense (Comptroller)(ASD(C)), General Services Administration (GSA), Bureau of the Budget (BoB), and the Defense Communications Agency (DCA). The information collected during these interviews and obtained from documents provides the basis for this report. In order to minimize the time requirements on Department personnel, the interviewees were not asked to provide written responses to each of the 21 areas under consideration. The Department of Defense had undertaken a similar study during 1967.* In general, the conditions at the present time are essentially the same as described in the 1967 report. Extensive discussions were held with the Chairman of the 1967 study group. The primary result of their study was to originate some changes to DoD Directives 5100.40 and 4105.55. As of February 1970, the changes were still undergoing review, but a revised DoD Directive 5100.40 has since been issued (18 May 1970). Another change which has occurred since the 1967 report has been the transfer of staff responsibility for ADP to the ASD(C) from ASD(I&L).

1.2 Study Constraints and Assumptions

The major constraints placed on this study were those resulting from limitations of time and available personnel. The study assumed that recommendations could be made to any area where substantial benefits could be derived, even if current directives and statutes required changes. No attempt was made to limit the study scope to fit

*Report of Assistant Secretary of Defense (Installations and Logistics) ad hoc study group, "Computer Selection Policies, Procedures, and Techniques in the Department of Defense, July 1967."

FIGURE 2

AREAS FOR PANEL CONSIDERATION

1. Justification procedures for ADP applications.
2. Justification procedures for ADP equipment.
3. Computer selection procedures.
4. Criteria for replacing/adding computers.
5. Computer procurement procedures.
6. Criteria for retirement of computer equipment.
7. Feasibility of establishing a list of acceptable and undesirable computers.
8. Feasibility of establishing a set of evaluation programs (benchmarks) for adding computers to the list of acceptable computers.
9. Use of time sharing vs. locally installed equipment.
10. Evaluate DoD use of commercial computer services for some uses and establish guidelines.
11. Establishment of mobile computer systems which could be used to support temporary workloads and for initial workloads for new installations.
12. Programming languages (Fortran, COBOL, PL/1, Assembly).
13. Operating systems and operating procedures.
14. Data storage and retrieval software.
15. Feasibility of producing "liberation" programs to allow some older computers to be retired without requiring complete reprogramming.
16. Establishment of common ADP systems and reports within the Department.
17. Increased program exchange between installations.
18. Computer use reporting and installation effectiveness evaluation.
19. Administrative responsibility for computers.
20. Computer installation operating responsibility.
21. Feasibility of establishing a Defense Communication and Computer Agency.

within current procedures, assignments of responsibility, or directives.

Assumptions were made that the Department would continue in its major roles and that the present National priorities would continue. It was also assumed that the Department desired to make the most effective use of its resources and that it must retain the capability to rapidly respond to unexpected requirements.

The study was completed within this framework and makes recommendations for changes which will provide the Department with effective and efficient ADP support.

1.3 Summary of Findings

During the interviews some anticipated and some unexpected facts and opinions were discovered. This section gives some insights into the Department's problems which were discovered during the interviews. The comments are keyed to the 21 areas (Figure 2).

1. Justification procedures are too involved and require too much time and resources. Although few interviewees had concrete suggestions for improvements, all agreed that some changes were required.
2. Same comments as 1 above.
3. The selection process has often resulted in equipment which did not meet requirements when it was installed. This resulted partially from the long time delays between recognition of the requirement and installation of the equipment.

4. There are no criteria for replacing computers. If a computer system will no longer carry the workload, it is frequently augmented by the addition of another identical computer. The Department of Defense has many computers which have been in use for over 10 years.

5. Computer procurement is largely handled by the General Services Administration and eventually they will handle all procurements.

6. See comment 4 above. There are no criteria for retirement of computer equipment.

7. All computers are assumed to be acceptable to the Department and the selection is made from the bids submitted.

8. If the Department feels a demonstration of capability is required, benchmarks are included in the procurement specifications. The Department selects computers to perform approved functions on the basis of system specifications and cost of the proposed system. It does not select equipment based on general performance vs. cost evaluations.

9. Concern was voiced on the use of a priority system which would allow work to be completed when required.

10. DoD components currently use some commercial computer services but there are no DoD guidelines or directives concerning their use. In most cases, gaining approval for the use of these services is easier than purchasing equipment.

11. No comments of significance were made on this subject.

12. Programming languages and programs were discussed with all interviewees.

    Some of the viewpoints were as follows:

    a. The Department requires business data processing programs to be written in COBOL unless substantial savings will result from other languages.

    b. COBOL has been in existence for some time and other higher level languages provide more capability.

    c. Perhaps COBOL was premature and the Department should have waited before making it the standard.

    d. Programs written in COBOL are easier to change than programs written in assembly language.

    e. COBOL programs require from 1.5 to 10 times more computer capability than assembly language programs.

    f. FORTRAN is the common scientific processing language within the Department, and it seems to be satisfactory since it has been updated and expanded on several occasions.

13. Operating systems are the responsibility of the supplier and the Department does not undertake to provide its own.

14. Data storage and retrieval software is the major software problem of the Department. Millions of dollars have been spent and many more millions will be required before there is a suitable system developed.

15. The Department has met with some degree of success in this area but efficient use of the new computer is the major problem. Also some manual work may be required for some conversions.

16. Common ADP systems and reports within the Department must wait for resolution of differences between each of the Military Departments and other components before they can be developed. Common management systems do not currently exist.

17. Increased program exchange is not possible until differences are removed between the DoD components.

18. Computer hours per month and manpower directly relatable to computers are currently being reported. There are no criteria for installation effectiveness, and continuing cost effectiveness analysis is not undertaken.

19. Administrative responsibility rests with the Military Departments and other DoD components. The Office of the Secretary of Defense (OSD) is involved only in selection and procurement, and in budget approval.

20. See 19 above.

21. No comments were made except questions concerning its operation.

2.0 DOD COMPUTER INVENTORY, USAGE, AND MANAGEMENT

2.1 Current Inventory of Computers

The Department of Defense currently has approximately 2800 computers which are used for general purpose data processing. Figure 3

shows the number of computers within the Department for each manufacturer and model designation. Several of these computers are obsolete and these are indicated by an asterisk (*) following the model number. The definition of the term varies with individuals but the equipment indicated in this list would be considered obsolete by most computer personnel. A computer which is no longer manufactured is not considered obsolete if it is still capable of performing work efficiently. All of the Department's computers are not shown on this list since some are used for classified work and this list was taken from unclassified sources. Of the computers listed, 1019 (36%) are considered obsolete. Some of the computers listed are normally considered as process control types and they are commonly not used for general purpose data processing. Examples of process control type computers are SDS 910, 920, PDP 8, etc.

An inventory of ADP equipment within the Department of Defense was obtained from the General Services Administration (GSA) based on data supplied to GSA by the Department of Defense. This inventory provided data in three arrangements: First, by geographical location; second, by manufacturer and model number; and third, by hours used per month.

The Department's procurement policies have resulted in multiple computers of the same type in the same locations. Figure 4 shows some examples of this duplication. It is a commonly accepted fact that doubling the thru-put of a computer installation can be achieved with an increase of only 20% to 50% in cost if a larger computer is used. However, one factor which must be included in this trade-off, is the difficulty and cost of reprogramming in the event that the new computer

FIGURE 3

DOD COMPUTER INVENTORY AS OF 30 JUNE 1969

ADG	200	2	DSI	620*	4	IBM	1620*	35	RCA	7045	3
ASI	210*	1	DEQ	LINC8	5	IBM	1710	1	SDS	910	10
ASI	6020	15	DEQ	PDP1	6	IBM	1800	9	SDS	920	7
ASI	6040	2	DEQ	PDP5	1	IBM	36020	57	SDS	92	2
ASI	6050	1	DEQ	PDP8	10	IBM	36030	61	SDS	9300	3
AUT	REC2*	7	DEQ	PDP8S	1	IBM	36040	44	SDS	930	7
BRA	133*	3	DEQ	PDP9	1	IBM	36044	2	SDS	940	1
BRA	400*	1	DCG	NOVA	1	IBM	36050	38	SDS	SIGMA7	3
BUR	205*	1	DSS	1006	1	IBM	36065	20	SEL	810	1
BUR	B160	1	EAI	640	1	IBM	36067	5	SEL	810A	11
BUR	B2500	1	EAI	8400	2	IBM	36075	1	SEL	840A	3
BUR	B250	1	ELT	ALW3*	1	IBM	36091	1	UNI	1004*	183
BUR	B263	156	EMR	6130	1	IBM	6400	3	UNI	1004III*	16
BUR	B280	1	FAR	3030	7	IBM	650*	2	UNI	1005*	238
BUR	B283	4	GEL	115	3	IBM	7010	21	UNI	1005II*	12
BUR	B3500	11	GEL	215*	2	IBM	7030	2	UNI	1005III*	4
BUR	B5500	10	GEL	225*	21	IBM	7040	5	UNI	1050*	171
BUR	E101*	2	GEL	235*	1	IBM	7044	7	UNI	1050A*	1
CDC	1604*	18	GEL	415	1	IBM	705*	3	UNI	1050III*	6
CDC	160*	45	GEL	425	1	IBM	7074	6	UNI	1105	1
CDC	160A*	19	GEL	605	1	IBM	7080	25	UNI	1107*	3
CDC	1700	6	GEL	635	3	IBM	7090	10	UNI	1108	10
CDC	3100	16	GEL	645	1	IBM	7094	25	UNI	1218	14
CDC	3150	1	GEL	D30	1	IBM	7094II	4	UNI	1219	4
CDC	3200	11	HON	1200	14	IBM	7740	7	UNI	1230	13
CDC	3300	13	HON	120	8	INF	4900	1	UNI	418	26
CDC	3400	3	HON	1800*	2	LIT	FSG1	1	UNI	490	5
CDC	3600	5	HON	200	49	MON	X1*	5	UNI	494	10
CDC	3800	12	HON	2200	12	NCR	304*	4	UNI	642A	3
CDC	4000	1	HON	400*	4	NCR	315	7	UNI	642B	9
CDC	4010	1	HON	800*	18	NCR	390	138	UNI	667	1
CDC	5350	1	HON	DDP116	7	NCR	500	118	UNI	818	1
CDC	6400	1	HON	DDP224	4	NDI	3300	1	UNI	855	3
CDC	6500	2	HON	DDP24	5	PHI	1000*	4	UNI	9300	10
CDC	6600	4	HON	DDP516	3	PHI	2000	5	UNI	DCT9000	1
CDC	8041	1	HPC	HP2116	3	RAY	250*	7	UNI	III*	6
CDC	8090	19	IBM	1130	22	RAY	440	1	UNI	M460	1
CDC	8092B	7	IBM	1401	259	RAY	520	3	UNI	SS80*	2
CDC	924A*	1	IBM	1410	61	RCA	301*	100	UNI	SS90*	1
CDC	G15D*	25	IBM	1440	19	RCA	3301	25	VAR	620I	1
CDC	LGP21*	2	IBM	1460	30	RCA	501*	26			
CDC	LGP30*	10	IBM	1500	2	RCA	7035	2			

* Indicates an obsolete computer

is not program-compatible with the older one. The Department's approval and selection policies have been directed toward matching the computer to an approved workload and then installing this computer in each location which had this function to perform. Therefore, no attempt has been made to reduce the number of computers at these installations. Where large numbers of computers are installed at a geographical location, the number of personnel and the cost of operating the installation could be greatly reduced.

As can be seen in Figure 4, there are installations which have 7, 8, or 9 computers of the same type, some of which are owned and some are leased. These RCA 301 installations are typical of the results of selecting computer equipment to meet workload units, and then installing this equipment without regard to the total requirements for computer support.

Figures 5 through 8 show computers installed in four different geographical locations. Figure 8 shows the computers installed in the vicinity of Norfolk, Virginia. There is not a single modern large scale computer included in this list, and of the 82 computers shown, approximately half would be considered obsolete by most computer personnel.

The present policies within the Department result in the selection and use of medium scale computers dedicated to performing independent functions. The latest computer inventory (June 30, 1969) shows the following large scale computer installations within the Department:

CDA 6000 Series	7
GE 600 Series	5
IBM 360/65 and larger	27
IBM 7080/90/94	64
UNIVAC 1108	10
TOTAL	113

FIGURE 4

INSTALLATIONS OF RCA 301 COMPUTERS

City/Post Office	Command	Qty.	Owned	Rented	Avg. Mthly. Hrs. in Svc.	% Utiliz.
Maxwell AFB	Air University	1	1	+	126	18.0
McClellan AFB	Ass't. Dir. Plan Programs Sys.	4	2	2	694	99.2
" "	Air Force Logistics Command	7	4	3	444	63.5
" "	AF Communications Command	1	+	1	NA	--
Presidio San Fran	Sixth US Army	1	+	1	328	46.9
San Diego	Commander in Chief PAC Fleet	1	1	+	537	76.8
Denver	AF Account and Fin. Ctr.	1	1	+	365	52.2
"	Office of the Surgeon General	1	1	+	193	27.6
Washington	Bureau of Naval Personnel	1	1	+	219	31.3
"	Chief of Naval Material NEC	1	1	+	446	63.8
"	Naval Communications Command	1	+	1	172	24.6
Ft. McPherson	Third US Army	1	+	1	623	89.1
Robins AFB	Air Force Logistics Command	8	5	3	450	64.4
Heidelberg, Germany	US Army Europe	3	+	2	621	88.8
Ft. Shafter	US Army Pacific	1	+	1	567	81.1
Honolulu	Naval Communications Command	1	+	1	447	63.9
Ft. Sheridan	Fifth US Army	1	+	1	556	79.5
Joliet	US Army Munitions Command	2	1	1	687	98.2
Rock Island	US Army Weapons Command	2	2	+	508	72.6
Scott AFB	AF Communication Service	1	1	+	379	54.2
Edgewood Arsenal	Office Adjutant General	1	+	1	682	97.5
Ft. Geo. G. Meade	First US Army	1	+	1	681	97.4
Warren	US Army Tank Auto. Command	3	2	1	570	81.5
Kansas City	Office Chief of Engineers	1	+	1	398	56.9
St. Louis	ACIC	1	1	+	330	47.2
" "	Office Adjutant General	1	+	1	542	77.5
" "	Office Chief of Eng.	1	+	1	302	43.2
Omaha	" " " "	1	1	+	501	71.6
McGuire AFB	Military Airlift Command	1	+	1	313	44.8
Griffiss AFB	Air Force Logistics Command	1	1	+	599	85.7
Gentile AFS	Ass't. Dir. Plan Programs Sys.	9	3	6	700	100.0
Newark	Air Force Logistics Command	2	2	+	637	91.1
Wright Patterson	" " " "	6	3	3	309	44.2
Tinker AFB	" " " "	8	5	3	466	66.6
" "	" " Communications Command	1	+	1	NA	--
Philadelphia	Ass't. Dir. Plan Programs Sys.	2	1	1	702	100.0
Kelly AFB	Air Force Logistics Command	8	5	3	501	71.6
Hill AFB	AF Communications Command	1	+	1	NA	--
" "	Air Force Logistics Command	7	4	3	368	52.6
Ft. Belvoir	US Army Mobility Eq. Command	1	+	1	229	32.7
Norfolk	Commander in Chief LANT	1	1	+	272	38.9
Long Binh	US Army Pacific	2	+	2	397	56.7
	Total	99	50	49	486	69.5

Figure 5 - Computers Installed in the Boston Area

(Bedford, Boston, Cambridge, Chelsea, Ft. Devins, Hanscom Field, Lexington, Natick, Otis, Waltham)

Manufacturer	Model No.	Quantity	Avg. Hours in Svc.	% Utiliz.
DEQ	PDP1	5	270	36.8
"	PDP7	3	221	31.6
"	PDP8	1	120	17.2
"	PDP8L	2	NA	--
"	LINC8	2	NA	--
IBM	1130	1	NA	--
"	1401	1	184	26.3
"	1410	2	224	32.0
"	1460	1	471	81.6
"	1800	1	221	31.6
"	7030	1	335	47.9
"	7044	1	579	82.8
"	7094	1	573	81.9
"	7094 II	1	186	26.6
"	36020	2	131	18.7
"	36030	1	164	23.4
"	36040	1	464	66.4
"	36050	2	406	58.1
"	36067	1	668	95.5
SDS	920	1	152	21.7
"	93001	1	242	34.6
"	SIGMA2	1	NA	--
"	SIGMA5	1	NA	--
SGD*	CAMC	1	NA	--
"	T2	1	373	53.3
Univac	490	1	277	39.6
"	1004	3	136	19.5
"	1005	2	283	40.5
"	1050	2	450	64.4
"	1050 III	1	687	98.2
"	III	1	694	99.2
"	1218	1	200	28.6
"	1219	1	525	75.1
"	M460	1	125	17.9
CDC	3200	1	105	15.0
"	3300	1	407	58.2
"	5360	1	176	25.2
"	8092B	1	NA	--
"	LPG30	1	21	3.0
Honeywell	200	1	339	48.5
"	2200	1	516	73.8
"	DDP224	3	374	53.5
"	DDP516	1	150	21.5
Burroughs	B263	1	198	28.3
"	B3500	2	NA	--
RAY	70L	1	NA	--
SEL	810A	2	232	33.2
VAR	620I	1	544	77.8
GE	225	2	451	64.5
NCR	390	1	238	34.0
Total		70	309	44.2

*Special Government Design

Figure 6 - Computers Installed in Hawaii (Oahu)

(Barbers Point, Ft. Shafter, Helemana, Hickam AFB, Honolulu, Kaneohe Bay, Kunia, Oahu, Pearl Harbor, Wakiawa, Wheeler AFB)

Manufacturer	Model No.	Quantity	Avg. Hours in Svc.	% Utiliz.
IBM	1130	3	108	15.4
"	1401	7	391	55.9
"	1410	5	516	73.8
"	1460	2	603	86.2
"	7010	2	692	98.9
"	7740	1	NA	--
"	36020	5	449	64.2
"	36030	1	NA	--
"	36040	2	NA	--
"	36050	3	576	82.4
RCA	301	2	507	72.5
"	501	2	560	80.1
SGD*	ANUYK5V	2	493	70.5
Univac	1004	7	255	36.5
"	1005 III	1	185	26.5
"	1050	2	654	93.5
"	1050 III	1	352	50.3
CDC	1604	5	342	48.9
"	160A	5	537	76.8
"	3100	3	687	98.2
"	8090	3	191	27.3
"	8490	1	612	87.5
NCR	390	2	230	32.9
Total		67	429	61.3

*Special Government Design

Figure 7 - Computers Installed in the St. Louis* Area

Manufacturer	Model No.	Quantity	Avg. Hours in Svc.	% Utiliz.
Autonutics	REC2	4	31	4.4
Burroughs	B263	2	151	21.6
"	B3500	2	NA	--
Honeywell	200	3	489	70.0
"	1200	1	442	63.2
"	800	1	498	71.2
IBM	1401	5	448	64.1
"	1410	2	360	51.5
"	1440	3	474	67.8
"	1620	1	146	20.1
"	36020	1	NA	--
"	36030	2	652	93.2
"	36040	1	200	28.6
"	36050	3	625	89.4
"	36065	5	434	62.1
"	7010	2	661	94.5
"	7080	1	694	99.2
"	7094	3	457	65.3
NCR	390	2	213	30.5
CDC	8092B	1	139	19.9
Philco	1000	1	221	31.6
"	2000	1	287	41.0
RCA	301	1	330	47.2
"	501	1	338	48.3
Univac	418	1	NA	--
"	1004	4	658	93.2
"	1050	1	473	67.6
"	1108	2	653	93.4
Total		57	423	60.5

*St. Louis and Scott AFB

Figure 8 - Computers Installed in the Norfolk Area

(Ft. Eustis, Ft. Monroe, Hampton, Langley AFB, Little Creek, Norfolk, Portsmouth, Virginia Beach, Yorktown)

Manufacturer	Model No.	Quantity	Avg. Hours in Svc.	% Utiliz.
IBM	1130	1	147	21.0
"	1620	1	81	11.6
"	1401	9	396	56.6
"	1410	2	456	65.2
"	36020	2	435	62.2
"	36030	3	445	63.6
"	36025	1	NA	--
"	36040	1	514	73.5
"	36050	1	NA	--
"	6400	2	174	24.9
"	7010	1	536	76.6
"	7040	1	519	74.2
"	7740	1	491	70.2
Univac	1004	8	289	41.3
"	1005	3	336	48.0
"	1050 III	1	430	61.5
"	III	1	580	82.9
"	1051	1	NA	--
"	1107	1	NA	--
Honeywell	200	5	548	78.4
"	1200	3	515	73.7
"	800	3	503	71.9
Burroughs	B263	2	NA	--
"	B3500	1	500	71.5
NCR	390	3	453	64.8
"	500	2	183	26.2
RCA	301	1	272	38.9
"	3301	1	698	99.8
"	501	1	308	44.0
"	7045	2	648	92.7
SGD*	ANUYK5V	4	466	66.6
"	ANUYK4V	1	526	75.2
CDC	1604	3	553	79.1
"	160A	5	240	34.3
"	310Q	2	628	89.8
"	8090	1	361	51.6
"	8490	1	545	77.9
Total		82	416	59.5

*Special Government Design

Some samples of medium scale computer inventory are as follows:

CDC 3000 Series	73
Honeywell 800/1800	20
IBM 1410	61
IBM 360/30-40	105
IBM 7010	21
RCA 301	100
RCA 501	26
Burroughs 3500/5500	21

2.2 Current Computer Usage.

Large numbers of the Department's computers are used less than 16 hours per day. As can be seen in figure 4 there are some installations where there are multiple computers of the same type, some of which are leased and some of which are owned. In these installations, the average use indicates that one or more of the leased computers could be returned, and the workload could be performed by the remaining computers by using them more hours per day. This is the result of two factors; first, the delays in obtaining computer equipment demands that some idle computer time be saved for future requirements, and second, restrictions on the use of overtime does not allow the necessary operating personnel to operate the computer 24 hours per day and seven days per week. If computers could be obtained when needed, and personnel were available to operate them, substantial savings could be achieved. The inventory referred to earlier indicates average computer usage during FY 69 for those DoD computers which reported time used. Several computer installations are exempt from time reporting requirements.

So long as the present policies are in effect within the Department, it is not likely that these usage hours can or should be increased.

2.3 Current Management Techniques

DoD computers are currently managed by the component where the computer is installed. Inventory and usage data is reported and this data becomes a part of the "Inventory of Automatic Data Processing Equipment in the United States Government" which is published by the General Services Administration for each fiscal year. Personnel and financial information is also reported annually and is included in the inventory.

Figure 9 gives the summary data for FY 68, FY 69, and projected data for FY 70. The projected total for FY 70 is $1.381 billion, which does not include the cost of capital invested in owned computers. The Department of Defense owns 1212 computers, and by a rough estimate, each cost approximately $750,000. If the cost of invested capital is 8%, then a total of $91 million results. The depreciation cost, based on an expected life of 5 years, is $182 million, totalling $273 million which is not included in figure 9. The salaries are reported at $721 million but the average cost per man year is reported at $8278. This average salary does not include normal overhead items such as fringe benefits, cost of facilities, cost of other supporting personnel, etc. A rough guess would place this figure at 50% of direct salaries, giving a total labor cost of $1.08 billion, and making the estimated total cost of computers $2 billion for FY 70.

Figure 9 - Summary Data from GSA "Inventory of Automatic Data Processing Equipment in the United States Government"

	FISCAL YEAR 68 (FINAL)				FISCAL YEAR 69				FISCAL YEAR 70 (PROJECTED)			
	DOD	NON DOD	TOTAL	DOD %	DOD	NON DOD	TOTAL	DOD %	DOD	NON DOD	TOTAL	DOD %
Total ADPCost (Millions)	1,003	650	1,653	60.7	1,218	720	1,938	62.8	1,381	820	2,201	62.7
Salaries	536	302	838	64.0	641	355	996	64.4	721	412	1,133	63.6
Rentals	221	91	312	70.8	261	92	353	73.9	319	98	417	76.5
Contract Service	98	105	203	48.3	149	123	272	54.8	143	130	273	52.4
Capital Cost	67	93	160	41.9	63	100	163	38.6	71	122	193	36.8
Other Cost	81	59	140	57.9	104	53	157	66.2	127	58	185	68.6
Number of Man/years	76,617	42,196	118,813	64.5	81,860	45,839	127,749	64.1	87,170	49,334	136,504	63.9
Ave. Cost per Man/year	7,000	7,173	7,054	N/A	7,836	7,751	7,800	N/A	8,278	8,357	8,300	N/A
Inventory by MFR				% of DOD TOTAL				% of DOD TOTAL		TOTAL FIGURES NOT AT THIS TIME	CONFIDENCE AVAILABLE	% of DOD TOTAL
IBM	732	468	1,200	27.1	787	524	1,311	27.2	685			24.7
Control Data	223	177	400	8.3	228	176	404	7.9	218			7.9
NCR	247	2	249	9.2	267	1	268	9.2	232			8.4
UNIVAC	719	184	903	26.7	757	193	950	26.1	755			27.2
RCA	143	28	176	5.5	157	32	189	5.4	129			4.7
Burroughs	184	9	193	6.8	188	7	195	6.5	200			7.2
Honeywell	111	136	247	4.1	127	144	271	4.4	117			4.2
Digitol Equip Corp	26	188	214	1.0	29	302	331	1.0	34			1.2
Scientific Data	27	159	186	1.0	33	176	209	1.1	36			1.3
All Others	277	187	464	10.3	325	213	538	11.2	386			13.8
Number of Computers	2,694	1,538	4,232	63.6	2,893	1,763	4,666	62.1	2,772	1,984	4,757	58.2
Number Owned	1,210	1,224	2,434	49.7	1,324	1,466	2,790	47.5	1,212	1,698	2,911	41.6
Number Leased	1,484	314	1,793	82.5	1,574	302	1,876	83.9	1,560	286	1,846	84.5
Average yearly Utilization (8640 Maximum)	3,924	N/A	N/A	N/A	4,589	N/A	N/A	N/A	5,237	N/A	N/A	N/A

Figure 9 Cont'd - Summary Data from GSA "Inventory of Automatic Data Processing Equipment in the United States Government"

	FISCAL YEAR 68 (FINAL)						FISCAL YEAR 69						FISCAL YEAR 70 (PROJECTED)					
	DOD TOTAL	ARMY	NAVY	AIR FORCE	DSA	OSD & OTHER	DOD TOTAL	ARMY	NAVY	AIR FORCE	DSA	OSD OTHER	DOD TOTAL	ARMY	NAVY	AIR FORCE	DSA	OSD & OTHER
Total ADP Costs (Millions)	1,003	284 (28.3)	263 (26.2)	363 (36.7)	55 (5.5)	33 (3.3)	1,218	405 (33.2)	289 (23.7)	416 (34.2)	64 (5.3)	44 (3.6)	1,381	483 (35.0)	332 (24.0)	446 (32.3)	69 (5.0)	51 (3.7)
Salaries	536	168 (31.3)	136 (25.4)	192 (35.8)	30 (5.6)	10 (1.9)	641	216 (33.7)	151 (23.6)	229 (35.7)	33 (5.1)	12 (1.9)	721	256 (35.5)	172 (23.9)	244 (33.8)	36 (5.0)	13 (1.8)
Rentals	221	58 (26.2)	57 (25.8)	89 (40.3)	13 (5.9)	4 (1.8)	261	73 (28.0)	64 (24.5)	101 (38.7)	18 (6.9)	5 (1.9)	319	94 (29.5)	85 (26.6)	116 (36.4)	18 (5.6)	6 (1.9)
Contract Services	98	22 (22.4)	27 (27.6)	31 (31.6)	1 (1.0)	17 (17.4)	149	65 (43.5)	27 (18.1)	30 (20.1)	2 (1.4)	25 (16.8)	143	55 (38.4)	29 (20.3)	32 (22.4)	2 (1.4)	25 (17.5)
Capital Costs	67	11 (16.4)	19 (28.3)	30 (44.8)	7 (10.5)	0 (---)	63	17 (27.0)	11 (17.5)	28 (44.4)	6 (9.5)	1 (1.6)	71	32 (45.1)	6 (8.4)	23 (32.4)	6 (8.4)	4 (5.7)
Other Costs	81	25 (30.9)	24 (29.6)	26 (32.1)	4 (4.9)	2 (2.5)	104	34 (32.7)	36 (34.6)	28 (26.9)	5 (4.8)	1 (1.0)	127	46 (36.2)	40 (31.5)	31 (24.4)	7 (5.5)	3 (2.4)
Number of Man/Years	76,617	24,807	18,840	28,261	3,649	1,060	81,860	28,306	19,117	29,563	3,789	1,085	87,170	31,739	20,032	30,409	3,752	1,238
Average Cost Per Man/Year	7,000	6,774	7,234	6,808	8,333	10,000	7,836	7,633	7,905	7,763	8,920	12,000	8,278	8,044	8,600	8,026	9,730	11,314

Since each of the Military Services and DoD components is responsible for the management of computers in its area of responsibility, there is no office within the Department of Defense which has responsibility for minimizing the total cost of computers. Most of the management effort within the Department is directed toward selecting computers, justification of these selections, and the preparation of directives and policy statements.

The present procurement and selection procedures are based on the concept of a computer system for a set of clearly defined applications. These applications are defined and a cost analysis is undertaken to determine how much the proposed system will cost and what benefits will be derived from the use of the computer. The Department also makes an analysis to determine if lease or purchase is desirable for each procurement, but it considers only the workload of the component which generates the requirement. Sharing a computer with another element in order to take advantage of the reduced cost per job on larger computers is not considered in making the selection. In fact, in many cases multiple computers of the same type are installed in the same location. Department of Defense Instruction 5030.40 details how charges can be made for shared resources. Basically, the policy is to charge only for direct out-of-pocket costs which makes the sharing unattractive for the agency with excess computer time.

The direct costs of the Military Department's ADP management and selection are shown in Figure 10.

System specifications, which are the primary documentation used for computer procurement, for a small to medium scale computer may require

FIGURE 10

ADP MANAGEMENT AND SELECTION STAFFS
OF THE MILITARY DEPARTMENTS

DEPARTMENT	FISCAL YEAR 68		FISCAL YEAR 69		FISCAL YEAR 70	
	Man/Yrs	Cost (000)	Man/Yrs	Cost (000)	Man/Yrs	Cost (000)
Navy						
OISPD	38	548	51	778	52	812
SASN	9	126	8	135	8	131
ADPESO	15	227	28	466	28	517
Total	62	901	87	1,379	88	1,460
Army						
MISD	57	782	99	1,415	123	1,883
CSEC	67	824	68	908	116	1,580
Total	124	1,606	167	2,323	239	3,463
Air Force						
AFADA	141	1,983	122	2,796	130	3,059
ESQ	42	554	46	619	64	863
Total	183	2,537	168	3,445	194	3,922
Grand Total	369	5,044	422	7,147	521	8,845

several man-years to complete, and can cost several hundred thousands of dollars. The specifications for the CS3 computer system are five inches thick and were used to procure an IBM 360/40 computer system. These specifications are dated August 1966, and as of February 1970, the system was not yet fully operational.

3.0 JUSTIFICATION, SELECTION, AND PROCUREMENT PROCEDURES

3.1 Current Procedures.

Present justification, selection, and procurement procedures for ADP equipment within the Department of Defense are based on the provisions of Bureau of the Budget Circular No. A-54.

The Office of the Assistant Secretary of Defense (Comptroller) and each of the Military Departments has issued instructions which establish procedures intended to assure that the computer is used for beneficial applications and that the selection process provides the necessary capability at the lowest cost and promotes competition between vendors.

System specifications basically consist of detailed information concerning the application which the computer will perform. This description can be as large as several thousand pages and includes each input-output and file description, estimates of the number of instructions in each program or sub-routine, the frequency of use of each sub-routine or program, the number of characters in each record, and the number of records in each file. The file descriptions also include whether the character is alpha or numeric.

If the computer is used for a new application, the effort required to complete the selection documents can be as large as the effort required to actually prepare the programs. The cost of this work is approximately the same as the actual cost of the equipment.

In addition to the descriptions of the inputs, outputs, and files, flow diagrams are required for each program or sub-routine. These

descriptions are also used to determine whether a computer application should be approved and therefore becomes a first step in any selection of computers by the Department. Needless to say this system has not worked effectively and its use causes delays of two to three years in the procurement of the computer. In the past, the Department has even attempted to use this same procedure to obtain equipment to be used for research and development centers.

These descriptions are sent to the computer manufacturers and they then propose to provide equipment which will perform the work described and the Department often buys the lowest priced proposed system.

The major difficulty involved in the justification and selection process is the time required to complete the process and the difficulty of predicting the workload with sufficient accuracy to select the ADP system which adequately meets the requirements over the life span of the equipment. The vast majority of estimates are lower than the actual workload, and this causes the system to be too small to perform all the required functions.

In many cases the selection is made by personnel who have no first-hand knowledge of the workload but depend entirely on the description of the applications.

This process has caused the Department of Defense some difficulties in the past and in several cases the computer equipment selected by this process has been too small to carry the workload for even the first year.

There is general agreement among Department of Defense personnel that the procedures are too complex and time consuming. Information obtained from vendors by an 'in-house' study group also indicates that vendors feel the system is too expensive and time consuming, and that the procedures limit competition between vendors.

In an attempt to reduce the problems inherent in these system specifications, the Department of Defense at other times has used other means of computer selection. The primary alternative has been the use of the benchmark. A benchmark is a typical computer workload either selected from the present computer workload or is generated from a knowledge of the type of work the new computer will perform. These benchmarks require less time and effort to prepare than the system specifications, but they also require substantial investments by potential vendors for programming, debugging, and machine time for running these benchmarks. In general, some difficulties result from the failure of most benchmarks to truly represent the actual computer workload. The same problems of estimating the workload during the system life exist for this method as exist for the system specifications. In general, forecasting the future is difficult and most likely incorrect, and computer workload forecasts are no exception.

In a recent procurement (Air Force Logistics Command ESQ Project 43-67) the Air Force based a major procurement on in-house system design and benchmarks for selection of the computer system. In this

procurement, a determination was made as to the system configuration and capacity required before the procurement was released for bids.

The elapsed time between the preparation of the first documentation describing a computer requirement and the installation of the equipment varies between a minimum of two years and a maximum of at least six years. This time is used in the preparation of the justification documents, the system specifications, soliciting bids from vendors, evaluating proposals from vendors, and obtaining equipment. Often it is necessary to repeat one or more of these steps. During each visit of the computer task group to DoD personnel, comments were received concerning the delays in obtaining computer hardware.

The computer workload is a dynamic and changing requirement, and often by the time the computer has been installed, the workload is significantly different than the one anticipated at the time the computer procurement began. The time required to change the documentation is almost as long as the initial preparation. Therefore, often the requirement is not updated during the procurement cycle and the system effectiveness may not be as high as it could have been. If the DoD is to have effective and efficient computer support of its missions, the time delays in obtaining computer support must be greatly reduced.

3.2 Effects of Current Procedures on the Department

The current procedures result in major inefficiencies within the Department,caused primarily by the long delay in obtaining new or replacement equipment. This delay results in equipment being kept long beyond its useful life. The determination of useful life should be

based on the cost of performing work with the equipment, not on the age of the equipment. The IBM 7090/94 and IBM 7080 computers were designed more than 10 years ago, yet these computers are cost effective today if they are owned.

The other major effect of the present procedures is the installation of several small and medium scale computers in the same geographical area. There are several locations which have over 50 computers. These multiple computers can result in costs which are as much as 5 times larger than would be necessary if a few large computers were used in a shared operating mode.

Additional views on the Government's selection and procurement of computer systems are summarized in the Annex. The text of this short report delineates many of the ADP problems which currently face the Department of Defense and for which answers are urgently required.

4.0 COMPUTER SYSTEM CHARACTERISTICS

Computer equipment has varied characteristics depending on the manufacturer and the intended use and market for the equipment. In general, computer systems are designed for families of applications and the major division is between Scientific Computing and Business Data Processing. Developments in ADP equipment have gone in all directions and ADP equipment is available in all sizes, prices, and capabilities. The "Auerbach Standard ADP Reports" is a commonly used handbook of computer system characteristics and consists of ten volumes, each being three inches thick. Evaluation of ADP equipment capability and selection of equipment which best meets a particular set of requirements is a difficult task requiring large amounts of technical data and experience.

4.1 Current Computer Characteristics

Some of the characteristics of computer equipment have been summarized (Figure 11) in an effort to display the total costs of performing one of three generalized computer applications. These applications include sorting 10,000 records, posting 10,000 transactions to a master file on tape, and posting 10,000 transactions to a master file on disc.

The job cost of performing these standard applications is determined by the following procedure:

1. The monthly lease cost is divided by 40,000 (the approximate number of minutes in a month) giving the cost per minute of the computer and maintenance.
2. The time to perform the application is multiplied by the cost per minute determined in step 1.
3. The cost for personnel, supplies, space, power, air conditioning, and physical security is based on the size of the computer system as follows:

a.	Less than $10,000 per month	20¢ per minute
b.	$10,001 to $20,000 per month	25¢ per minute
c.	$20,001 to $30,000 per month	30¢ per minute
d.	$30,001 to $50,000 per month	35¢ per minute
e.	$50,001 to $99,000 per month	40¢ per minute

As can be seen from Figure 11, the cost of performing any of these jobs decreases with the cost of the equipment and with the year of

Figure 11 - Typical Job Costs on Different Computer Systems

Computer and Configuration		Monthly Rent	Cost per Minute	Time for Job	Job Type	Computer Cost	Labor & Other Cost	Total Job Cost
Burroughs 200								
	I	$ 4,525	11.3¢	67	1	$ 7.55	$13.40	$20.95
	II	5,895	14.7¢	26	1	3.82	5.20	9.02
	III	8,840	22.1¢	26	1	5.74	5.20	10.94
	II	5,895	14.7¢	22	3	3.23	4.40	7.63
	III	8,840	22.1¢	9.5	3	2.10	1.90	4.00
Burroughs 2500								
	II	4,950	12.4¢	18	1	2.23	3.60	5.83
	II	4,950	12.4¢	7.5	3	0.93	1.50	2.43
	III	6,455	16.1	18	1	2.89	3.60	6.49
	III	6,455	16.1	5	3	0.81	1.00	1.81
	IVR	9,210	23.0	21	2	4.83	4.20	9.03
Burroughs 3500								
	IVR	11,064	27.6	21	2	5.80	5.25	11.05
	VIIA	15,918	39.7	18	1	7.14	4.50	11.64
	VIIA	15,918	39.7	2.5	3	0.99	0.63	1.62
Burroughs 5500								
	III	23,340	58.3	19	1	11.08	5.70	16.78
	V	25,250	62.6	19	1	11.89	6.65	17.54
	VIIA	30,995	77.4	17	1	13.58	5.10	18.68
	VIIA	30,995	77.4	2.9	3	2.24	1.01	3.25
	VIIB	28,705	71.7	1.8	1	1.29	.63	1.92
	VIIB	28,705	71.7	2.9	3	2.08	1.01	3.09
Control Data Corp.								
3100	VI	14,610	36.5	20	1	7.30	5.00	12.30
		14,610	36.5	6.1	3	2.23	1.53	3.76
	VIIA	20,375	50.9	20	1	10.18	6.00	16.18
		20,375	50.9	2.7	3	1.37	.81	2.18
3300	VI	16,240	40.5	20	1	8.10	6.00	14.10
	VI	16,240	40.5	6.1	3	2.55	1.83	4.38
	VIIA	22,025	55.0	20	1	11.00	6.00	17.00
		22,025	55.0	2.7	3	1.49	.81	2.30
3400	VI	16,640	41.5	16	1	6.64	4.80	11.44
				3.7	3	1.54	1.11	2.65
	VIIB	23,511	58.8	2.6	1	1.53	.78	2.31
	VIIIB	39,045	97.6	1.0	1	.98	.35	1.33
	VIIIB	39,045	97.6	1.8	3	1.76	.63	2.39

Figure 11 (Cont'd)- Typical Job Costs on Different Computer Systems

Computer and Configuration		Monthly Rent	Cost per Minute	Time for Job	Job Type	Computer Cost	Labor & Other Cost	Total Job Cost
Control Data Corp.								
3600	VIB	$40,110	$1.00	1.2	1	$ 1.20	$ .42	$ 1.62
				1.4	3	1.40	.49	1.89
	VIIIB	57,045	1.43	1.0	1	1.43	.40	1.83
6400	VIIIA	54,540	1.36	1.0	1	1.36	.40	1.76
				1.3	3	1.77	.52	2.29
IBM 360 20								
	I	2,776	6.9¢	67	1	4.62	13.40	18.02
	II	3,558	8.9	21	1	1.87	4.20	6.07
				61	3	5.43	12.20	17.63
	IIIR	3,630	9.1	32	2	2.91	6.40	9.31
				10	3	.91	2.00	2.91
IBM 360 30								
	II	4,714	11.8	20	1	2.36	4.00	6.36
				40	3	4.72	8.00	12.72
	III	6,956	17.4	20	1	3.48	4.00	7.48
				9.7	3	1.69	1.94	3.63
	IIIR	6,111	15.3	25	2	3.83	5.00	8.83
				9.2	3	1.41	1.84	3.25
IBM 360 40								
	III	8,208	20.5	20	1	4.10	4.00	8.10
				9.7	3	1.99	1.94	3.93
	IIIR	7,343	18.4	25	2	4.60	5.00	9.60
				4	3	.74	.80	1.54
IBM 360 50								
	VIIB	19,720	49.4	2.0	1	.99	.60	1.59
				2.3	3	1.14	.69	1.83
IBM 360 65								
	VIIIB	51,944	$1.30	1.1	1	1.43	.44	1.87
				1.8	3	2.34	.72	3.06
IBM 1401								
	II	5,920	14.8¢	40	1	5.92	8.00	13.92
				15	3	2.22	3.00	5.22
IBM 1410								
	IV	19,060	47.7	20	1	9.54	6.00	15.54
				6.0	3	2.86	1.80	4.66

Figure 11 (Cont'd) - Typical Job Costs on Different Computer Systems

Computer and Configuration	Monthly Rent	Cost per Minute	Time for Job	Job Type	Computer Cost	Labor & Other Cost	Total Job Cost
IBM 7010							
VIIB	$28,355	71.0¢	3.2	1	$2.27	$1.12	$3.39
			4.8	3	3.41	1.68	5.09
IBM 7040							
VIIIB	47,145	$1.18	5.5	1	6.49	1.93	8.41
			2.2	3	2.60	.77	3.37
IBM 7044							
VIIIB	56,645	1.42	1.9	1	2.70	.76	3.46
			1.9	3	2.70	.76	3.46
IBM 7080							
VIIB	51,745	1.29	2.0	1	2.58	.80	3.38
			2.6	3	3.35	1.04	4.39
RCA 301							
II	5,084	12.7¢	49	1	6.22	9.80	16.02
			60	3	7.62	12.00	19.62
III	9,687	24.2	32	1	7.74	6.40	14.14
			15	3	3.63	3.00	6.63
RCA 3301							
III	11,390	28.5	18	1	5.13	4.50	9.63
			4.0	3	1.14	1.00	2.14
VIIB	21,604	54.0	1.3	1	.70	.39	1.09
			1.9	3	1.03	.57	1.60
Univac 494							
VIIA	39,405	98.5	1.9	1	1.87	.67	2.54
			2.1	3	2.07	.74	2.81
Univac 1108							
VIIA	50,365	$1.26	1.5	1	1.89	.60	2.49
			1.9	3	2.39	.76	3.15
Univac 418							
VIIA	17,875	44.7¢	3.7	1	1.65	1.11	2.76
			2.8	3	1.25	.84	2.09

introduction, and sometimes this reduction is by factors approaching ten. As can be seen in Figure 11, step one can be performed at a total cost of less than $2.00 by any of eight computer systems. The cost of personnel alone to do the same job on 24 of the configurations exceeds $2.00. This comparison indicates that the use of a small or obsolete computer, even if it is owned and no cost of ownership is assumed, may be higher than the rental of new equipment to perform the same job. The Department of Defense has older and even less efficient computers than those shown in Figure 11.

With few exceptions, the greatest gain by a computer manufacturer can be obtained by keeping its customers dependent on its equipment to fill the customer's computer requirements. Early in the development of the computer it became apparent that the market for computers would grow at an explosive rate for many years and that if old customers could be kept from switching to new equipment from different suppliers while new customers were added, the manufacturers would be able to continue their growth. This dependence has been achieved by maintaining substantial differences between the equipment and software supplied by each manufacturer. Therefore, it is very difficult to change to new manufacturer's equipment. Sufficient differences exist between even COBOL and FORTRAN as implemented by different manufacturers to make it undesirable to change to another supplier of computer equipment.

The cost of software development is so great that most computer users cannot afford to become independent from the software supplied by the manufacturers. The Department of Defense is one of the few computer users who has sufficient resources to become independent of software

supplied by the manufacturer, but to date it has not made any real effort to achieve this independence.

4.2 ADP System Characteristics 1970 to 1980

During the past decade the use of computers has expanded at an explosive rate, the philosophy of their use has changed greatly, and the cost of performing a task using computers has been reduced by a factor of approximately ten. During this time the computer has become a part of almost every facet of the business and industrial life of the nation and its effectiveness in these functions universally accepted. The computer technology during this decade has developed to include time sharing, remote job entry, storage allocation and data protection, and high speed digital data transmission.

During the next decade, it is expected that computer systems will continue to change at the rapid rate which characterized the preceding two decades. Continuing development will reduce the cost of electronics by a factor approaching ten. Advances will be made in the availability of vast amounts of "on-line" data storage. Files containing hundreds of billions of characters will be "on-line" by 1980. It is anticipated that the largest computer systems by 1980 will have as much as one hundred times the capacity of the largest systems today. The medium scale computer which has been the backbone of the Department's computer system will disappear during the next decade.

Such developments will reduce the cost of computer hardware by a large factor during the next decade. The present computer system has

about equal investments in hardware and software. The software cost for an ADP system could be 5 times the hardware cost by 1980. If some of the current predictions of the reduction in hardware costs are true, then it is possible that the Department could spend millions of dollars programming a computer which would cost less than $100.

The development of time sharing and remote job entry will continue as the availability of communications increases. It is estimated that most processing will be accomplished in this mode by 1980.

5.0 EXPECTED ENVIRONMENT 1970 to 1980

It is likely efficiency, effectiveness, and economy will continue to be major DoD guidelines during the next decade, and that the Department of Defense will be required to apply these guidelines to ADP systems during this period. The allowable response time of the Department will be reduced in many cases thereby increasing the computer requirements. Manpower ceilings will require more ADP and more effective use of ADP personnel and ADP equipment.

During this decade, the Department of Defense will be required to develop extensive computer systems to replace the current obsolete systems. Two such systems are currently under development: the Worldwide Military Command and Control System, and the Air Force Logistics Command System. These systems will require several large scale computers and represent major advances in the use of computers by the Department of Defense.

If the present economic restraints continue, each ADP procurement must be subject to careful analysis. Therefore, the Department of Defense must provide the necessary justification for each of its major procurements and be prepared to answer questions. The recent Air Force Phase II reversal portends of the future for the Department. Selections which involve hundreds of millions of dollars between a few large suppliers are always questioned.

The recent move by manufacturers to separate hardware and software support, often referred to as "unbundling", will have major effects on ADP acquisitions by the Department of Defense. Conversations with ADP suppliers indicate that further "unbundling" will occur, and by 1980 each part of an ADP system will be obtained separately. Main frames, memories, tapes, discs, printers, card equipment, terminals, maintenance, software, etc., will be purchased separately. Large users will require substantial systems staffs to convert these individual items into an integrated operating ADP system.

A major change in the computer environment during 1970 to 1980 will result from telecommunications between computers and computer users. A recent report* indicates that by 1980 most computers will be on-line with teleprocessing capability. At the present time almost none of the Department's computers are on-line with teleprocessing capability, and the majority of the Department's computers cannot be used in this mode.

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* "Teleprocessing", prepared by the Office of Telecommunications Management, Executive Office of the President, December 1969.

6.0 CONCLUSIONS

The concepts which guided the Department of Defense during the last decade from a position of leadership during the late fifties to its present position of obsolescence cannot be continued another decade. Most of the present ADP system must be completely rebuilt during a period of austerity. This rebuilding must occur under dynamic leadership and cannot be accomplished by revising directives and policy statements. Hundreds of the decisions which must be made must be based on hard technical facts and mature judgment and cannot be made by the application of a set of rules.

The Department of Defense must develop the capability to design its own ADP systems, develop its own software, and fabricate its ADP systems using the system elements it finds in the marketplace. It must provide a career ladder and salaries which will attract top level ADP personnel into Government jobs. This is not an impossible task, but it cannot be achieved without some major changes within the Department. In summary, the most critical problems which the Department of Defense faces are:

1. The justification and selection procedures are too long and expensive and they often do not result in the most economical solution to ADP requirements. Millions of dollars and several years are necessary to obtain a medium scale computer system. By the time a computer system is installed it is often inadequate to perform the necessary data processing.
2. Most of the Department's computer equipment is either obsolete,

falls into the small or medium scale classification, or is not fully used. These computers perform much less work per unit of cost and therefore result in at least $500 millions of added cost.

3. The Department of Defense derives less than effective utilization of ADP management personnel because such personnel are fragmented throughout the Military Departments and other DoD components, performing essentially the same tasks in their respective organizations.

4. The Department is currently incapable of performing its necessary role of system design under the environment which will result from "unbundling".

5. The Department is not equipped to take advantage of the economies of large scale computers by sharing their use between activities belonging to different DoD components.

6. The Department derives much less benefit from its computer dollar than industrial users of ADP equipment. The Department has no integrated management information system and its computer files are independent and not capable of being interconnected. The Department often develops similar and parallel systems for the same functions in each of the Military Departments. This duplication costs the Department millions of dollars annually.

7. No office currently has the responsibility to determine the most cost-effective method of providing ADP support to the Department of Defense or has the authority to implement such a system once having determined it.

7.0 RECOMMENDATIONS

The ADP study group believes that the following recommendations are necessary to provide the Department of Defense with the capability to meet its present and future ADP requirements effectively and efficiently. Although these changes represent drastic steps, it is the firm conviction of the ADP study group that less drastic changes will not provide the desired results.

The recommendations are:

1. Establish at the Assistant Secretary of Defense level an office of Computer Systems and Services.
2. Make this office responsible for providing all ADP support to the Military Departments and other DoD components by the use of a network of computers and telecommunciations, and locally installed equipment.
3. Assign to this office all the general purpose ADP equipment currently installed within the Military Departments and other DoD components.
4. Assign to this office the responsibility for coordinating applications effort, supplying technical support to DoD components, and establishing appropriate policies and common data formats to this end.
5. Assign to this office the responsibility of DoD's interface with the Bureau of the Budget (now the Office of Management and Budget), the General Services Administration, the General Accounting Office, and the National Bureau of Standards concerning ADP.
6. Establish an ADP Industrial Fund for the purpose of purchasing and leasing ADP equipment, system software, related telecommunications, and ADP equipment maintenance.

7.1 DISCUSSION OF RECOMMENDATIONS

Early in the data-gathering phase of the study, it became apparent that most of the problem areas of ADP employment were associated directly or indirectly with organizational complexity. This was not an entirely unexpected result. Certainly the DoD is one of the more complex organizations with more than its share of real and artificial barriers to simple solutions to problems. The background information in the preceding sections brings out some salient points in this regard as they apply to ADP.

The recommendations set forth here, therefore, are primarily concerned with an organizational realignment of ADP effort, supported by a change in financial structuring and some streamlinig of justification and acquisition procedures.

7.1.1 The establishment of the office of Computer Systems and Service at the Assistant Secretary of Defense level is necessary before significant progress can be made. This step will provide the office with sufficient stature and authority to get the rebuilding job done internally, and will give short effective communication lines with other government elements (BOB, GSA, NBS, etc.). Currently, the ADP responsibility is divided among the Office of the Assistant Secretary of Defense (Comptroller), the Military Departments, and the other DoD components. This division of responsibility causes many of the present problems.

Though previous studies have not recommended centralization at this level, there are precedents for establishing such a DoD system. Currently the Defense Supply Agency, the Defense Intelligence Agency, the Defense Atomic Support Agency and the Defense Communications Agency provide DoD-

wide services.

Although the Department spends only about $2 billion for ADP support, the computer is a part of almost all the management functions within the Department. Additional billions are spent in providing data for computer processing and in evaluating the results of this data. Decisions involving operations of this magnitude cannot be assigned to one of the Military Departments but must be assigned to the Office of the Secretary of Defense (OSD).

7.1.2

There is much evidence of poorly applied, fragmented, underutilized, and obsolete computer equipment in DoD. Installations of several of the Military Departments tend to be clustered together in geographic areas, but have very little effective consolidation of ADP facilities or of application programs.

Modern software and hardware configurations with powerful equipment and operating systems, and using versatile communications links, have proven their ability to satisfy the needs of quite varied mixes of application requirements. They are able to do this at significant savings and with more capability than in fragmented situations.

As long as each component or even sub-component goes its own way in ADP, not much can be done to correct the inefficiencies of fragmented load. By designating one organization to supply ADP support, one factor presently inhibiting the use of progressive ADP techniques will be considerably improved. Also, the use of common facilities, or at least a common selection function, will provide the best environment for progress toward the much more subtle and difficult objective of reducing duplicate application effort. Experience has shown that inroads here are won slowly

and with hard work. Too many people must learn new ways and too many technical problems must be solved along the way to permit giant steps. However, even small steps will be slow in coming if the basic hardware and the sources of primary technical support remain fragmented.

The operation of this ADP support system is best understood if it is compared to the operation of a public utility such as electric power. The larger and newer electric power generating plants tend to be more efficient. This efficiency has resulted in concentration of all generating capacity into a minimum number of installations. Since excess plant capacity is expensive to maintain, the different electric power systems are interconnected to allow exchange of power to meet local peak loads. ADP support requirements of the different installations within the Department of Defense could be met much in the same manner as are electric power requirements at these same installations. Commercial computer utilities are already coming into being. Also, a government computer utility is being initiated by the General Services Administration. These changes foretell of the disappearance of the medium scale computer and will necessitate the use of very large computer systems by 1980.

7.1.3

As a practical means of establishing the single source of supply for ADP and of initiating an orderly replacement of facilities, it is necessary to assign all the present equipment to the ADP support office. As the new ADP system is implemented, it will be desirable to convert some of the present equipment into terminal equipment and to integrate it into the overall system. These goals are best obtained if the equip-

ment is assigned to the new organization. After the equipment ownership has been reassigned, it will continue to be used in the present mode until more efficient support can be provided to its present owner.

It is also very desirable to establish the structure for collecting meaningful costs as early as possible to guide the development of the service organization. The capital and lease costs and the operating costs of the equipment are major components of the total.

7.1.4

If the Department of Defense is ever to take advantage of the capability of ADP equipment and systems, it must be able to use ADP to integrate information from all its components into summary reports which can support its decision-makers. These reports require common data elements, common data codes, common management information specifications, etc. If the Department is to have the capability to use ADP capacity to perform these management tasks then it needs a major standardization effort. Standardization will also reduce the present duplication of effort in the preparation of ADP software. Often there are three or more different programs which perform almost the same function in each of the Military Departments.

An important communications function between the users of the centralized service and the service itself must be included. There will be a concentration of the technology of the system in the central organization which must be transmitted to the users through training and applications consulting. In the other direction, the information required for load projection and desired system capabilities must flow from the user to the design and operations components.

7.1.5

The DoD interface with the Bureau of the Budget (now the Office of Management and Budget (OMB)), the General Services Administration, the National Bureau of Standards, and the General Accounting Office is currently maintained at OSD level, in each of the Military Departments, and in other DoD components. These duplicate interfaces require more time not only on the part of personnel of the Department of Defense, but also on the part of personnel of these outside agencies. The Department of Defense cannot afford to waste its scarce ADP talent with such duplication.

7.1.6

The industrial fund appears to be an appropriate mechanism to shorten reaction time on ADP procurement and to provide a very good fiscal management tool. The first problem which became apparent was the long delay between conception and implementation of a project. Most of the unnecessary time losses appeared to be associated with the hardware justification and acquisition rather than with the application request approval, though the total cycle delay often abrogated the early work done on the specifications. By using the industrial fund, the director could purchase or lease equipment or services without the necessity of waiting for the budget cycle.

The cost of ADP service could be collected from the users so that the cost of invested capital, depreciation allowances, system designs, and evaluations could be recovered during the life of the system. A direct comparison of operating cost could be made with other alternatives, principally commercial service, on a logically similar basis. If another

alternative showed lower cost, then that alternative could be used, or management action could be taken to bring internal costs in line.

The concept of charging users for services rendered allows a straight-forward means for control of expenditures at the application level. The initial justification can be done without reference to the hardware, taking one large segment of time out of the conception-to-implementation cycle; and then normal budgeting procedures will maintain firm management control over the life cycle of the application.

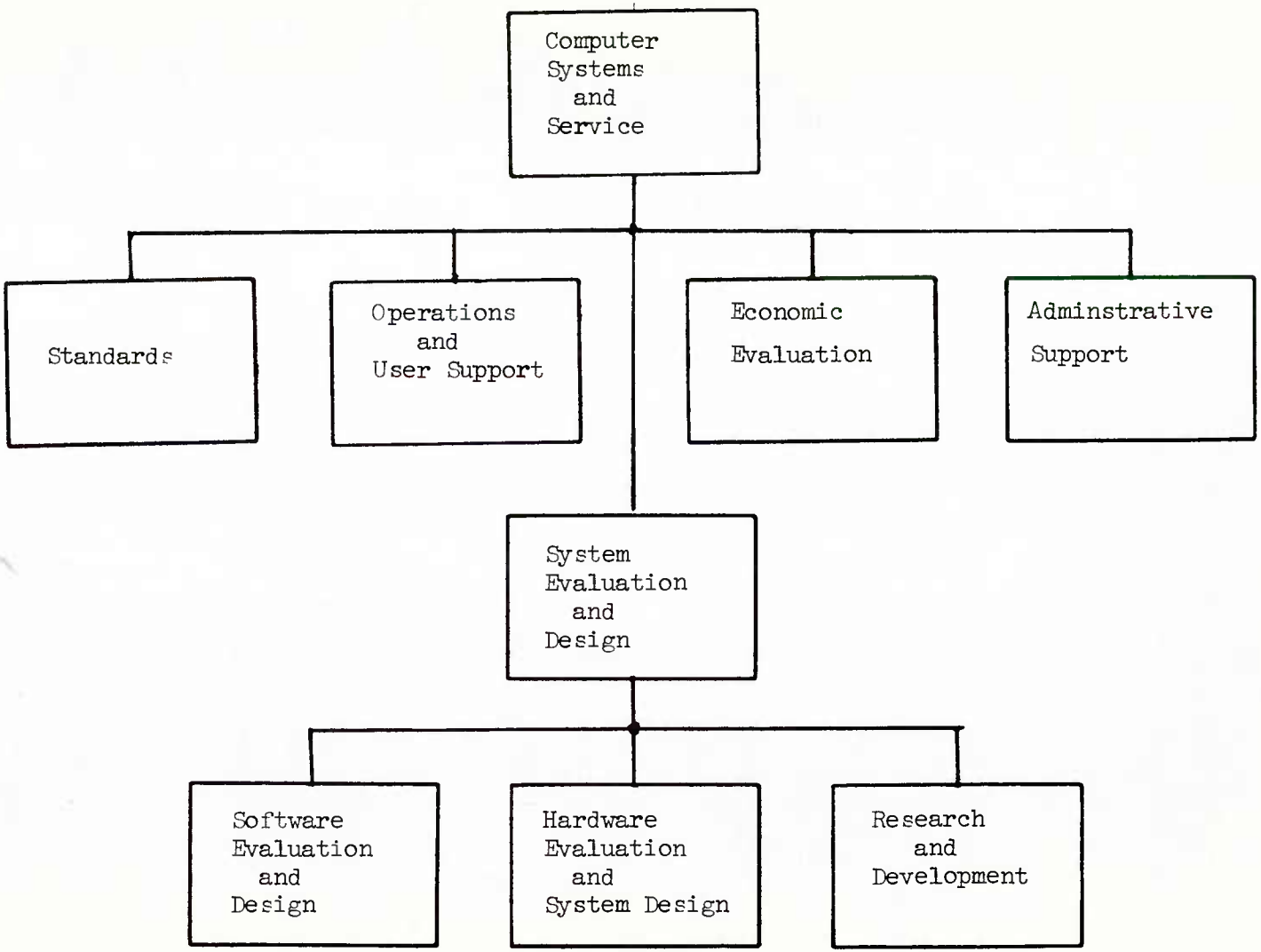
It should be recognized that while the operation within the fund should break even over the long run, it should be permitted to show a variance in any single year. Artificial fluctuations of rates produced by large acquisitions should be avoided. Some degree of stability in this respect is necessary if the cost of applications is to be properly assessed.

The industrial fund concept has been used for other types of services, such as those provided by the Military Airlift Command (MAC) and by the Defense Communications Agency. Analysis of the use of this fund by MAC indicates that the allocation of airlift services is achieved by means of charges to the users. The use of an industrial fund for ADP, and user chargers, would similarly serve to allocate computer resources. It is anticipated that charges for the use of ADP resources would be established so as to provide a priority system which allows urgent work to be completed when needed and provide "off-hours" loading for non-urgent work.

7.2 Organizational Functions and Responsibilities

The proposed organizational structure, with major elements identified, is shown in Figure 12. Brief statements of responsibility in the following

Figure 12 - Recommended Organization



paragraphs establish the scope if not a detailed description of the intended functions.

7.2.1 Computer Systems and Services

The proposed organization would be responsible to the Secretary of Defense for supporting the entire Department of Defense in all aspects of ADP. It would manage the Computer Service Network and its associated industrial fund, coordinate with other government agencies, and furnish coordination and support in applications efforts. The following paragraphs describe its subordinate functions.

7.2.2 Standards

- Establishes and monitors DoD standards for
  - Hardware interfaces
  - System software
  - Data elements and codes
  - Common data formats
  - Data storage formats
- Provides DoD interface on ADP standards with the National Bureau of Standards and other governmental agencies.

7.2.3. Operations and User Support

- Manages the Computer Service Network
- Provides focal point for ADP coordination among the Military Departments and other DoD components.
- Provides focal point for communication between Computer Systems and Services and DoD Components

- Provides technical assistance to users
  - In program preparation
  - With information on available programs
  - On cost and facilities of the Computer Service Network
  - In preparing application justification
  - In training

7.2.4 Economic Evaluation

- Assists Computer Systems and Services office in making decisions involving resources
- Makes economic analyses to evaluate
  - Cost of computer support to users
  - Lease-purchase trade-offs
  - Suppliers bids
  - Proposed system changes
  - Operational guidelines
- Maintains close interface with Bureau of the Budget (now OMB), General Services Administration, and General Accounting Office

7.2.5 Administrative Support

- Provides administrative functions of Computer Systems and Service office for
  - Personnel
  - Billing
  - Purchasing
  - Accounting
  - Others as needed

7.2.6 Systems Evaluation and Design

- Serves as designer and systems integrator for Computer Service Network
- Supplies technical assistance to support efforts of Operations and User Support
- Establishes techniques and maintains tools for system evaluation
- Executes additional functions as described for its subordinate elements

7.2.6.1 Hardware Evaluation and Systems Design

- Designs computer and communication configuration
- Evaluates supplier hardware configuration proposals
- Establishes techniques and evaluates available vendor hardware
- Determines compatibility of components for mixed system design
- Evaluates present computer inventory for capability and/or obsolescence

7.2.6.2 Software Evaluation and Systems Design

- Evaluates vendor supplied software
- Specifies new software products for development
- Assists in specification and development of system software for Computer Service Network
- Assists in development of "liberation" software to allow retirement of obsolete equipment
- Establishes techniques and maintains tools for evaluating total systems throughout

7.2.6.3 Research and Development

- Develops new hardware and software required for efficient Computer Service Network
- Provides technical direction of commercial contractors for new development
- Takes over present DDR&E development contracts associated with general purpose ADP equipment and software

7.3 Operation of the Computer Service Network

The Computer Service Network will consist of a number of major computer centers. These centers will be connected by telecommunications links with users in the same geographical area. It is anticipated that these major computer centers will be co-located with major workload concentrations. These centers will be designed by the System Evaluation and Design group and will contain the most cost-effective equipment for the expected workload. The operating personnel will most likely belong to the DoD unit where the equipment is installed. The Computer Systems and Service office will contract for these operating personnel and will reimburse the DoD unit for their cost.

Users of the Computer Service Network will retain the capability to write their own applications programs which will use the network computers. The Operations and User Support group will provide assistance and training to assist these users. The Operations and User Support Group will maintain a library of programs and will assist users in adapting them for their use. If input, output, files, or reports standards exist the applicable standards will be supplied to the user.

System Software, including compilers, utility programs, operating system, translators, 'liberator' programs, and accounting programs for service charges to users, will be supplied by the Operations and User Support Group.

It is anticipated that the Computer Service Network centers will be operated on an around-the-clock seven-day-week schedule and that the charges for different priorities will even the workload over the week.

Justification for the application of ADP to the operations of the Military Departments and other DoD components will be based on three levels.

The first level is operational necessity. These applications are so critical that the mission of the unit cannot be completed without the use of ADP support. These applications are always approved.

The second level is the result of a general evaluation of the application and a determination that the use of ADP for a function is always justified on a cost-benefit basis. These general justifications will be published. The Military Departments and other DoD components having one or more of these applications would have automatic approval to use ADP support for these applications.

The third level is the justification of the application for the particular user. This justification will be performed jointly by the user organization and the Operations and User Support Group. In determining the cost of ADP support, the rates for the Computer Service Network will be used in conjunction with estimates of the amount of computer time that will be required.

Although it is anticipated that the requirement will be rare, it is possible that a user might require a computer installed in his facility to be used only by him. The user, under such an arrangement, would request the installation of suitable computer equipment to meet his workload requirements. The total cost of the installation, plus overhead assessment, would be billed to this user each month, and the monthly bill would contain two charges: first, the cost of performing the workload using the Computer Service Network, and second, a surcharge which covers the additional cost of the dedicated computer system. In so far as possible these installations will use the same software as the Network and use the same standards for data elements, codes, formats, and storage. The user of such "dedicated" equipment would also be charged for any special software developments, maintenance costs, or other items.

7.4 Implementation of the Computer Service Network

The implementation of the Computer Service Network would be on a progressive basis beginning with an evaluation of the status of computer support in each geographical area. Those areas having the most critical requirements for additional computer capacity would be the location of the first computer centers. Each of the regional computer centers would be interconnected using telecommunications for data transmission so that workloads can be balanced, and backup computer support can be made available. Equipment which is released as the result of the availability of Computer Service Network support would be used wherever its capability can be effectively integrated into the system. This progressive

implementation by geographical areas would allow the overall system to be implemented without causing major disruptions. Also as a result of solving the most urgent problems first, the benefits of the proposed Computer Service Network would be more immediate.

The initial staffing of the Computer Systems and Service office could come from the current ADP policy and support staffs of the Department of Defense.

It is anticipated that the implementation of the Computer Service Network might require three to five years.

7.5 Benefits

It is expected that a number of benefits would accrue to the Department of Defense as a result of the recommended changes:

1. The Department of Defense would obtain better ADP support for less cost primarily because of the economies of the larger computers. These larger computers can perform some jobs for 1/10 of the present cost of work performed on some of the Department's present equipment.
2. The responsibility for ADP decisions would be placed in an organization having the technical capability to make these decisions.
3. The Department would be able to hire better qualified personnel for ADP systems activities because it would have a better career ladder and could afford higher salaries.
4. The response time for implementing new ADP applications would be greatly reduced since only a teleprocessing link is required to place the entire capability of the Department's Computer Service Network at the disposal of any user.

5. The Department would have fewer types of computer systems and therefore much of the present duplication of work involved in the preparation of programs for many different computers would be eliminated.

6. The use of an ADP Industrial Fund would provide visibility as to the total cost of ADP support to the Department of Defense, therefore, allowing decision-makers to make decisions regarding the desired level of ADP support based on hard facts.

7. By removing the procurement of ADP equipment from the current budget and placing it in the fund it would be possible to obtain needed equipment without the necessity of large appropriations.

8. A continuous review of the cost of ADP support would allow decisions to be made which will reduce the cost of ADP support to the Department.

REPORT OF THE

CONFERENCE ON THE SELECTION AND PROCUREMENT
OF COMPUTER SYSTEMS BY THE FEDERAL GOVERNMENT

Federal Executive Institute
Charlottesville, Virginia

September 15, 16, 17, 1969

PURPOSE OF THE CONFERENCE

The purpose of the Conference was to examine the impact of recent developments upon the Government's existing policies and practices concerning the selection, procurement and management of computer systems. These developments include

-- the Comptroller General's report of June 24, 1969, which states that significant savings could be achieved if selected components were procured from independent suppliers of such components instead of from the system manufacturer

-- the Comptroller General's earlier report of April 3, 1968, which states that substantial economies might be achieved if maintenance of computers were performed on an in-house basis instead of by contract

-- recent actions by some system manufacturers to separate the prices of equipment, software and related services, providing the customer with potentially beneficial options in the selection and procurement of systems.

INTRODUCTION

This Report summarizes the consensus of the Conference participants. Their views resulted from discussions which followed a series of presentations that examined the impact of the recent developments from several different perspectives. Because of the short Conference period, the Report does not necessarily represent an exhaustive examination of the topics discussed, but it does provide views and suggestions that will be considered by the responsible Federal agencies as they develop their respective programs.

CONFERENCE VIEWS

1. It appears that separate pricing of the various elements of a computer system (i.e., hardware, software, maintenance and training) may ultimately work to the net benefit of the Federal Government. Government actions should, therefore, be directed toward capitalizing on the benefits obtainable from this trend.

-- Separate pricing enables the customer to select and pay for only those items within a system package that he needs, thus potentially reducing the cost to those customers who do not require the full range of system support formerly included in the single price. Separate pricing can also stimulate competition by enabling independent vendors to bid on selected elements of the system which heretofore were usually supplied in toto by the system manufacturer. Such increased competition should lead to lower costs and improved performance.

-- On the other hand, the benefits anticipated by separate pricing, particularly as they relate to multi-vendor procurements, are offset by a number of complex managerial and technical problems that are created and must be brought under control before the benefits can be fully realized. These problems include:

a. the development of appropriate interface standards (hardware and software) to achieve the necessary compatibility across products of a broader range of vendors;

b. the development and testing of new selection and procurement techniques that (1) guarantee total system performance in accordance with the user's needs, (2) provide fair and equal opportunity for multi-vendor competition, and (3) can be carried out within an acceptable time frame and reasonable cost;

c. the development of arrangements and diagnostic techniques for pinpointing individual vendor responsibilities in the event of a system breakdown, and securing prompt and effective vendor response to those responsibilities.

2. The Federal Government should retain the use of the prime contractor concept for the acquisition of new systems until the implications of deviating from this method are more clearly defined and evaluated.

-- The selection, procurement and managerial problems associated with the acquisition and operation of whole systems are considerably more complex than the mere replacement of leased peripheral components within existing systems. The problems center primarily on the capability to (a) assemble and integrate the various elements of a system (hardware, software, maintenance) into a workable whole at minimal cost under conditions where each element (or parts thereof) can potentially be supplied by a number of different vendors with different product capabilities, and thereafter (b) maintain operational effectiveness when total system performance is dependent upon the responsiveness of the several vendors whose products make up the system.

-- The prime contractor concept currently used by the Federal Government, coupled with the benchmark technique, is a tested, proven and effective method for evaluating total system performance against specific Government requirements. The method assures that all elements of the system (e.g., central processor, peripheral units, and software) interact properly and effectively in carrying out the stated work, and it clearly holds the prime contractor responsible for any system deficiencies. It was noted that the benchmark technique itself was developed to counteract the severe operational problems encountered several years ago when system manufacturers delivered hardware and software which did not work effectively when combined into a single system. Therefore, any new techniques developed to take advantage of

multi-vendor procurements should be thoroughly tested before they are substituted for existing methods.

-- The non-Government participants who presented systems, software and peripheral viewpoints agreed that a "systems integrator" type of skill is essential to assure that all elements of a computer system are properly integrated and responsive to the user's needs. It was noted that the systems integrator need not be the system manufacturer, as is now usually the case. It might be an independent software house, a "systems integration" firm, or it might be the Government itself. It was also noted that the function requires a high degree of managerial and technical competence, particularly when a variety of vendors products comprise the system. Within the Government, it appears that a review should be made of whether the requisite background and technical competence are available or can be provided to assume this kind of function satisfactorily.

-- It was noted that the differences in degree to which system manufacturers have separated prices (ranging from no separation to rather complete separation) will pose some difficulties in making comparative evaluations of their system proposals and related costs. For example, a Fortran compiler specifically required by a user may be separately priced in one proposal, but may in another proposal be combined without separate price identification.

3. Intensive work should begin now to develop appropriate interface standards, looking toward their full implementation in the next generation of equipment.

-- The need for interface standards becomes critical when considering the potentials of multi-vendor procurement. Industry-wide adoption of these standards will offer the user a wider range of competitive products from which to select the components of his system and will facilitate its subsequent management and operation.

-- The difficulties and impracticality of developing interface standards for implementation on currently available computer systems are recognized. Therefore, the development work should be geared toward implementation of the standards on systems of the next generation which are acquired and paid for from Federal funds. Because of the lead time required for the development of such interface standards and their implementation on the vendors' products, intensive work should begin now.

-- To achieve this standards objective, the Government should continue actively to support and participate in the work of the American National Standards Institute (ANSI, formerly United States of America Standards Institute, USASI) X3 Committee on Computers and Information Processing. To accelerate the work, however, the National Bureau of Standards should consider embarking on a well-publicized, fully staffed and fully funded effort to develop standard interface specifications that would satisfy the Federal Government's requirements and which could be introduced into the X3 deliberations for consideration as American National Standards. In the event ANSI procedures, which have been relatively slow in the past, fail to show promise of achieving interface standards for the next generation of systems, the Federal Government would be in a position to include these specifications in the procurement of all such systems.

4. Leased peripheral equipment components in systems now installed should be replaced by components available from independent peripheral manufacturers or other sources, if it is determined that such components are comparable, compatible, reliable, less expensive, and can be adequately maintained. Similar consideration should be given when adding to or modifying existing systems. These determinations should be made on a case-by-case basis in consideration of the particular circumstances that exist.

-- Experiences within and outside Government have demonstrated that selected replacements of leased components can produce significant economies in rental costs while retaining comparable (and sometimes better) system performance.

-- It was noted, however, that because IBM supplies an estimated 65-70 percent of the commercial market, the great bulk of peripheral components offered by independent manufacturers are made to be compatible on a plug-to-plug basis with IBM equipment. This fact severely limits the opportunities for effecting such replacements within the Government's inventory since only one-third or about 650 of the Government's leased systems are supplied by IBM. To extend these replacement opportunities to a larger segment of the Government's inventory, independent manufacturers should be encouraged to widen the range of their compatibility with other computer systems and support the development of interface standards.

-- It was noted, further, that the initial outright purchase of components in accordance with current purchase/lease policies forecloses any possibility of later replacing such components with comparable, but less expensive equipment.

5. A catalog should be developed which would document, for the benefit of all Federal agencies, information about the hardware devices, software packages and related items that are currently available.

-- In view of the growth of independent companies and the resulting variety of hardware and software products that are becoming available, the agencies would be helped tremendously by having access to a catalog which described (a) the products available, (b) the performance factors claimed by the supplier for his products, (c) a validation of actual performance, and (d) an evaluation of the performance related to specific applications. The development of this catalog should be undertaken immediately. The development of any one part should not be inhibited by difficulties encountered in the development of another part.

-- In connection with the catalog, the term "Qualified Products List" was discussed. GSA pointed out that a true "QPL" requires either a Federal specification or an interim Federal specification and that "QPL" means a list of products tested and approved under qualification tests set forth in the specifications. Procurement can then only be made from the QPL. Ramifications regarding use of QPL need to be considered before moving ahead in this area. It was noted that "QPL's" exist now with respect to automobile tires, magnetic tapes, and other items in accordance with current General Services Administration Federal Property Management Regulations.

-- The discussion pointed to a need for quantitative performance measurements as an aid to agencies in the selection of various elements of a computer system. For the near term, it would be useful to establish a Government-wide mechanism for the exchange of information among Federal agencies on the various benchmarking techniques being used in the selection process, and possibly the case results of actual benchmark tests. On a longer term basis, there is a need for a strong Government program to develop performance measurements. This program would involve extensive research which, in turn, would benefit from the information gathered under the short-term mechanism.

-- It was noted that some Federal Supply Schedules for independent suppliers of hardware devices identify other equipment with which the devices are compatible. This practice should be extended to all Schedules to assist agencies in making decisions on the selection and procurement of system components.

-- As an extension of the above technique, system suppliers offering system components under their trade names but which are actually manufactured and offered for sale by an independent peripheral manufacturer should identify in their Schedules the source of their supply.

6. There is a need to find ways for reducing both the time and cost involved in the selection and procurement process.

-- The time span from the issuance of an RFP to an actual award in 28 situations during FY 1969 was 11 months. The total cycle from the system study to actual productive computer operations may approach 4 years. The result is that the computer system being operated may not be attuned either to the latest technology or to the user's current needs. Studies are needed to find ways of accelerating and reducing the costs involved in the specification, selection, procurement, preparation and testing periods.

-- Consideration should be given to the development of standard benchmark tests in common application areas against which proposed system configurations would be measured. The results would be cataloged so that the tests need not be redeveloped or repeated for each subsequent selection involving essentially the same type of application. Tolerance ranges could be established to provide for slight deviations from the standard benchmark as dictated by specific user requirements.

7. Information regarding the marketing policies of system suppliers, and their probable impact, if any, upon the Government should be distributed to Federal agencies in a more formal way.

-- Marketing policies of the various suppliers are currently in a state of flux. In general, Federal agencies rely upon trade journals, newspapers, magazines, and company representatives for their information. To assure that complete and accurate information is available for all significant announcements, arrangements should be made to receive and distribute such information to Government agencies through a central point. Care must be exercised to distinguish that information which is applicable to Federal Supply Schedule contracts.