STUDY S-382

STUDY OF DoD AUTOMATED ENVIRONMENTAL SERVICES SUPPORT SYSTEMS

Appendix G: Costs of a Spectrum of Options for Data Processing of DoD Environmental Services Support Systems of 1975-80

Kenneth P. Heinze

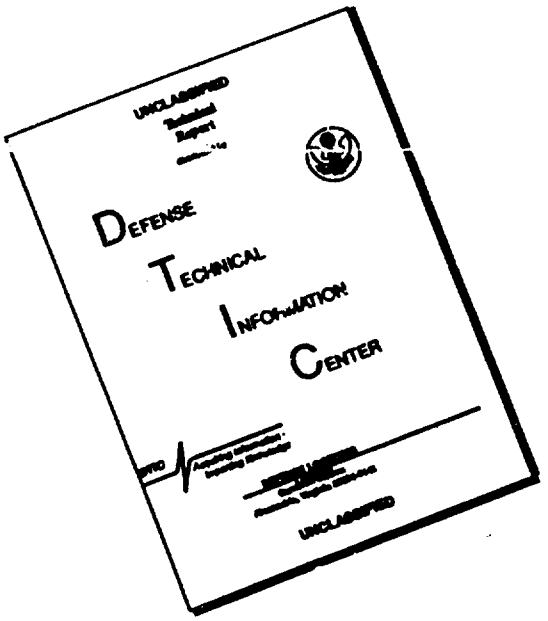
June 1971

INSTITUTE FOR DEFENSE ANALYSES
SCIENCE AND TECHNOLOGY DIVISION

IDA Log No. HQ 71-12459
Copy 139 of 200 copies

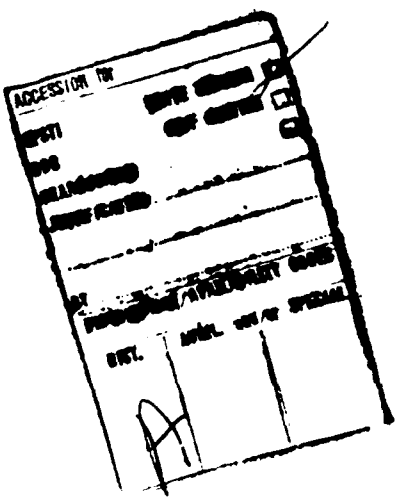
65

DISCLAIMER NOTICE



THIS DOCUMENT IS BEST QUALITY AVAILABLE. THE COPY FURNISHED TO DTIC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

The work reported in this document was conducted under contract DAHC15 67 C 0011 for the Department of Defense. The publication of this IDA Study does not indicate endorsement by the Department of Defense, nor should the contents be construed as reflecting the official position of that agency.



UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1 ORIGINATING ACTIVITY (Corporate author) INSTITUTE FOR DEFENSE ANALYSES 400 Army-Navy Drive Arlington, Virginia 22202	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b GROUP --

3 REPORT TITLE
Study of DoD Automated Environmental Services Support Systems
Appendix G: Costs of a Spectrum of Options for Data Processing of DoD Environmental Services Support Systems of 1975-80

4 DESCRIPTIVE NOTES (Type of report and inclusive dates)
Study S-382 - June 1971

5 AUTHOR(S) (First name, middle initial, last name)
Kenneth P. Heinze

6 REPORT DATE June 1971	7a. TOTAL NO OF PAGES 56	7b NO OF REFS 6
8a CONTRACT OR GRANT NO DAHC15 67 C 0011 b. PROJECT NO Task T-80 c d	9a. ORIGINATOR'S REPORT NUMBER(S) S-382 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) None	

10 DISTRIBUTION STATEMENT
Approved for public release; distribution unlimited.

11 SUPPLEMENTARY NOTES NA	12 SPONSORING MILITARY ACTIVITY Advanced Research Projects Agency Arlington, Virginia 22209

13 ABSTRACT

This Appendix to IDA Study S-382 examines the costs of a selected set of options open to DoD regarding the feasibility of collocation and/or consolidation of the Navy and Air Force environmental services computer centers.

Costs are developed for four basic options: Option 0--separate Navy and Air Force facilities with no expansion to meet future military needs, Option 1--collocated Navy and Air Force facilities with no expansion of capability, Option 2--separate Navy and Air Force facilities with the capability of meeting projected 1975 requirements, Option 3--a collocated or consolidated Navy/Air Force facility with the equipment and personnel capable of meeting 1975 military needs.

Equipment lists, personnel needs, and the time-phased implementation plans that are the bases of the cost estimates are given.

It is estimated that the investment and operations costs of each of the options for a 10-year period would be as follows: Option 0--$118 million, Option 1--$124 million, Option 2--$312 million, and Option 3--$276 million.

DD FORM 1473

UNCLASSIFIED

Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
costs						
satellite data processing						
DoD equipment options						

STUDY S-382

STUDY OF DoD AUTOMATED ENVIRONMENTAL SERVICES SUPPORT SYSTEMS

Appendix G:
Costs of a Spectrum of Options for Data Processing of DoD Environmental Services Support Systems of 1975-80

Kenneth P. Heinze

June 1971

INSTITUTE FOR DEFENSE ANALYSES
SCIENCE AND TECHNOLOGY DIVISION
400 Army-Navy Drive, Arlington, Virginia 22202
Contract DAHC15 67 C 0011
Task T-80

READER'S REFERENCE

This Study of DoD Automated Environmental Services Support Systems consists of the following documents:

Report of Findings

Appendix A. DoD Needs for Environmental Support Services

Appendix B. Navy Environmental Support Services in 1970

Appendix C. Air Force/Army Environmental Support Services in 1970

Appendix D. Sources of Data for DoD Environmental Services Support Systems of 1975-80

Appendix E. Numerical Simulation of Global Circulation of the Atmosphere up to an Altitude of 300 km

Appendix F. Data Processing for DoD Environmental Services Support Systems of 1975-80

Appendix G. Costs of a Spectrum of Options for Data Processing of DoD Environmental Services Support Systems of 1975-80

ABSTRACT

This Appendix to IDA Study S-382 examines the costs of a selected set of options open to DoD regarding the feasibility of collocation and/or consolidation of the Navy and Air Force environmental services computer centers.

Costs are developed for four basic options: Option 0--separate Navy and Air Force facilities with no expansion to meet future military needs, Option 1--collocated Navy and Air Force facilities with no expansion of capability, Option 2--separate Navy and Air Force facilities with the capability of meeting projected 1975 requirements, Option 3--a collocated or consolidated Navy/Air Force facility with the equipment and personnel capable of meeting 1975 military needs.

Equipment lists, personnel needs, and the time-phased implementation plans that are the bases of the cost estimates are given.

It is estimated that the investment and operations costs of each of the options for a 10-year period would be as follows: Option 0--$118 million, Option 1--$124 million, Option 2--$312 million, and Option 3--$276 million.

CONTENTS

FIGURES

TABLES

I. INTRODUCTION

OBJECTIVE

The objective of IDA Study S-382 is to examine the feasibility of a collocation and/or consolidation of the Navy and Air Force current and programmed (five years) operational environmental services computer centers. As a part of this task, we assessed the cost of present operations at these centers and developed estimates of the costs for four alternative configurations postulated for these centers in the 1975-1980 time period. This Appendix presents the composition and derivation of the costs for these options.

ORGANIZATION OF THIS DOCUMENT

The costs developed for this study are summarized and major cost differences among the options are noted in Section II. In Section III the detailed time-phased costs for each option are presented successively as separate packages that include a summary table followed by explanatory notes that are keyed to the table and explain the source and composition of each element of cost. Tables 3, 8, 9, and 14 in Section III summarize the costs and provide the framework for showing the composition of the costs of Options 0, 1, 2, and 3, respectively. The Annexes summarize estimates of personnel manning and time phasing.

OVERVIEW

Four major options, labeled 0, 1, 2, and 3, were costed for this study. Option 0, which can be thought of as a "base case", is based on the assumption that the FY 1971 funding applicable to the two weather centrals (i.e., $3.0 for FNWC and $8.8 for AFGWC, resulting in a total of $11.8 million) remains unchanged through 1980. The

10-year costs developed for the other three options show this same funding for FY 1971 as described for Option 0, but for each of the remaining nine years the estimated costs reflect the total time-phased funding expected each year through 1980.

Stated in broad terms, Option 0 ($118 million), assumes that the current operations continue unchanged through 1980 at both Fleet Numerical Weather Central (FNWC), Monterey, and at Air Force Global Weather Central (AFGWC), Omaha; in Option 1 ($124 million), such operations remain unchanged except that FNWC operations are transferred to Omaha to be collocated with those of AFGWC. In contrast, both Options 2 and 3 assume greatly expanded equipment and operations; in Option 2 ($312 million) FNWC and AFGWC each pursue these expanded operations on larger equipment at their present sites, while in Option 3 ($276 million) the expanded operations are assumed to be collocated at an unspecified site, assumed (for costing purposes only) to be Omaha.

To interpret and understand the options costed in this appendix, it is necessary to refer to Appendix F where the options are described in detail. Several tables from Appendix F showing the time-phased plan and the personnel buildup for Options 1, 2, and 3 are supplied as annexes to this appendix for the reader's convenience.

To provide further perspective for viewing the costs developed in this study, the current U.S. and DoD-wide funding for environmental services are shown on Table 1, which was abstracted from two federal plans. The first,[1] published annually by the Federal Coordinator for Meteorological Services and Supporting Research, provides Congress and the executive branch with a coordinated, overall funding plan for all government meteorological services for the current and succeeding year. The second,[2] published by the Federal Coordinator for Marine Environmental Prediction, covers marine activities. The funding

1. The Federal Plan for Meteorological Services and Supporting Research, Fiscal Year 1972.

2. Federal Plan for Marine Environmental Prediction, Fiscal Year 1972.

TABLE 1. SUMMARY OF U.S. FUNDING AND MANNING FOR ENVIRONMENTAL SERVICES SUPPORT ACTIVITES IN FY 1971
(Extracted from the Federal Plans for Meteorological Services and Supporting Research (MSSR) and Marine Environmental Prediction (MEP)

	FUNDING (in millions of dollars)						MAN YEARS					
	METEOR. SERV. SUPPORT ACT.				MEP[c]	TOTAL	METEOR. SERV. SUPPORT ACT.				MEP	TOTAL
OPERATIONS	ARMY	AIR FORCE	NAVY[b]	TOTAL			ARMY	AIR FORCE	NAVY	TOTAL		
Observations	$ 9	$ 59	$11	$ 79	$ 9	$ 88	1,023	3,134	613	4,770	390	5,160
Upper Air		(4)	(.5)									
Upper Air Rockets		(3)										
Surface Observ.		(9)	(4)									
Weather Reconn.		(42)	(4)									
Weather Radar		(.3)	(1)									
Subsurface Obsv.					(4)							
Op.Met.Sat.Obsv.		(.3)	(1)									
Air-Sea Interact. Zone					(4)							
Upper Air Zone Obs.					(1)							
Analyses & Forecasts		16	8	24	5	29 (d)		1,325	713	2,038	354	2,392
Primary Centers		(8)	(3)	(11)	(3)	(14)						
Area & Guid.Centers		(3)	(5)		(2)							
Specialized Centers		(5)										
Communications		24	4	28	2	30		111	2[illegible]9	349	195	544
High Speed Teletype		(17)	(3)		(1)							
Facsimile		(7)	(1)		(1)							
Dissemination to Users		32	3	35	2	37		2,928	357	3,285	223	3,50[illegible]
Weather Service Offices		(30)	(1.6)		(1.6)							
Flt.Service Stations			(.7)									
Coastal Warning Display			(.5)		(.3)							
Studies & Consultants		(1.6)	(.1)		(.2)							
Voice		(.1)	(.2)		(.1)							
TV		(.1)	(.1)		(.1)							
General Agency Support	1	37	15	53	6	59	131	3,303[e]	975	4,409	61[illegible]	5,019
Operations Totals by Service	$10	$1[illegible]8	$41	$219	$24	$243	1,154	10,801	[illegible]	[illegible]3,851	1,772	1[illegible],[illegible]23
Other Ops in DOD					6	6				75		
Total DOD Operations				219	30	249[f]						
All Other Agencies (FAA, Commerce, etc.)				191	26	217				9,862		
Total U.S. Envir. Service Ops.				410	56	466				24,713		
SUPPORTING RESEARCH												
DOD				14	12	26						
All Other Agencies				63	59	122						
Total U.S. Envir. Service Research				77	71	148						
TOTAL U.S. OPERATIONS & RESEARCH FUNDING (for Envir. Serv. Activities)				$487	$127	$614						

(a) This summary reflects data abstracted from the FY 1972 issues of two Federal Plans: (1) The Federal Plan For Meteorological Services and Supporting Research (MSSR), pp. 9, 45, and 46) and (2) The Federal Plan for Marine Environmental Prediction (MEP), p. 15.
(b) The major portion of the Navy's activities for environmental services is reported in the Federal Plan for MSSR; the remainder in the Federal Plan for MEP. Hence, to obtain total environmental service activities for Navy, add [illegible] in two columns (i.e., $41 + $24 million).
(c) The published Federal Plan for MEP does not identify funding and manning by Service as shown here but the Navy's portion was obtained from the Navy's report to the Federal Coordinator.
(d) Parentheses indicate component contributions to totals. The dashed line enclosing funds for Primary Centers highlights the general area covered by this study.
(e) The 3303 man years reported for the Air Force include some non-AF manning used for MSSR activities in the Air Force.
(f) Total DOD funding for Environmental service activities operations constitutes 53 percent of the total U.S. spending for such services (i.e., $249 out of $466 million).

reported in these plans for "Primary Centers" under the "Analysis and Forecasts" function has been enclosed with a dashed line (i.e., $8 million for the Air Force and a total of $6 million for the Navy) to highlight that this is the area of most interest in this study, but that such funds constitute only about 5 to 10 percent of the total operations funds reported for each Service. Though AFGWC (Omaha) and FNWC (Monterey) account for most of the funding identified to Primary Centers in the Federal Plans, the funds shown for Primary Centers cannot be compared directly with the estimates of funding allocable to these centers as developed for this study. Such a comparison is invalid for a number of reasons, some of which are listed in Annex I.

COSTING PROCEDURES AND LIMITATIONS

In defining which costs should be associated with the operation of the weather centrals* at Monterey and Omaha, we concentrated on establishing boundaries that would reflect the cost of operating the central at its present location as distinguished from what it would cost if that central were moved, consolidated, or changed its operations. Accordingly, the costs of operating the Navy's Weather Service Headquarters in Washington and of operating the Air Force's Weather Headquarters at Scott Air Force Base were ignored. In effect, it was assumed that the cost of running these headquarters would remain the same whichever option was chosen. Similarly, the extensive communications networks, such as the Automated Weather Network (AWN), the CONUS Meteorological Teletypewriter System (COMET), and the Naval Environmental Data Network (NEDN), used to transmit both observed

*Current funding for AFGWC is about 3 times greater than that for FNWC (i.e., $8.8 million vs. $3 million), but to a large extent this difference reflects the fact that AFGWC's operation at Omaha is centralized while the Navy's environmental services support functions are decentralized. Accordingly, the costs shown in this study for the Navy's weather central apply only to the operations in the Monterey area, though the Navy has other centrals, such as those at Pearl Harbor and Guam.

data to the centrals and processed data to the users, were assumed to remain unchanged (except for changes in the cost of the specific leased lines terminating at the weather centrals and allocable to that site).

In developing the costs, stress was given to maintaining consistency in the treatment of the factors used to obtain the estimates--the objective being to highlight relative cost differences among the options, not to obtain completely accurate estimates in absolute terms. To illustrate, in all cases an annual average cost of $12,000 per person was used to estimate Pay and Allowance costs--regardless of whether the personnel are Air Force or Navy or whether today's mix of personnel might change over time (i.e., percent of military to civilian; officers to enlisted).

All costs developed for this study reflect Total Obligational Authority (TOA) funds and are expressed in terms of constant 1971 dollars. No attempt was made to "discount" the flow of future funding, at some appropriate rate, to present value because recurring costs constitute such a large part of the total costs and there are only minor differences in the time-phasing of acquisitions between Options 2 and 3. Also, no attempt was made to incorporate costing refinements such as anticipated price and wage adjustments due to inflation, or to guess at price reductions that might result from improvements in technology. The estimates of costs provided are deemed appropriate for this planning study but are considered to be too coarse for such uses as determining specific funding action; further refinement and analysis would be needed in these cases.

II. SUMMARY OF COST FINDINGS FOR THE OPTIONS POSTULATED

FRAMEWORK FOR EXAMINING THE COSTS OF ALTERNATIVE OPTIONS

The costs developed for the four alternative options postulated in this study are displayed in chart form in Figs. 1 and 2 and in tabular format in Table 2. In Fig. 1 the time-phased costs are shown in terms of Investment and Operations categories of funding, while in Fig. 2 the costs for each option are identified by site. As a framework for examining these costs, the main features of the four options and their 10-year costs (in millions of dollars) are presented in the following matrix:

Level of Operations	Separate	Collocated
Present	#0 = $118	#1 = $124
Expanded	#2 = $312	#3 = $276

In reflecting on these 10-year costs, one should remember that Options 0 and 1 assume no increase in the work being done currently at the two weather centrals; the difference in these two options arises simply in separate versus collocated centrals--in Option 0 FNWC and AFGWC remain at their present sites, but in Option 1 the FNWC operation is moved from Monterey to be collocated with the AFGWC operation at Omaha. In contrast, under Options 2 and 3 greatly expanded operations are postulated for both the Navy and Air Force; again, the difference in these two options is the separate versus combined locations--under Option 2 Navy operations are expanded at Monterey and Air Force operations are expanded at Omaha, while under Option 3 both Navy and Air Force operations are collocated at one site (labeled Site C), which could be Monterey, Omaha, or a new site.

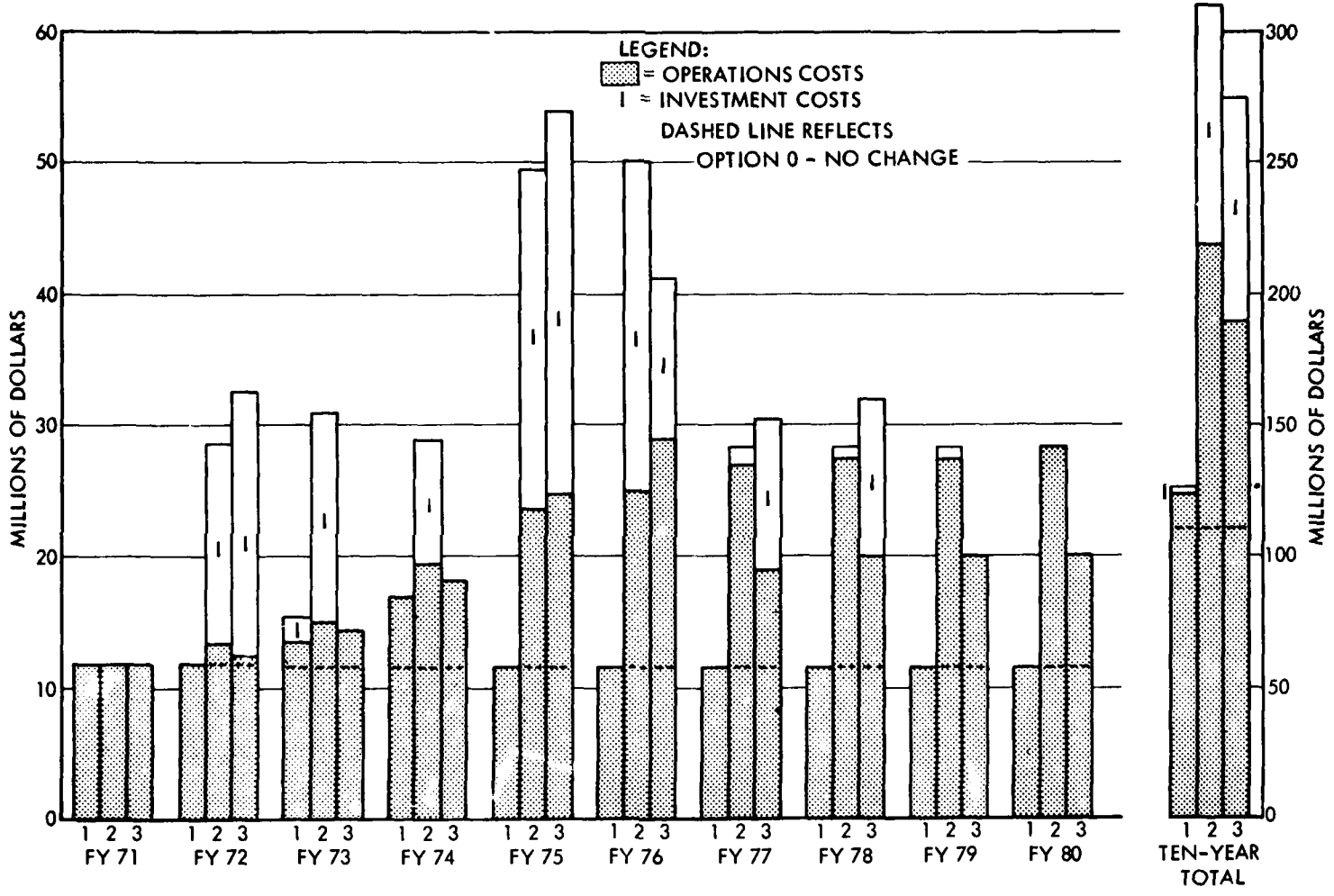


FIGURE 1. Comparison of Invesrment and Operating Costs for Data Processing of DOD ESS Systems of 1975-80 Under Options 1, 2 and 3

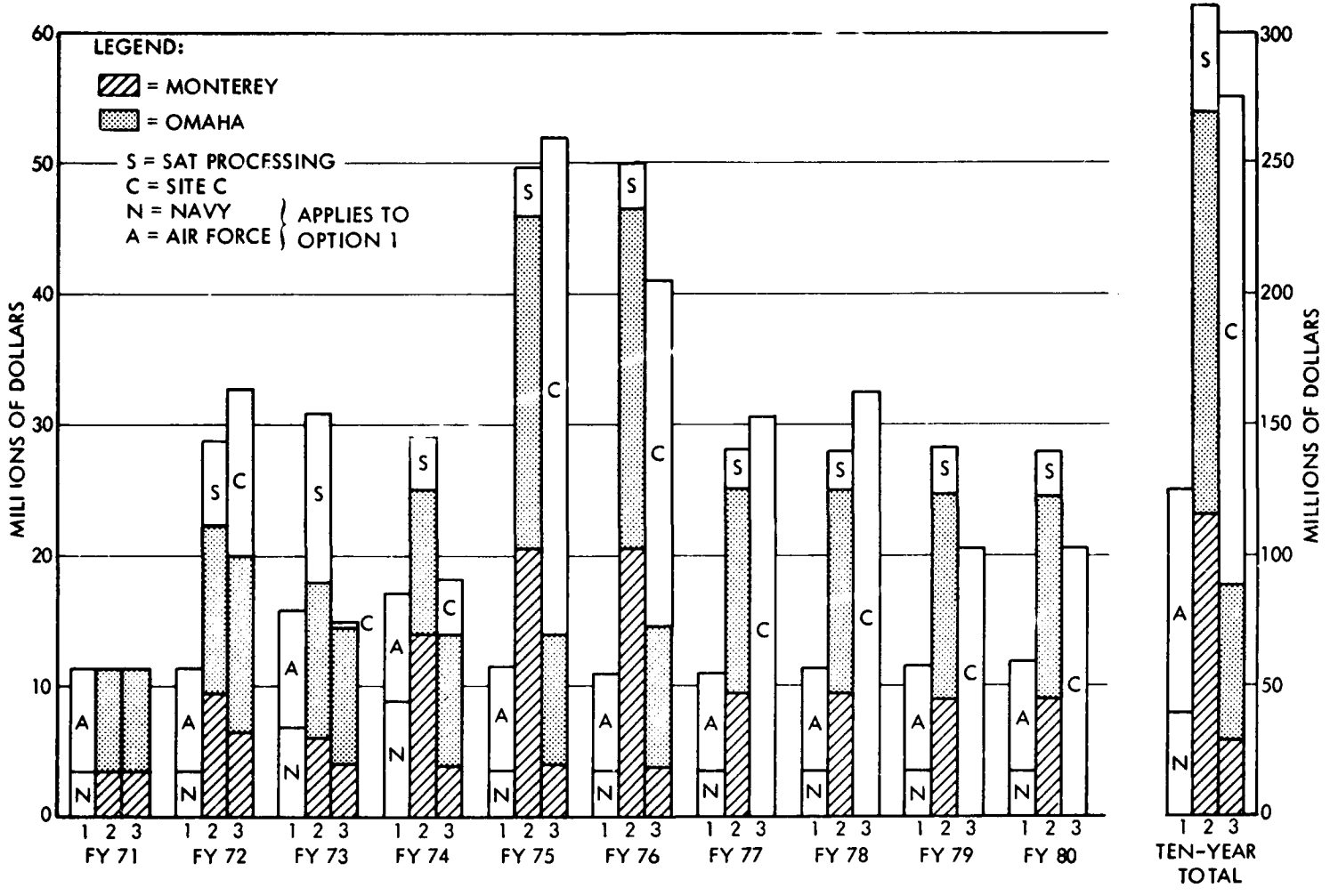


FIGURE 2. Comparison of Costs by Site for Data Processing of DOD ESS Systems of 1975-80

TABLE 2. COMPARISON OF INVESTMENT AND OPERATING COSTS FOR DATA PROCESSING OF DOD ESS SYSTEMS OF 1975-80 UNDER OPTIONS 1, 2 AND 3*

	FY 71	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80	TOTAL
OPTION 1											
Investment											
Navy	-	-	2.3	-	-	-	-	-	-	-	2.3
Air Force	-	-	-	-	-	-	-	-	-	-	-
Total Investment	-	-	2.3	-	-	-	-	-	-	-	2.3
Ops											
Navy	3.0	3.0	4.2	8.4	3.1	2.9	2.8	2.9	2.8	2.9	36.0
Air Force	8.8	8.8	8.8	8.8	8.4	8.4	8.4	8.4	8.4	8.4	85.6
Total Ops	11.8	11.8	13.0	17.2	11.5	11.3	11.2	11.3	11.2	11.3	121.6
TOTAL OPTION 1 (Inv. & Ops)	11.8	11.8	15.3	17.2	11.5	11.3	11.2	11.3	11.2	11.3	123.9
OPTION 2											
Investment											
Monterey	-	6.0	2.0	8.3	13.0	12.0					41.3
Omaha		5.1	1.1	-	13.0	12.0					31.2
Omaha Sat. DPF		4.1	13.0	1.0							18.1
Total Investment		15.2	16.1	9.3	26.0	24.0					90.6
Ops											
Monterey	3.0	3.6	4.4	6.4	7.7	9.5	10.0	10.0	10.0	10.0	74.6
Omaha	8.8	9.0	10.4	10.7	12.6	13.9	15.2	15.2	15.2	15.3	126.3
Omaha Sat. DPF		.5	.9	2.5	2.8	2.8	2.8	2.8	2.8	2.8	20.7
Total Ops	11.8	13.1	15.7	19.6	23.1	26.2	28.0	28.0	28.0	28.1	221.6
TOTAL OPTION 2 (Inv. & Ops)	11.8	28.3	31.8	28.9	49.1	50.2	28.0	28.0	28.0	28.1	312.1
OPTION 3											
Investment											
Monterey		3.1									3.1
Omaha		5.1									5.1
Site C		11.9			29.0	13.0	12.0	12.0			77.9
Total Investment		20.1			29.0	13.0	12.0	12.0			86.1
Ops											
Monterey	3.0	3.6	3.8	3.8	3.8	3.8					21.8
Omaha	8.8	9.0	10.3	10.3	10.3	10.3					59.0
Site C	-	-	.5	3.8	10.6	14.2	18.7	20.3	20.7	20.7	109.5
Total Ops	11.8	12.6	14.6	17.9	24.7	28.3	18.7	20.3	20.7	20.7	190.3
TOTAL OPTION 3 (Inv. & Ops)	11.8	32.7	14.6	17.9	53.7	41.3	30.7	32.3	20.7	20.7	276.4

*This tabular summary of costs was used in preparing Figure 1.

COMPARISON OF OPTION COSTS

Since no changes are postulated in the level of operations for Options 0 and 1, the 10-year costs for these two options can be expected to reflect roughly 10 times the current level of funding for the Navy and Air Force centrals (except for the cost of the move assumed under Option 1); while obviously the greatly expanded facilities, equipment, and operations postulated under Options 2 and 3 result in much greater funding requirements.

One might also view the option costs in terms of the increased costs of Options 1, 2, and 3 over Option 0. Option 1 adds $6 million, Option 2 adds $194 million, and Option 3 adds $158 million to the $118 million 10-year cost of Option 0.

Since collocation versus separate operations is the focus of interest in this study, the major cost comparisons accordingly center on Option 0 versus 1 and on Option 2 versus 3.

Option 0 Versus Option 1

The main items that account for the difference in Option 0 versus 1 are listed below in millions of dollars:

	Increase for Option 1
Construction of new FNWC building at Omaha	$ 2.3
Additional pay during period of transition	2.3
Savings in pay resulting from elimination of duplicated applications (reflecting 48 fewer people after collocation)	-3.0
Lease and maintenance of 2 CDC-6500s during transition	3.7
Other move costs	.7
10-year cost increase of Option 1 over 0	$ 6.0

Option 2 Versus Option 3

In the second comparison, the costs for Option 2 exceed those for Option 3 by $36 million. As noted below, most of this difference results from Non-Pay costs covering items such as computer maintenance, parts, supplies, and power used in operating the EDP system.

	Option 2	Option 3	Greater Cost for Option 2
Facilities - investment	$ 12	$ 12	$ 0
EDP equip. procurement	79	74	5
Pay and allowances	133	125	8
Non-pay costs	68	46	22
Communications	21	20	1
Totals	$313	$277	$ 36

The $22 million greater Non-Pay costs in Option 2 reflect, to a large extent, the higher costs (for equivalent computing capability) associated with operating Class 1 and 2 machines, since under Option 2 these machines remain operational over the entire 10-year period.* In contrast, under Option 3, the lower class machines are phased out in FY 1976 and are replaced (at the new site C) entirely with Class 3 and 4 machines. It should be noted that while the costs for Option 2 exceed those for Option 3, the reserve capacity of the EDP equipment postulated for Option 2 exceeds that for Option 3, as is explained in Appendix F.

The Pay and Allowances increase of $8 million for Option 2 over Option 3 also reflects the higher number of personnel needed for the slower machines during the entire 10-year period. In terms of people, beginning with FY 1978 Option 3 operates with about 240 fewer people than Option 3 (see Table 4, which summarizes personnel for each option). The recurring costs for Option 3 (after the big investment is made for facilities and computers) level off after FY 1978 at a rate of about $21 million per year, compared to $28 million for Option 2.

The costs for Option 2 are based on having one Satellite Data Processing Function (SDPF), located at Omaha, with a high-capacity

*Under the ground rules used to cost Option 2, the CDC-6500s at Monterey and the upgraded Univac-1108s at Omaha are not retired. In reality, though, in the late 1970's the Class 1 and 2 machines at these sites probably would be replaced with higher class machines--a possibility that is noted on the time-plan for Option 2, supplied as Annex D. This alternative, which was not configured or costed, would increase the investment costs for Option 2 but should result in annual savings in operating costs beginning in the late 1970's.

land line connecting it to Monterey, because this configuration appeared to be less costly than duplicating this function. However, if it were assumed that each Service should have its own SDPF, the Navy would be supplied with its own SDPF at Monterey and the cost of Option 2 would rise by $35.3 million, to $347.4 million, as is explained in Section III-C.

With the exception of the satellite ground readout station and its attendant data processing function, located at Omaha, the costs developed for Options 2 and 3 specifically exclude the costs of all satellites and satellite-related costs. Similarly excluded are the costs for the ocean data buoy system, which senses ocean data that in turn is relayed by the meteorological satellite system. The rationale for omitting such costs here is that such data are expected to be provided by already existing or planned programs and hence are not chargeable to the program costed here. Sections III and IV of Appendix D supply costs of the satellite and the ocean buoy data systems, should it be necessary to develop and operate such systems to be dedicated to this program. Annexes D and E to this Appendix provide the time plans for Options 2 and 3 and imply when the satellite system is expected to be operational.

III. DEVELOPMENT OF DETAILED COSTS BY OPTION

Section III, consisting of four parts, serves to show how the detailed costs were developed for each of the four options.

A. Costs Developed for Option 0

Features of Option 0

In essence, this option provides a baseline useful for showing how much it would cost over 10 years to continue operating the FNWC operations at Monterey and the AFGWC operations at Omaha exactly as they are operated today. Under this option nothing changes: no moves are made, no additional facilities or equipment are procured, and no provisions are made to meet the expected needs of 1975-1980.

Observations About the Cost for Option 0

Unlike the costs developed for Options 1, 2, and 3, the costs shown for Option 0 attempt to show the amount of recurring funding needed to cover today's operations. Excluded are any funds that may be expended to procure new equipment or facilities; rather, the attempt is to show the amount of recurring costs that can be expected each year the present system operates. The composition of these funds is presented in the explanatory notes that are keyed to and support Table 3 which follows.

TABLE 3. OPTION 0 COSTS FOR DATA PROCESSING OF DOD ESS SYSTEMS OF 1975-1980

(Millions of Dollars)

Key		FY 71	72	73	74	75	76	77	78	79	80	TOTAL (FY 71-80)
	FNWC											
A	Invest. Facilities	-										
B	Invest. EDP Equip.	-										
	Invest. Total	-										
C	Ops-Communications	0.5										5.0
D	Ops-Pay & Allowances	1.7										17.0
E	Ops-Non-Pay Costs	0.8										8.0
	Ops-total	(3.0)										(30.0)
	TOTAL FNWC	(3.0)										(30.0)
	AFGWC		NO CHANGE FROM CURRENT COST									
A	Invest. Facilities	-										
B	Invest. EDP Equip.	-										
	Invest. Total	-										
C	Ops-Communications	1.2										12.0
D	Ops-Pay & Allowances	5.9										59.0
E	Ops-Non-Pay Costs	1.7										17.0
	Ops-total	(8.8)										(88.0)
	TOTAL AFGWC	(8.8)										(88.0)
	TOTAL OPTION 0	(11.8)										(118.0)

EXPLANATORY NOTES FOR TABLE 3
(OPTION 0 COSTS)

Key FNWC

C Operations--Communications

Based on conversations with FNWC management and a cursory examination of leased-line rates, the annual cost of leased lines terminating at FNWC are estimated to be $0.5 million.

D Operations--Pay and Allowances

As of the beginning of 1971, FNWC's authorized strength was 143 persons. This quantity, consisting of 27 officers, 58 enlisted and 54 civilians, was used in developing Pay and Allowance costs for FNWC for FY 1971 for all options. The numbers of personnel used for this (and the other options) are summarized on Table 4 while detailed functional breakouts of these estimates appear by option on Annexes F, G, and H. The algorithms used in deriving estimates of personnel for future years appear in an annex to Appendix F.

An average annual rate of $12,000 per person was used to calculate all estimates of Pay and Allowance costs for all options. This rate reflects constant FY 1971 dollars and is based on average planning factor rates by Service plus a detailed examination of pay costs at FNWC.

E Operations--Non-Pay Costs

The recurring costs of FNWC's current operations at Monterey is estimated to be $0.8 million. The major basis for this estimate is the tabulation below which covers 1970 experience at FNWC.

Item	Thousand $
Electric power (commercial)	$ 50
Maintenance of administration building	50
Maintenance of air conditioning (Bldg. 200) plus emergency generator	15
Maintenance of EDP equipment (includes regular CDC maint. on selected equip. on prime shift; also $82,000 for emergency repairs by CDC plus $50,000 of non-CDC purchased maint.)	294
Parts for non-standard EDP switching equipment	40
Complete equip. repair & spare parts	140
Consumable computer supplies (tapes, cards, ribbon)	100
Key punch machine rentals	7
Total FNWC non-pay costs	$ 696

The $0.7 million itemized above is increased to $0.8 million to cover non-itemized costs. FNWC currently operates two CDC-6500s; the non-pay costs for one CDC-6500 (i.e., a Class 1 machine) are estimated at $0.4 million. This factor was used in developing the standardized costs for a Class 1 machine summarized on Table 12. Table 5 lists all EDP equipment at FNWC Monterey.

AFGWC

C Operations--Communications

Current leased lines for AFGWC at Offutt are estimated to cost $1.2 million, based on a study of such charges by the communications office at AFGWC, as summarized on Table 6.

D Operations--Pay and Allowances

The current authorized strength for AFGWC, as of the beginning of 1971, was 492 persons, distributed as follows: 139 officers, 334 airmen, and 19 civilians. The functional breakout of the personnel at both AFGWC and FNWC appears in Section VI of Appendix F. The numbers of personnel used to cost pay and allowances for all options are recapped on Table 4. An annual rate of $12,000 per person is used.

E Operations--Non-Pay Costs

Based on discussions with AFGWC personnel, the non-pay costs for AFGWC (having 4 Univac 1108s) is approximately $1.7 million and this amount coincides with the annual standardized rate of $0.43 million per year in recurring costs for a single Class 1 machine, as indicated on Table 12.

Table 7 provides a summary of all AFGWC EDP equipment and its applicable cost.

TABLE 4. SUMMARY OF MANNING ESTIMATES USED IN DEVELOPING COSTS FOR OPTIONS 0, 1, 2 AND 3*

	FY 71	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80
OPTION 0										
Monterey	143	143	143	143	143	143	143	143	143	143
Omaha	492	492	492	492	492	492	492	492	492	492
Total Option 0	635	635	635	635	635	635	635	635	635	635
OPTION 1										
Monterey - FNWC	143	143	143	143	-	-	-			
Omaha - FNWC			48	143	143	132	132	132	132	132
Omaha - AFGWC	492	492	492	492	492	455	455	455	455	455
Total Option 1	635	635	683	778	635	587	587	587	587	587
OPTION 2										
Monterey	143	172	225	316	335	418	426	426	426	428
Omaha - AFGWC	492	506	601	626	702	753	811	811	811	813
Omaha - Sat. DPF	-	45	78	112	112	112	112	112	112	112
Total Option 2	635	723	904	1054	1149	1283	1349	1349	1349	1353
OPTION 3										
Monterey	143	172	172	175	175	175	-	-	-	-
Omaha - AFGWC	492	506	590	592	592	592	-	-	-	-
Site C	-	-	42	272	584	766	1052	1108	1108	1110
Total Option 3	635	678	804	1039	1351	1533	1052	1108	1108	1110

*The manning shown for Option 0 reflects authorized strengths for AFGWC and FNWC as of the beginning of 1971; estimates for Options 1, 2 and 3 are taken from the detailed buildups of personnel that appear on several tables in Appendix F and also are reproduced here as Annexes F, G and H. Annex B to Appendix F supplies the algorithms used to estimate the numbers of personnel by function for each option.

TABLE 5. PRICE OF EDP EQUIPMENT AT FNWC MONTEREY
(Includes Equipment at Pt. Pinos; Inventory as of January 1971)

CDC No.	Name	Qty	Current Purchase Price Each	Current Purchase Price Total	Prime Shift Mtce. Price
3204	Central Processor	2	205,000	410,000	$ 594
3209	Storage Module	8	46,250	370,000	1,168
3206	Communication Channels	8	5,800	46,400	304
3207	Communication Channel	2	8,500	17,000	108
3422	Tape Controller	1		52,000	153
3691	Paper Tape Reader/Punch	1		12,000	135
3232	Disk Controller	2	20,000	40,000	108
852	Disk Drive	2	17,500	35,000	148
3682	Satellite Coupler	2	10,000	20,000	54
607	Tape Unit	24	41,700	1,000,800	3,888
3228	Tape Controller	2	19,800	39,600	142
3248	Card Read Controller	1		4,800	37
405	Card Reader	3	22,500	67,500	213
3256	Print Controller	3	23,000	69,000	195
505	Printer	1		27,000	227
6513	Central Processor	2	2,730,000	5,460,000	15,336
6612	Console	2	48,000	96,000	346
6635	Extended Core Storage	2	900,000	1,800,000	3,888
6638	Disk File	1	351,500	351,500	816
6681	Channel Converter	12	14,000	168,000	528
501	Printer	2	44,500	89,000	520
3447	Card Read Controller	2	12,000	24,000	120
3423	Tape Controller	2	69,500	139,000	346
6603	Disk File	2	205,000	410,000	1,318
6640	ECS Controller	1	80,000	80,000	238
3555	Print Controller	1		27,000	49
512	Printer	1		48,000	243
3245	Punch Controller	1		14,000	48
415	Card Punch	1		18,150	65
8082	Basic Computer	1		41,000	200
8084	Auxiliary Memory			26,500	108
8073	Paper Tape Punch	1		3,200	29
8074	Paper Tape Reader	1		2,800	21
8071	Tape Controller	1		12,500	114
3681	Channel Converter	2	11,500	23,000	44
160A	Computer	1		90,000	225
162-2	Tape Controller	1		29,500	115
169	Auxiliary Memory	1		52,500	100
1604B	Computer	1		990,000	2,360
1615	Tape Controller	3	33,000	99,000	570
1612	Printer	1		65,800	400
1617	Card Reader	1		21,800	155
606	Tape Unit	5	38,000	190,000	700
	Univac Drum	1		293,300	N/A
1604A	Computer	1		1,039,000	2,480
	Bryant Drum	2	277,000	554,000	N/A
Total Equivalent Purchase Price				$14,469,650	
Total Prime Shift Maintenance Charge					$38,916

Source: Inventory taken by FNWC; prices taken from CDC Federal Supply Catalog for 1971.

Note: FNWC owns this EDP equipment and purchases only the basic monthly maintenance (also called Prime Shift Maintenance) service from CDC. FNWC does the remaining maintenance on its EDP equipment with its own personnel, except for certain emergency needs.

TABLE 6. ANNUAL LEASED LINES COSTS FOR AFGWC
(Used in Explanatory Note C to Table 3)

The AFGWC communications office prepared an analysis of the leased-lines costs terminating at Offutt. The analysis shows that such charges are approximately $96,000 per month which translates to an annual rate of $1.16 million. As a part of that study estimates of the leased-lines costs to AFGWC were made assuming it were located at Monterey or alternatively at Carswell and these estimates are also reproduced below:

MONTHLY LEASED CIRCUIT COSTS FOR AFGWC

CIRCUIT TYPE	END TERMINAL	COST TO OFFUTT	EST COST TO MONTEREY CA	EST COST TO CARSWELL
4800 Baud Data	Carswell ADWS	309.	745.	
4800 Baud Data	Carswell ADWS	295.	745.	
2400 Baud Data	Sunnyvale CA	486.	234.	661.
300 Baud TT	Scott AFB IL	183.	800.	262.
300 Baud TT	Barksdale AFB LA	367.	825.	97.
300 Baud TT	March AFB CA	704.	378.	532.
300 Baud TT	Pentagon (AFCP)	486.	1,102.	551.
300 Baud TT	Travis AFB CA	454.	372.	532.
300 Baud TT	McGuire AFB NJ	486.	1,140.	624.
75 Baud TT	McClellan AFB CA	213.	98.	325.
75 Baud TT	Kelly AFB TX	195.	381.	55.
75 Baud TT	Pentagon NMCC	224.	551.	278.
75 Baud TT	Beale AFB CA	305.	90.	328.
AUTODIN (2400 B)	Tinker AFB OK	209.	197.	72.
AUTODIN (2400 B)	Gentile AFS OH	282.	490.	300.
Wideband	Fairchild AFB WA	31,979.	18,530.	36,966.
Wideband	Loring AFB ME	48,132.	72,353.	49,115.
Voice/Data Line	Fairchild AFB WA	608.	163.	588.
Voice/Data Line	Fairchild AFB WA	608.	388.	588.
Voice Data Line	Loring AFB ME	801.	1,216.	825.
Voice/Data Line	Loring AFB ME	801.	1,216.	825.
Voice Line	Suitland MD	471.	1,106.	561.
Voice Line	Loring AFB ME	801.	1,216.	825.
75 Baud	SAGE Net	401.	604.	413.
75 Baud TT	Loring AFB ME	400.	553.	375.
75 Baud TT	Fairchild AFB WA	304.	193.	307.
2400 Baud	SACCS-Offutt AFB	-	634.	271.
2400 Baud	WSU-Offutt AFB	-	634.	271.
2400 Baud	WSU-Offutt AFB	-	634.	271.
300 Baud	WSU-Offutt AFB	-	634.	271.
300 Baud	WSU-Offutt AFB	-	634.	271.
75 Baud	WSU-Offutt AFB	-	324.	135.
75 Baud	WSU-Offutt AFB	-	324.	135.
FAX-109	Network	-	172.	-
FAX-1234	Network	-	48.	-
TIROS-NOAA	Alaska-Wallops	3,417.	11,954.	6,370.
75 Buad	S Island			
75 Baud	SAGE Net	70.	200.	120.
75 Baud	SAGE Net	70.	200.	75.
* 4800 Baud	Classified	500.	360.	550.
* 4800 Baud	Classified	500.	360.	550.
* Photofax	Classified	500.	1,100.	550.
* Voice	Classified	500.	360.	550.
* 75 Baud	Classified	225.	550.	250.
	TOTAL MONTHLY COST	96,285.	124,806.	106,645.

*Costs applicable to asterisked items are coarse estimates that are less exact than the other figures.

TABLE 7. FEATURES AND COSTS OF THE FOUR UNIVAC 1108 SYSTEMS INSTALLED AT AFGWC

AFGWC currently has 4 Univac-1108 systems. These systems, which are government owned, have a total current purchase price of $9.4 million, which translates to an average price of $2.3 million. For these systems AFGWC pays Sperry-Rand approximately $550,000 annually for full vendor maintenance. Full maintenance charges amount to 130 percent of the vendor's published regular basic monthly maintenance charge times 12.

The total annual recurring cost used for this study for the 4 1108 systems are estimated to be $1.7 million. This estimate, which applies to a Class 1 machine that is fully maintained by the vendor, is based on the following:

	Cost (Million $)
Full maintenance (130%) by Univac	$ .13
Paper, tapes, supplies	.20
Power, air conditioning, stand-by power and air conditioning	.10
Total Recurring Costs, Class 1, at AFGWC	$ .43

These costs are incorporated in the standardized annual cost for a Class 1 machine that appears on Table 12.

The features of the 4 Univac-1108s at AFGWC together with certain purchase and maintenance costs applicable to them (as derived from a letter from Systems Management Directorate, DCS/Systems, Hq. Air Weather Service) are reproduced below:

	System					
	A	B	C	D	TOTAL	AVG.
Features (Quantities)						
Words of core memory (thousands)	196	131	131	196		
Fastrand Drums	4	2	2	6		
Tape Transports	7	6	6	7		
Sanders CRT	3	0	1	1		
Drum, 2 million (36 bit) words	1	1	1	1		
GSA Costs (Thousands $)						
Total purchase price	$2,300	$2,100	$2,000	$3,000	$9,400	$2,350
Rental charge per month	93	63	65	94	315	79
Univac monthly maint.chg. to AFGWC (130% of prime shift charge)	13	10	10	13	46	11

B. Costs Developed for Option 1

Features of Option 1

Under this option, FNWC operations are discontinued at Monterey and instead collocated with those of AFGWC at Omaha. There is no expansion of equipment or applications, but the new FNWC facilities at Omaha are sufficient to relieve the congestion now being experienced at Monterey. Completely parallel operations are in effect for half of FY 1974. The Navy's move requires the lease of two CDC-6500s, one at Monterey, the other at Omaha, to accomplish the transition. Upon completion of the transition in FY 1975, the buildings in the Monterey area are vacated. Though AFGWC operations continue unchanged, there is a savings in personnel both at AFGWC and FNWC after the move, reflecting discontinuance of some duplicate operations, i.e., FNWC personnel are reduced from 143 to 132 and AFGWC personnel are reduced from 492 to 455 (see Table 4).

Observations About the Costs for Option 1

Aggregate differences in costs resulting from the move were covered in Section II, while details of those differences are covered in the explanatory notes that support Table 8, which follows.

TABLE 8. OPTION 1 COSTS FOR DATA PROCESSING OF DOD ESS SYSTEMS OF 1975-80

(Millions of Dollars)

KEY		FY 71	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80	TOTAL (FY 71-80)
	FNWC											
A	Invest. Facilities	-	-	2.3	-	-	-	-	-	-	-	2.3
B	Invest. EDP Equip.	-	-	-	-	-	-	-	-	-	-	-
	Invest. Total	-	-	(2.3)	-	-	-	-	-	-	-	(2.3)
C	Ops-Communications	.5	.5	.6	.5	.5	.5	.5	.5	.5	.5	5.1
D	Ops-Pay & Allowances	1.7	1.7	2.3	3.4	1.6	1.6	1.6	1.6	1.6	1.6	18.7
E	Ops-Non-Pay Costs	.8	.8	1.3	4.5	1.0	.8	.7	.8	.7	.8	12.2
	Ops-Total	(3.0)	(3.0)	(4.2)	(8.4)	(3.1)	(2.9)	(2.8)	(2.9)	(2.8)	(2.9)	(36.0)
	TOTAL FNWC	(3.0)	(3.0)	(6.5)	(8.4)	(3.1)	(2.9)	(2.8)	(2.9)	(2.8)	(2.9)	(38.3)
	AFGWC											
A	Invest. Facilities	-										
B	Invest. EDP Equip.	-										
	Invest. Total	-	-	-	-	-	-	-	-	-	-	-
C	Ops-Communications	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	12.0
D	Ops-Pay & Allowances	5.9	5.9	5.9	5.9	5.5	5.5	5.5	5.5	5.5	5.5	56.6
E	Ops-Non-Pay Costs	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	17.0
	Ops-Total	(8.8)	(8.8)	(8.8)	(8.8)	(8.4)	(8.4)	(8.4)	(8.4)	(8.4)	(8.4)	(85.6)
	TOTAL AFGWC	(8.8)	(8.8)	(8.8)	(8.8)	(8.4)	(8.4)	(8.4)	(8.4)	(8.4)	(8.4)	(85.6)
	TOTAL OPTION 1	(11.8)	(11.8)	(15.3)	(17.2)	(11.5)	(11.3)	(11.2)	(11.3)	(11.2)	(11.3)	(123.9)

EXPLANATORY NOTES TO TABLE 8
(OPTION 1 COSTS)

Key FNWC

A Investment - Facilities

Facilities for this option are estimated to cost $2.3 million, which covers the construction of a building in the hangar at Offutt AFB, next to the AFGWC computer center. No allowance is made under this cost element for the cost of alterations to the FNWC computer center building (No. 200) at the Navy Post Graduate School. The costs of alterations to Building 200 to accommodate a leased third CDC-6500 system during the transition period are treated instead as an O&M non-pay cost, since such alterations perhaps can be made without a request for military construction program (MCP) funds.

The cost estimate for constructing the FNWC computer center building at Offutt (to house the two CDC-6500 and support systems currently at Monterey) is based on an architect's design estimate prepared for FNWC for a building that would consolidate most of the FNWC operations in the Monterey area into one building, now scheduled to be located at the Presidio. That building, known as the meteorological building, is currently estimated to cost close to $3 million; it is designed to have 33,000 sq ft of floor area, of which 16,200 is in raised floor area. At $3 million, this construction cost translates to $185 per sq ft of raised floor area. The meteorological building is designed to house all the FNWC operations currently in the Monterey area (except office space for programmers) and in addition, to have sufficient space to house a CDC-STAR system. Under Option 1, no additional equipment would be procured; hence, that portion of the meteorological

building allocated to the STAR (estimated to be 3,000 sq ft of raised floor) is removed, leaving a net requirement of 13,200 sq ft of raised floor area for FNWC at Offutt. A factor of $150 per sq ft of raised floor is used to estimate $2 million as the construction cost for the needed 13,200-sq ft at Offutt. The lower rate of $150 recognizes that construction in the hangar avoids certain site preparation and utilities costs.

Since the meteorological building proposed for Monterey provides no programmer office space, the cost of constructing such space at Offutt is added in developing costs for this option. Offices for 55 applications programmers (see Annex F) are estimated to cost an additional $0.33 million, based on an allowance of 200 sq ft per person and a construction cost of $30 per sq ft.

For this study the residual value of government-owned buildings vacated by FNWC (in FY 1974 under this option) are treated as a sunk cost and disregarded. It is very possible, however, that Navy could use the vacated buildings for another program for which it otherwise would have to request military construction program funds. In that case, a credit for such buildings should be assessed and the cost of this option reduced accordingly.

Several small facilities in the Monterey area totaling about 6,000 sq ft are leased by FNWC. These facilities consist of office space for programmers located on Munras Avenue, plus several trailers. Beginning in FY 1975 under this option, FNWC is credited with $50,000 annual rental savings under Ops--non-pay costs.

With the transfer of FNWC to Offutt some allocable support facilities (messing, housing, security, etc.) are released in the Monterey area, but such needs increase at Offutt. The transfer is judged to require no change in the cost to the government for support facilities, but a more thorough analysis of the costs, given a specific site and conditions, may reveal changes in such costs that should be incorporated into the cost of the option.

B Investment--EDP Equipment

Under this option, no new EDP equipment is purchased. The Navy's currently owned equipment is transferred from Monterey to Offutt. The Navy's lease of two CDC-6500s for use during the transition period is treated under O&M--non-pay costs.

C Ops--Communications

Based on consultations with FNWC management, it is assumed that though changes in leased lines are required (i.e., some lines lengthened, others shortened) there are no appreciable net differences in recurring charges for leased lines. A one-time hook-up and change-over cost can be expected, however, and these are estimated to be $0.1 million for FY 1973. A high-quality duplex line already exists between Monterey and Offutt that can be used to a fuller extent during the interim period.

D Ops--Pay and Allowances

See Table 4 for estimates of manning at $12,000 per person.

E Ops--Non-Pay Costs

Under this option, FNWC operations in Monterey cease as of first quarter FY 1975. The $0.8 million of recurring annual non-pay costs for operating FNWC's two CDC-6500 systems at its Monterey facility (less $50,000, as shown later) are expected to continue after the move to Offutt. The composition of these recurring costs plus the special costs that would be incurred during the transition period are summarized below:

Recurring Costs. The recurring costs for operating Class 1 machines are estimated to be a standardized $0.4 million annually (see Table 12 for a summary of non-pay costs by type of EDP equipment).

Special Costs (during Transition)

	Cost (Millions $) FY 73	FY 74	FY 75
• Alterations to Building 200 to provide additional raised flooring (to accommodate leased CDC-6500), increased air conditioing, and plumbing changes	0.1		
• Lease of CDC-6500 System C without Ex. Core storage (ECS) @ $80,000 per mo. (Last Qtr FY 1973, all FY 1974, and first Qtr FY 1975)	0.3	1.0	0.2
• Lease of CDC-6500 System D with ECS @ $98,000 per mo. (All of FY 1974)		1.2	
• Maintenance parts, supplies, power, etc., at annual rate for Class 1 of $0.4 million:			
CDC-6500 System C	0.1	0.4	0.1
CDC-6500 System D		0.4	
• Move personnel from Monterey to Omaha (approx. 40 civilian plus 70 military @ $3500 ea.)		0.4	
• Move all EDP equipment (incl. in-transit insurance)		0.1	
• Move office files and spec. equip. (est. 75 tons @ $10/100 lbs)		0.2	
Total Transition Ops Non-Pay Costs	$0.5	$3.7	$0.3

FNWC operations costs at Offutt are reduced by $50,000 annually beginning with FY 1975, since rental charges for 6,000-sq ft of facilities in Monterey are no longer incurred. (Refer to Explanatory Note A.)

No additional space is needed at Offutt to house the leased CDC-6500 System D, since the CDC-3200 computer is removed at the time System B is transferred to Offutt.

A AFGWC

B

C Under Option 1, AFGWC operations continue unchanged; hence, ex-

D planatory notes for AFGWC under Option 0 also apply here.

E

C. Costs Developed for Option 2

Features of Option 2

Under this option, expanded weather control operations sufficient to meet the needs expected (but not verified by this study) in the 1975-1980 time period are assumed for both the Air Force and Navy. These expanded operations are done at Monterey for the Navy and at Omaha for the Air Force; large amounts of data are transferred between these two centers. Both centers provide tropospheric analyses needed by their respective Services; ocean-buoy data communicated by satellite are received at Omaha and transmitted by land line to Monterey for reduction. Satellite sensed data on the troposphere-stratosphere-thermosphere are reduced and entirely processed at Omaha. Activities of common interest, such as the satellite data processing function (SDPF), are operated as inter-Service joint operations. The SDPF is envisioned to consist of an EDP facility containing a Class 4 computer plus a communications facility. The latter would include three 30-foot antennae and house the electronic equipment that tracks and reads the data from satellites.

Observations About the Costs for Option 2

The costs for Option 2 reflect a considerable increase in the equipment, facilities, and people needed to operate the expanded system. In order to interpret the dollar amounts that appear on Table 9, which summarizes the costs for these resources, it is necessary to refer to several supporting tables that in turn summarize these components in meaningful format. For example, the numbers of personnel are aggregated for each option in Table 4, but also are given in detail for Option 2 in Annex G. Similarly, the EDP equipment procured for this option as well as for Option 3 is summarized on Table 10, while the annual non-pay costs associated with all the equipment on hand at each site are summarized by type of machine and time-phased in Table 11. Table 12 shows how standardized procurement and maintenance prices are developed by type of equipment for use throughout this Appendix. Another summary of major EDP equipment on hand each year, together with the detailed estimates of personnel for this

option, appears in Annex G. Finally, the explanatory notes that follow Table 9 explain how each estimate is developed.

As developed on Table 9, the costs for Option 2 are based on having only one Satellite Data Processing Function (SDPF), located at Omaha, with a high capacity land-line connecting it to Monterey. However, if it were assumed that each Service should have its own SDPF, the Navy would be supplied with its own SDPF at Monterey and the cost of Option 2 would rise by $35.3 million, to $347.4 million, as shown below:

		Ten Year Cost (Million $)
Total cost of Option 2 with 1 SDPF, Per Table 9		$312.1
Plus: Ten year cost of SDPF per Table 9 (includes Class 4 computer & Ground Readout Station with 3 30-ft antennas)	$38.8	
Less: Elimination of land line from Omaha to Monterey per Row C on Table 9 (i.e., $0.5 million annually for years 1974-1980)	3.5	
Net Additional Cost		35.3
Total Cost of Option 2 Assuming 2 SDPFs		$347.4

TABLE 9. OPTION 2 COSTS FOR DATA PROCESSING OF DOD ESS SYSTEMS OF 1975-80

(Millions of Dollars)

Key		FY 71	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80	TOTAL (FY 71-80)
	MONTEREY											
A	Invest. Facilities		3.0	2.0	.3							5.3
B	Invest. EDP Equip.		3.0	-	8.0	13.0	12.0					36.0
	Invest. Total		(6.0)	(2.0)	(8.3)	(13.0)	(12.0)	-	-	-	-	(41.3)
C	Ops-Communications	.5	.5	.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	8.5
D	Ops-Pay & Allowances	1.7	2.1	2.7	3.8	4.8	5.0	5.1	5.1	5.1	5.1	39.7
E	Ops-Non-Pay Costs	.8	1.0	1.2	1.6	2.7	3.5	3.9	3.9	3.9	3.9	26.4
	Ops-Total	(3.0)	(3.6)	(4.4)	(6.4)	(7.7)	(9.5)	(10.0)	(10.0)	(10.0)	(10.0)	(74.6)
	TOTAL Monterey	(3.0)	(9.6)	(6.4)	(14.7)	(20.7)	(21.5)	(10.0)	(10.0)	(10.0)	(10.0)	(115.9)
	OMAHA (AFGWC)											
F	Invest. Facilities	-	.3	1.1	-	-	-	-	-	-	-	1.4
G	Invest. EDP Equip.	-	4.8	-	-	13.0	12.0	-	-	-	-	29.8
	Invest. Total		(5.1)	(1.1)	-	(13.0)	(12.0)	-	-	-	-	(31.2)
H	Ops-Communications	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	12.0
I	Ops-Pay & Allowances	5.9	6.1	7.2	7.5	8.4	9.0	9.7	9.7	9.7	9.8	83.0
J	Ops-Non-Pay Costs	1.7	1.7	2.0	2.0	3.0	3.7	4.3	4.3	4.3	4.3	31.3
	Ops-Total	(8.8)	(9.0)	(10.4)	(10.7)	(12.6)	(13.9)	(15.2)	(15.2)	(15.2)	(15.3)	(126.3)
	TOTAL AFGWC	(8.8)	(14.1)	(11.5)	(10.7)	(25.6)	(25.9)	(15.2)	(15.2)	(15.2)	(15.3)	(157.5)
	OMAHA-SATELLITE DPF											
K	Invest. Facilities	-	4.1	1.0								5.1
L	Invest. EDP Equip.	-		12.0	1.0							13.0
	Invest. Total		(4.1)	(13.0)	(1.0)							(18.1)
M	Ops-Communications	-	-	-	-	-	-	-	-	-	-	0
N	Ops-Pay & Allowances	-	.5	.9	1.3	1.3	1.3	1.3	1.3	1.3	1.3	10.5
O	Ops-Non-Pay Costs	-	-	-	1.2	1.5	1.5	1.5	1.5	1.5	1.5	10.2
	Ops-Total		(.5)	(.9)	(2.5)	(2.8)	(2.8)	(2.8)	(2.8)	(2.8)	(2.8)	(20.7)
	TOTAL Satellite DPF	-	(4.6)	(13.9)	(3.5)	(2.8)	(2.8)	(2.8)	(2.8)	(2.8)	(2.8)	(38.8)
	GRAND TOTAL OPTION 2	(11.8)	(28.3)	(31.8)	(28.9)	(49.1)	(50.2)	(28.0)	(28.0)	(28.0)	(28.1)	(312.1)

EXPLANATORY NOTES FOR TABLE 9
(OPTION 2 COSTS)

Key

A Investment--Facilities, Monterey

Facilities required at Monterey for Option 2 are estimated to total $5.3 million, spread over the years FY 1972 through FY 1974. The proposed facility consolidates all FNWC activities in the Monterey area into a multiwing building at the Presidio. The costs for this building (which is to house three CDC-6500s, 1 Class 2, and two Class 4 computers) are developed in three parts as follows:

	Sq Ft of Area		
	Total Bldg.	Raised Floor	Est. Cost ($ Millions)
Basic Meteorological Bldg.(Funds already requested by FNWC to house two 6500s and one Class 4)	33,000	16,200	$ 3.0
Additions to Met.Bldg. to satisfy computer needs in Option 2 (1 ea of Class 3 and 4)	18,000	9,000	1.4
Climatology File Area	1,400	700	0.1
Offices for 128 programmers	25,600	--	0.8
Total Facility	77,000	25,900	$ 5.3

The $3 million estimate for the meteorological building is based on an architect's detailed estimate that supports the FNWC's 1970 request for about $2.8 million of military construction funds for a new meteorological building designed to house two CDC-6500 and one CDC-STAR computer systems and all the supporting FNWC activities, except office space for programmers. That estimate of construction costs includes supporting equipment such as emergency

generator, standby air conditioning, etc. The requested meteorological building is designed to have 33,000 sq ft of floor area including 16,200 sq ft of raised flooring.

At $3 million for the entire meteorological building the 16,200 sq ft of raised flooring amounts to $185 per sq ft which is the factor used in this study to estimate the cost of a new facility but additions for such space are costed at $150 (i.e., 80 percent of $185). Accordingly, $150 per sq ft was used to estimate the cost of adding 9,000 sq ft of raised flooring (and automatically providing a proportionate share of regular floor area) to the meteorological building to house three additional computers and provide a proportionate share of office and bay work area. The estimate of 9,000 sq ft is based on a CDC engineering estimate that suggests allowing about 3,000 sq ft of raised floor area (which includes space for customer engineering, motor generator, and equipment cooling) to accommodate a STAR computer system.

To accommodate the climatology file, 700 sq ft of raised floor area (at $150 per sq ft) are added.

The estimate of $0.8 million to construct non-air conditioned office space for programmers is added here because the requested meteorological building does not provide such space. The estimate is based on a need for offices for 123 applications and systems programmers postulated in Option 2 for Monterey. Each person is assumed to require 200 sq ft of space at $30 per sq ft (20 x 200 sq ft x 128 = $0.8 million).

B Investment EDP Equipment--Monterey

See Table 10 for a summary of the EDP equipment procured for Monterey under this option.

C Operations-Communications, Monterey

Current FNWC leased-lines communications costs are estimated to be $0.5 million annually; this amount is expected to continue through 1980 except that beginning with FY 1974 a 40.8 KHz wideband line is needed from Omaha to Monterey, at a cost of $0.5

million annually. The estimate is based on the latest tariff schedule, which indicates that such a line costs about $30 per airline mile per month. In addition, there is a terminal charge at each end of $240 per month. Hence the computation for the wide-band line is: $30 x 1424 miles + $480 x 12 mo. = approximately $0.5 million.

D Operations-Pay and Allowances, Monterey

Refer to Table 4 for numbers of personnel at $12,000 each.

E Operations-Non-Pay Costs, Monterey

See Table 11 for composition of these estimates.

F Investment Facilities--Omaha

The EDP equipment postulated in this option for Omaha includes two Univac-1108 multiprocessors, two Univac-1110s, two Class 4 machines, and one climatology storage file. The costs of the facilities needed to house this equipment are estimated in three parts as follows:

	($ Millions)
1 Univac-1110 (partial)	$ 0.3
2 Class 4 @ $480K ea.	1.0
1 climatology storage	0.1
Cost of Total Additional Facilities	$ 1.4

The computations used in deriving these estimates are detailed below:

- AFGWC currently has four Univac-1108s. When these are converted to two 1108 multiprocessors and two 1110s, there will be a shortage of 2000 sq ft of raised floor area needed to accommodate the more powerful machines. The cost for the needed 2000 sq ft of raised flooring (which includes space for maintenance and additional support facilities, such as cooling, standby, and no-break power, etc.) is estimated at $150 per sq ft of raised-floor area, i.e., 2000 x $150 = $300K.

- Costs of the facilities for the two Class 4 computers are developed as follows:

	Sq Ft Req'd	Price Sq Ft	Facility Cost
Raised floor area only	3,000	$ 50	$ 150K
Related offices, test area, work bays, tape vaults, storage	2,000	40	80
Emergency & no-break power, stand-by air conditioning	--	--	250
Total Facilities Cost/Class 4			$480K

Note: $480,000 divided by 3000 sq ft translates to $160/sq ft of raised floor area.

- Climatology storage facilities are estimated to cost $0.1 million (i.e., 700 sq ft of raised floor area x $150 sq ft = $105 thousand).

G Investment--EDP Equipment, Omaha

See Table 10 for summary of EDP equipment procured for Omaha under this option; also Table 13 for itemization of cost of converting four Univac-1108s.

H Operations-Communications, Omaha

AFGWC leased circuit costs are estimated (per an analysis prepared by AFGWC and summarized on Table 6) to be almost $100 thousand per month or $1.2 million annually. This charge is assumed to continue through 1980.

I Operations-Pay and Allowances, Omaha

Refer to Table 4 for numbers of personnel at $12,000 each.

J Operations-Non-Pay Costs, Omaha

See Table 11 for summary of these estimates.

K Investment Facilities- Omaha, SDPF

The facilities needed for the satellite data processing are viewed as consisting of two parts: 1) an EDP wing or building

and 2) a communications wing or building. The estimated costs for these two facilities are detailed below:

- EDP Wing. This EDP facility consists of the housing for a Class 4 computer (estimated at $480K) and for a buffer storage file (estimated at $100K) for a total cost of $580 thousand. Both estimates include the construction cost of the raised floor area (including vendor maintenance area, etc.) plus proportionate related administration offices, work bays, etc., as well as power facilities such as emergency power, standby air conditioning, no-break power, etc. (See Explanatory Note F.)
- Communications Wing. This facility which houses the electronic equipment that communicates with a satellite, is estimated to cost $4.5 million. The major components in this estimate are:

	Cost ($ Millions)
Bldg. construction (est. at 10,000 sq ft @ $50/sq ft including ducts, busways, cabling, etc.)	$ 0.4
30 ft antenna and foundation, 3 ea.	0.9
Electronic equipment (tracking, computer, monitor, duplexer, amplifier, receiver, transmitter, instrumentation, clocks and timing generators.	1.5
Support facilities (power generator, cooling, AGE).	0.5
Installation, engineering, transportation, management, documentation.	0.7
Initial spares (@ 10% of Elec. Equipment), plus test facilities and equipment.	0.5
	$ 4.5

L Investment--EDP Equipment - Omaha - SDPF

Refer to Table 10 for a summary of these estimates.

M Operations--Communications - Omaha - SDPF

No additional leased circuits costs were envisioned for this operation which is collocated with AFGWC EDP area.

N Operations-Pay and Allowances - Omaha - SDPF

Refer to Table 4 for number of personnel at $12,000 each.

O Operations-Non-Pay Costs - Omaha - SDPF

See Table 11 for composition of these estimates.

TABLE 10. SUMMARY OF ESTIMATED EDP PROCUREMENT COSTS FOR EQUIPMENT POSTULATED IN OPTIONS 2 AND 3

Key		Qty	(Cost (Million $) Per Unit	Total
	OPTION 2 (Ref. Table 9)			
	Investment - EDP Equipment			
B	Monterey			
	CDC 6500 (c)	1	$ 3	$ 3.0
	Class 3	1	8	8.0
	Class 4	2	12	24.0
	Climatology Storage	1	1	1.0
	Total Posted in Row B			$36.0
G	Omaha - EDP			
	Conversion of 4 Univac 1108's	-	-	4.8
	Class 4	2	12	24.0
	Climatology Storage	1	1	1.0
	Total Posted in Row G			$29.8
L	Omaha - Sat. DPC			
	Class 4	1	12	12.0
	Buffer Storage	1	1	1.0
	Total Posted in Row L			$13.0
	OPTION 3 (Ref. Table 14)			
	Investment - EDP Equipment			
B	Monterey			
	CDC 6500 (c)	1	3	3.0
G	Omaha			
	Conversion of 4 Univac 1108's	-	-	4.8
L	Site "C"			
	Class 3	2	8	16.0
	Class 4	4	12	48.0
	Archival Storage	1	1	1.0
	Buffer Storage	1	1	1.0
	Total Site "C"			$66.0

Dollar totals on this summary appear in the respective "total" columns for "Investment - EDP Equipment" on the Summary Cost Tables for Options 2 and 3. The appropriate time-phasing can be deduced from the applicable Time-Plan that appears in Appendix F and also in an Annex to this Appendix. The costs for converting four Univac 1108s are detailed in Table 13.

TABLE 11. SUMMARY OF OPS NON-PAY COSTS DEVELOPED FOR OPTIONS 2 AND 3 (USED IN ROWS E, J AND O ON TABLES 9 AND 14)

Key		Non/Pay Cost/Mach. (Million $)	Max. No.Mach.	Millions of Dollars FY 71	'72	'73	'74	'75	'76	'77	'78	'79	'80	Total
	OPTION 2													
E	Monterey													
	CDC-6500 A&B	$0.4	2	.8	.8	.8	.8	.8	.8	.8	.8	.8	.8	
	CDC-6500 C	0.4	1	-	.2	.4	.4	.4	.4	.4	.4	.4	.4	
	Class 3	0.6	1				.4	.6	.6	.6	.6	.6	.6	
	Class 4	0.8	2					.4	1.2	1.6	1.6	1.6	1.6	
	Climatology Storage	0.5	1					.5	.5	.5	.5	.5	.5	
	Total Monterey			.8	1.0	1.2	1.6	2.7	3.5	3.9	3.9	3.9	3.9	26.4
J	Omaha													
	Univac 1108	0.43	4	1.7	1.7	-	-	-	-	-	-	-	-	
	Univac 1108MP	0.48	2	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
	Univac 1110	0.48	2	-	-	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	
	Class 4	0.90	2					.5	1.2	1.8	1.8	1.8	1.8	
	Climatology Storage	0.50	1					.5	.5	.5	.5	.5	.5	
	Total Omaha			1.7	1.7	2.0	2.0	3.0	3.7	4.3	4.3	4.3	4.3	31.3
O	Satellite DPF (Omaha)													
	Sat.Grd.Station (non-EDP Supplies Serv.)						.3	.3	.3	.3	.3	.3	.3	
	Class 4	0.9	1				.7	.9	.9	.9	.9	.9	.9	
	Buffer Storage	0.3	1				.2	.3	.3	.3	.3	.3	.3	
	Total Satellite DPC						1.2	1.5	1.5	1.5	1.5	1.5	1.5	10.2
	OPTION 3													
E	Monterey									C L O S E D				
	CDC 6500 A&B	0.4	2	.8	.8	.8	.8	.8	.8					
	CDC 6500 C	0.4	1	-	.2	.4	.4	.4	.4					
	Total Monterey			.8	1.0	1.2	1.2	1.2	1.2					6.6
J	Omaha									C L O S E D				
	Univac 1108	0.43	4	1.7	1.7	-	-	-	-					
	Univac 1108MP	0.48	2	-	-	1.0	1.0	1.0	1.0					
	Univac 1110	0.48	2	-	-	1.0	1.0	1.0	1.0					
	Total Omaha			1.7	1.7	2.0	2.0	2.0	2.0					11.4
O	Site "C"													
	Grd Station (non-EDP Supplies & Serv.)							.3	.3	.3	.3	.3	.3	
	Class 3	0.6	2	-	-	-	-	.9	1.2	1.2	1.2	1.2	1.2	
	Class 4	0.9	4	-	-	-	-	.7	1.4	2.3	3.2	3.6	3.6	
	Buffer Storage	0.3	1	-	-	-	-	.2	.3	.3	.3	.3	.3	
	Archival Storage	0.5	1	-	-	-	-	-	.3	.5	.5	.5	.5	
	TOTAL Site "C"			-	-	-	-	2.1	3.5	4.6	5.5	5.9	5.9	27.5

Note: The "Non-Pay Costs" per machine summarized here are detailed on Tables 12 and 13.

TABLE 12. STANDARDIZED ESTIMATES OF COSTS USED FOR PROCUREMENT AND ANNUAL MAINTENANCE OF EDP EQUIPMENT*
(Millions of Dollars)

	Machine Class				Storage Files	
	1	2	3	4	Climatology	Buffer
Purchase Price[a]	$3.0[b]	5.0	8.0[c]	12.0	$ 1.0	$ 1.0
Annual Mtc. Charges (per machine)						
Prime Shift mtc. chg. to GSA[d]	.1	.14[e]	.3	.45[f]		
Paper, tapes, supplies	.2	.20	.2	.20		
Power, air conditioning, standby power & A/C	.1	.10	.1	.1		
Total Annual Cost at Monterey & Site C	$ .4	.44	.6	.8	.5	.3
Total Annual Cost at AFGWC (i.e., Prime Shift Maint. Charge at 130%[g] plus lines 2 and 3)	.43	.48	.7	.9	-	.3

(a) The cost of procuring the regular air conditioning, standby power and air conditioning, no-break power, etc., is treated as a facility investment cost, hence excluded here under "EDP Equipment-Procurement".
(b) The four Univac 1108 systems at AFGWC cost approximately $9.4 million, averaging $2.3 million each. FNWC paid $2.7 million for a CDC 6500, excluding supporting computers such as CDC 3200s. The estimate of $3 million used here is for a complete system, including various costs associated with the acquisition.
(c) See Annex A for an itemization of a representative Class 3 computer system costing $8 million and having an annual prime-shift maintenance charge of $.275 million.
(d) These annual prime shift maintenance costs are based on the following monthly CDC charges to GSA for representative systems: Class 1 = $9,000; Class 3 = $23,000, and Class 4 = $37,000. The monthly rates were annualized and rounded to the amounts shown.
(e) The Class 2 machines, for this study, apply to the converted Univac 1108s. Based on that cost data, supplied on Table 13, the prime shift maintenance cost for a Class 2 system amounts to $0.14 million.
(f) Annex B supplies a representative configuration for a Class 4 computer system. The STAR computer configuration shown on Annex B reflects a total purchase cost of approximately $12 million and a prime shift maintenance charge that, annualized, converts to $.372 million. Throughout this study, though, a slightly higher annual prime shift maintenance estimate of $.45 million was used for a Class 4 system, reflecting the maintenance cost for a configuration postulated earlier in the study.
(g) Continuing Air Force practice, non-EDP costs at Omaha reflect 130% of the manufacturer's prime shift maintenance charges to GSA. AFGWC is currently paying $.137 million annually (at 130%) for full maintenance on its average Univac 1108s, vs. the $.1 million shown here for prime shift maintenance only, of a Class 1 machine.

*Used in developing estimates for "Investment - EDP Equipment", and "O&M - Non-Pay Costs".

TABLE 13. ADDITIONAL COSTS OF UPGRADING UNIVAC 1108's AT AFGWC

(Used in Developing Estimates for "Investment-EDP Equipment" for Options 2 and 3)

CONVERSION COSTS

The total cost of converting the four Univac 1108 systems currently at AFGWC into two 1110 systems and two 1108 multiprocessors is as follows:

		$ in Thousands
Additional hardware needed (refer to itemized listing below) to convert 1108 A&C System to two 1110's	= $1945 x 2 =	$3,890*
An additional 131K of ECS		915
Total cost for the two 1110 systems (A&C)		$4,805*
Cost to convert 1108 B&D System to two 1108 Multiprocessors (assumes old 1108 CPU from Systems A&C are used by Systems B&D)	= $8.70 x 2 =	17
Total Cost of Conversion (4 machines)		$4,822

RECURRING ANNUAL COSTS

AFGWC currently is paying Sperry-Rand $45.7 per month (i.e., 130% x Pr. shift charge) or about $548 thousand annually for complete maintenance on its four 1108 systems. This amount would be increased for the more powerful four-machine system by $182 thousand, i.e., $4975 + 200 + (1345 ÷ 2)x 12 x 130%. The total annual maintenance cost to AFGWC then for the more powerful system is $730 thousand.

UNIVAC HARDWARE NEEDED TO CONVERT TO MORE POWERFUL SYSTEM

			Unit Cost		System Cost	
Qty	Model No.	Description	Purchase	Pr.Shift Maint. Charge Per Mo.	Purchase	Pr.Shift Maint. Charge Per Mo.
1	3023-99	1110 Processor - includes 2 command / arithmetic units (CAU), 1 input-out access unit (IOAU) with 8 I/O channels and interface for up to 262,144 words of main storage and up to 1,048,576 words of extended storage.	$692,520	$ 2,655	$692,520	$ 2,655
3	7015-00	Storage - provides 32,768 words of main storage. 3 units provide 98K of storage	300,805	425	902,415	1,275
1	4013-99	System Console - includes CRT display with entry keyboard, hard copy printer and real-time maintenance communication RTMCS) interface.	63,730	270	63,730	270
1	3021-99	Communication/Symbiont Processor	21,120	60	21,120	60
1	1276-99	1100 channel adapter - provides direct interface capability for an 1100 series system I/O channel.	5,280	20	5,280	20
1	7010-87	Storage - 32,768 bytes. 630 NS cycle time per 2 bytes, includes storage protection.	40,800	125	40,800	125
1	8542-00	General purpose communications channel. Includes data transfer control, processor interface logic, accommodations for 32 communications line terminals (CLT's), a multiplexer with 8 positions (4 CLT's), 1 asynchronous timing source.	11,040	30	11,040	30
4	0963-00	Multiple access interface - provides 4 access interfaces and control module for 131K of unitized extended storage.	43,065	120	172,260	480
4	F1397-00	1108 storage interface.	8,920	15	35,680	60
		Total common additions needed per 1108 to convert it to an 1110 system (needed for Systems A and C)			$1,944,845	$4,975
		Additional core memory needed to obtain a total of 262K of extended core storage on the two 1110s:				
1	7005-89	Core memory - 131K			915,000	1,345
		Additional unit needed to convert 1108 to an 1108 multiprocessor (for systems B & D) is an F-1053-99 multiprocessor			8,700	200

*The $4.8 million required to convert the four Univac 1108s appears on Table 10.

Source: Prices from Univac 1110 Price List, Effective January 8, 1971.

D. Costs Developed for Option 3

Features of Option 3

Under this option, an inter-Service, jointly operated Environmental Services Support Center (ESSC) is postulated that is equipped to meet 1975-1980 expected (but not verified by this study) DoD needs for environmental data. The center is located at a site not selected by this study but was assumed for costing purposes to be at Omaha, separate from the present operational centers. Interim operation of both present centers is assumed until a new site is fully operational. Present centers are assumed to reduce operations, deactivate, or assume new tasks beginning in FY 1977. As in the case of Option 2, the cost of the satellite ground read-out function is charged to the option, but the costs of getting data to this ground station (i.e., the costs of the sensing satellites, relay satellites and the buoy system) are excluded.

Observations About the Costs for Option 3

The costs for this option, which are summarized in Table 14, reflect considerably more equipment, facilities, and people than are now present in the operations at the two centrals. A time phased list of all the EDP equipment postulated for this option (as well as for Option 2) appears on Table 11. The time-phased plan for Option 3 appears as Annex E; it shows by site when each type of EDP equipment is phased in and out and the facility construction schedule necessary in order to allow operations to begin in those new facilities. Functional, time-phased breakouts of the estimates of personnel for this option, as well as the major EDP equipment on hand each year, appear in Annex H. The time-phased funding needed to procure new equipment is summarized by site in Table 10, and a summary of all EDP equipment maintenance costs appears in Table 11.

TABLE 14. OPTION 3 COSTS FOR DATA PROCESSING OF DOD ESS SYSTEMS OF 1975-1980

Key		FY 71	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80	TOTAL (FY 71-80)
	MONTEREY											
A	Invest. Facilities	-	.1	-	-	-	-	-	-	-	-	.1
B	Invest. EDP Equip.		3.0									3.0
	Invest. Total	-	(3.1)	-	-	-	-	-	-	-	-	(3.1)
C	Ops-Communications	.5	.5	.5	.5	.5	.5	-	-	-	-	3.0
D	Ops-Pay & Allowances	1.7	2.1	2.1	2.1	2.1	2.1	-	-	-	-	12.2
E	Ops-Non-Pay Costs	.8	1.0	1.2	1.2	1.2	1.2	-	-	-	-	6.6
	Ops-Total	(3.0)	(3.6)	(3.8)	(3.8)	(3.8)	(3.8)	-	-	-	-	(21.8)
	TOTAL Monterey	(3.0)	(6.7)	(3.8)	(3.8)	(3.8)	(3.8)	-	-	-	-	(24.9)
	OMAHA											
F	Invest. Facilities	-	.3	-	-	-	-	-	-	-	-	.3
G	Invest. EDP Equip.	-	4.8	-	-	-	-	-	-	-	-	4.8
	Invest. Total	-	(5.1)	-	-	-	-	-	-	-	-	(5.1)
H	Ops-Communications	1.2	1.2	1.2	1.2	1.2	1.2	-	-	-	-	7.2
I	Ops-Pay & Allowances	5.9	6.1	7.1	7.1	7.1	7.1	-	-	-	-	40.4
J	Ops-Non-Pay Costs	1.7	1.7	2.0	2.0	2.0	2.0	-	-	-	-	11.4
	Ops-Total	(8.8)	(9.0)	(10.3)	(10.3)	(10.3)	(10.3)	-	-	-	-	(59.0)
	TOTAL - Omaha	(8.8)	(14.1)	(10.3)	(10.3)	(10.3)	(10.3)	-	-	-	-	(64.1)
	SITE C (incl. Sat. DPF)											
K	Invest. Facilities	-	11.9	-	-	-	-	-	-	-	-	11.9
L	Invest. EDP Equip.					29.0	13.0	12.0	12.0			66.0
	Invest. Total	-	(11.9)	-	-	(29.0)	(13.0)	(12.0)	(12.0)	-	-	(77.9)
M	Ops-Communications	-	-	-	.5	1.5	1.5	1.5	1.5	1.5	1.5	9.5
N	Ops-Pay & Allowances	-	-	.5	3.3	7.0	9.2	12.6	13.3	13.3	13.3	72.5
O	Ops-Non-Pay Costs	-	-	-	-	2.1	3.5	4.6	5.5	5.9	5.9	27.5
	Ops-Total	-	-	(.5)	(3.8)	(10.6)	(14.2)	(18.7)	(20.3)	(20.7)	(20.7)	(109.5)
	TOTAL Site C	-	(11.9)	(.5)	(3.8)	(39.6)	(27.2)	(30.7)	(32.3)	(20.7)	(20.7)	(187.4)
	GRAND TOTAL OPTION 3	(11.8)	(32.7)	(14.6)	(17.9)	(53.7)	(41.3)	(30.7)	(32.3)	(20.7)	(20.7)	(276.4)

EXPLANATORY NOTES FOR TABLE 14
(Costs for Option 3)

Key

A Investment Facilities--Monterey

The maximum equipment postulated for Monterey under Option 3 calls for 3 CDC-6500's--one more than is currently on hand. FNWC management states that it can squeeze the third CDC-6500 into the already crowded computer center (Bldg. 200), but probably some alterations to that building would be needed and some of the equipment currently in the building would have to be transferred out. Such crowded conditions perhaps can be tolerated for a time since that building would be vacated at the end of FY 1976, according to this option. An allowance of $100 thousand is made in this option to accommodate the necessary alterations and facility enhancement.

B Investment EDP Equipment--Monterey

A CDC-6500 is procured for this option in FY 1972. (Refer also to Table 10).

C Operations--Communications, Monterey

No changes are anticipated, under this option, to the leased-lines charges applicable to Monterey (and also Omaha) until those facilities are closed, at the end of FY 1976.

D Operations--Pay and Allowances, Monterey

Table 4 supplies estimates of annual manning @ $12,000 per person.

E Operations--Non-Pay Costs, Monterey

The composition of this element appears in Table 11.

F Investment Facilities--Omaha

Under Option 3, the four Univac-1108s currently on hand at AFGWC Omaha are converted into two Univac-1108 multiprocessors and two 1110s. This improved system operates at Omaha until site C is fully operational, then it is phased out (FY 1976). This more powerful system is also a part of Option 2, and the facility needs for this system are explained in explanatory note F to Table 9 (i.e., an additional 2000 sq ft of raised flooring for the second Univac-1110, estimated to cost $300 thousand).

G Investment EDP Equipment--Omaha

The composition of the estimates for EDP equipment appears in Table 10; details regarding the cost of converting four Univac-1108s appear in Table 13.

H Operations--Communications, Omaha

No change is anticipated to Omaha's current annual leased-lines costs until 1976, at which time that facility is closed, according to this option.

I Operations--Pay and Allowances, Omaha

See Table 4 for annual estimates of manning @ $12,000 per person.

J Operations--Non-Pay Costs, Omaha

The composition of the annual estimates for this element appears in Table 11.

K Investment Facilities--Site C

Under Option 3, Site C is scheduled to have the following major EDP equipment: two Class 3 machines, four Class 4 machines, two archival storage units (a climatology storage unit and a Buffer storage), and satellite communications hardware. Housing this equipment requires construction of raised floor facilities and related work bays:

	Sq Ft Required	
	Per Machine	Total
2 Class 3 computers	3,000	6,000
4 Class 4 computers	3,000	12,000
2 archival storage units	700	1,400
Total Raised Flooring		19,400

Calculated at $150 per sq ft, the 19,400 sq ft of raised flooring costs $2.9 million. The factor of $150 per sq ft of raised flooring allows for a computer maintenance area, cooling units, emergency power, and no-break power equipment. This factor provides a proportionate share of work areas for operations maintenance and EDP administrative offices but not for offices for programmers or meteorological personnel. The costs for constructing these offices is estimated separately, as follows:

Offices for 748 persons @ $6,000 = $4.5 million

(748 persons are sum of 72 system programmers, 243 applications programmers, and 433 observer forecasters. An allowance of 200 sq ft per person is assumed and costed at $30 per sq ft)

The satellite communications facility is estimated to cost $4.5 million (this estimate covers a 10,000-sq ft building, its electronic equipment, including three 30-ft antennae, etc.). Refer also to explanatory note K to Table 9.

In summary, the costs of facilities for Site c are estimated at $11.9 million as recapped below:

	Total Cost (Million $)
Computer facilities	$2.9
Offices for programmers, observers	4.5
Sat. Communications Bldg.	4.5
Total Facilities Costs for Site C	$11.9

Facilities constructed at Site C are assumed to be built in the United States on government-owned land and provided with the basic security found on a base.

L Investment--EDP Equipment, Site C

Table 10 lists the equipment postulated at Site C under this option. Table 12 supplies additional information regarding standardized EDP procurement and annual maintenance estimates used in this study.

M Operations--Communications, Site C

Since Site C consolidates the separate communications for Monterey and Omaha (estimated to be respectively $0.5 million and $1.2 million), such consolidation can eliminate some duplication; hence, leased-lines charges for Site C are estimated at $1.5 million. Only after the location of Site C is chosen and a thorough study is made of the new communication needs can a meaningful estimate be made of the costs for those communications. Regardless of the location of the new site, a one-time hook-up or installation charge can be expected, estimated for this option to occur in FY 1974 and amount to $0.5 million.

N Operations--Pay and Allowances, Site C

See Table 4 for estimates of annual manning computed at $12,000 per person.

O Operations--Non-Pay Costs, Site C

See Table 11 for the composition of the estimates for this cost element.

BIBLIOGRAPHY

Authorized Federal Supply Schedule Price List, Control Data Corporation, 1971 edition.

Authorized Federal Supply Schedule Price List, Sperry Rand, 1971 edition.

Federal Plan for Marine Environmental Prediction, Fiscal Year 1972.

The Federal Plan for Meteorological Services and Supporting Research, Fiscal Year 1972.

Univac 1110 Price List, dated January 8, 1971, issued by Sperry Rand Univac Controller's Department.

USAF, Headquarters Air Weather Service (MAC), letter from Director, Systems Management Directorate, DCS/Systems to A.J. Grobecker, IDA, 4 February 1971.

ANNEX A

A REPRESENTATIVE CLASS 3 COMPUTER SYSTEM

(The CDC 7600 System Itemized Below is Installed at Livermore)

Qty.	Model #	Description	Purchase $ (millions)	Basic Month Maint.	Totals: Purchase $ (millions)	Totals: Basic Month Maint.
1	7613-1	Central Processor with 65,536 60-bit words of small core memory and 512,000 60-bit words of large core memory. Seven bi-directional I/O channels - each with assembly/disassembly logic, six 7602-1 peripheral processors - each attached to one of the I/O channels, and one maintenance control unit with card reader and visual display. Expandable to 15 bi-directional I.O channels and 13 7602-1 peripheral processors. Power and cooling included.	$ 6.02	$16,575	$ 6.02	$16,575
4	7602-1	Peripheral Processor. 12-bit, 4,096 word of independent magnetic core storage, two multiphased bands of 2048 words, controls up to 6 peripheral stations. (Note: these 4 are in addition to the 6 shown under the Central Processor.)	.05	97	.20	388
1	7606-1	Data Channel Unit. Four bi-directional CPU I/O channels, each with assembly/disassembly logic. Attaches to a 7613-1, 7614-1, 7615-1, or 7616-1 central processor, incrementing the number of data channels from 7 to 11. A second 7606-1 data channel unit can be used to increment the number of CPU channels from 11 to 15. Field installable.	.058	2,808	.058	2,808
2	7638-1	Disk File System. Provides 4.8 billion bit disk file and controller with 2 read/write controls each with time-shared access to 2 independent channels. 42 MC peak bit transfer rate.	.40	178	.80	356
1	7600-50	Drum File System - provides 50 million bits & controller with a head per track. Provides a 6 megabit per second transfer rate with a 34 millisecond rotational latency time.	.210	575	.210	575
3	7681	Data Channel Converter - permits 7000 series computers to use 3000 series peripheral equipment.	.0495	120	.147	360
1	512-1	Line Printer. Train printer, prints 1200 lines/minute using 48 character train, skips 70 inches/second at 6 lines/inch or 60 inches/second at 8 lines/inch, 136 columns, does not include interchangeable 595 series train cartridge.	.0477	236	.0477	236
1		Train Cartridge. 63 printing characters plus space, same as 501 printer character set, modified standard gothic font.	.00318	T&M*	.00318	T&M*
1	3555-1	Line Printer Controller. Single channel connection, controls one printer, full line buffer, train image storing, checking.	.02862	47	.02862	47
1	3423	Magnetic Tape Controller. Two independent channel connections, controls up to 8 tape units of a single model.	.07367	168	.07367	168
1	405	Card Reader. Reads 1200 cards/minute for 80 column cards, reads 1600 cards/minute for 51 column cards, 4000 card hopper capacity, 4000 card stacker capacity, 240 card secondary stacking capacity for limited sorting or rejecting.	.02491	69	.02491	69
1	3649	Card Reader Controller. Two channel connections, controls one card reader, full card buffer, BCD conversion, checking.	.01802	42	.01802	42
1	3291	Single Station Entry/Display. Display area is 6 x 8 inches, display format is 20 lines of 50 characters, 64 characters, single channel connection, includes keyboard, 1000 character buffer and character generator.	.01484	42	.01484	42
8	607	Magnetic Tape Transport. 7-track, 150 inches per second, 200, 556, and 800 BPI, 30, 83.3, and 120 KC. Read forward and reverse. Operator controls located in center of front panel.	.04664	157	.37312	1,256
		TOTAL			$8.01906	$22,922.

*Time and Material

ANNEX B

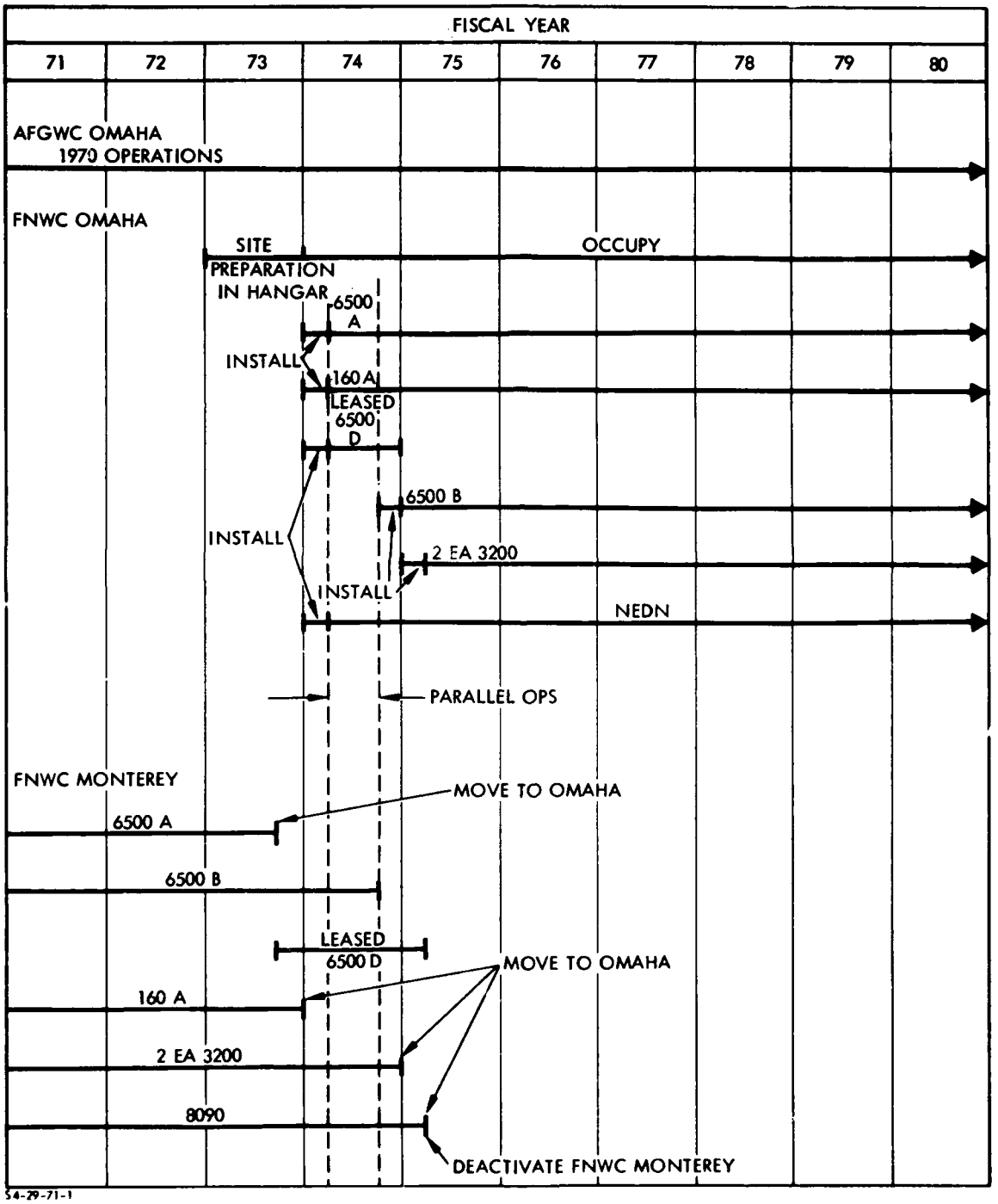
A REPRESENTATIVE CLASS 4 COMPUTER SYSTEM[a]
(Dollars have been rounded and are expressed in thousands)

Qty	Description[b]	Cost Per Unit		System Cost	
		Purchase	Mo.Maint.	Purchase	Basic Mo. Maint.
1	Processor Unit - Central Processor with high performance string array arithmetic unit; one million 32-bit words of memory at 1.28 microsecond cycle time; eight direct data channels; one memory channel; maintenance control unit with display, card reader, printer and magnetic tape unit; and power supplies and cooling apparatus.	$ 7,410	$ 17	$ 7,410	$ 17
1	Paging Station - One fifty-million bit, 34 ms magnetic storage drum with associated controller. First level interface via one direct data channel.	350	1	350	1
4	Disk File Assembly - 4.5 billion bit disk file with controller. First level interface via one or two direct data channels.	550	2	2,200	7
1	Multiple Disk Drive Assembly - 1.6 billion bits of magnetic disk storage on 8 spindle drive with controller. First level interface via one or two direct data channels.	440	1	440	1
1	Magnetic Tape Station - 2 x 8 Magnetic Tape Controller with first level interface via two direct data channels. Four 659-4 Magnetic Tape Transports are included.	450	2	450	2
1	Service Station - Station provides STAR data channel expansions giving a total of eight charnels feeding into a single mainframe channel. Includes 50-million bit magnetic storage drum.	390	1	390	1
1	Unit Record Station - I/O Station with a 405 Card Reader, 415 Card Punch, two 512 Printers and associated controllers.	380	1	380	1
1	Model 3528-3 Magnetic Tape Controller - Two independent channel connections, controls up to 8 model 657 or 659 (intermixed) tape units, provides code conversion, 200, 556, or 800 BPI, NRZI and 1600 BPI phase encoded.	70	.3	70	-
4	Model 657-4 Magnetic Tape Transport - Seven tracks, 30K, 83.3K and 120K 6-bit characters/second, 200, 556, and 800 bits/inch, reads and writes 150 inches/second, forward and reverse read.	47	.1	187	1
	TOTAL			$11,877	$31[c]

a. This representative Class IV system reflects a CDC STAR configuration scheduled for Los Alamos but augmented with additional disk capacity for use on weather problems.
b. Descriptions were extracted from the latest CDC GSA catalog and from a quotation to a government agency.
c. Annualized, the Prime Shift Maintenance cost for this system is approximately $372 thousand (i.e., $31 x 12).

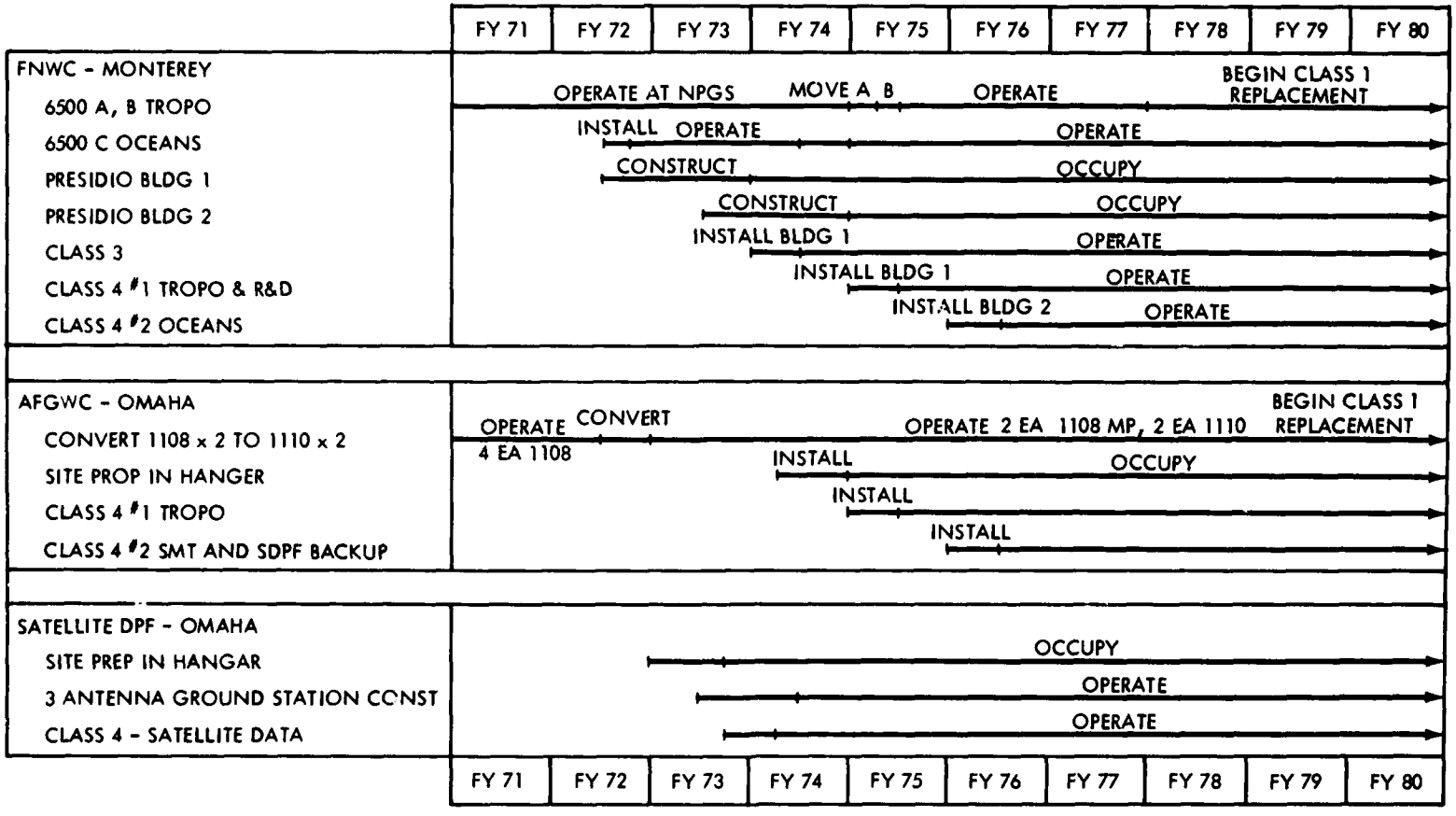
ANNEX C

TIME-PHASED PLAN FOR OPTION 1



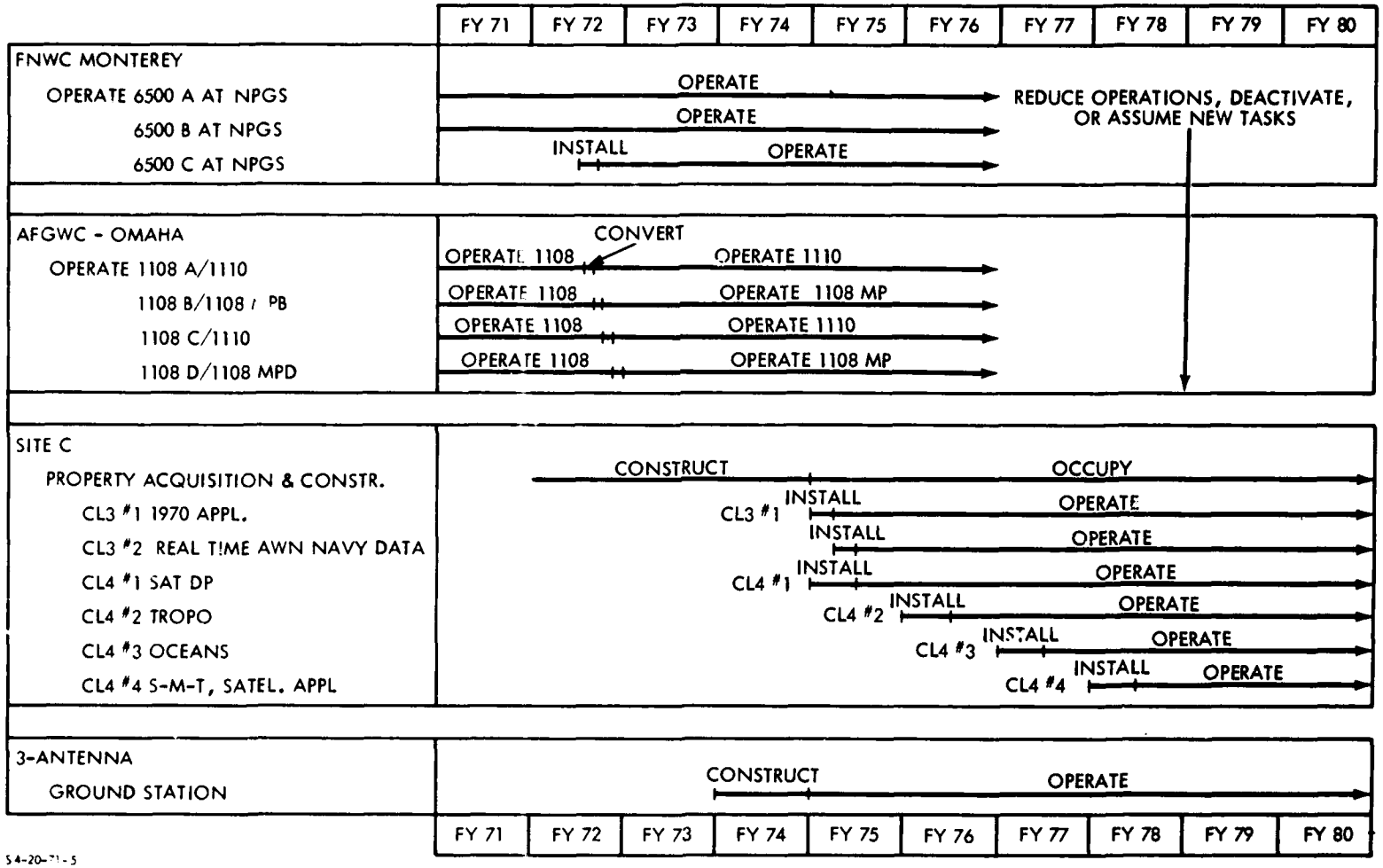
ANNEX D

TIME-PHASED PLAN FOR OPTION 2



ANNEX E

TIME-PHASED PLAN FOR OPTION 3



S4-20-71-5

ANNEX F

PERSONNEL ESTIMATES FOR OPTION 1

	FY 71	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80
FNWC Monterey Equipment	2_1	2_1	2_1	2_1	0	0	0	0	0	0
A. Operators	39	39	39	39	0	0	0	0	0	0
B. Maintenance & Engineering	22	2	22	22	0	0	0	0	0	0
C. Systems Programming	7		7	7	0	0	0	0	0	0
D. Applications Programming	55	55	55	55	0	0	0	0	0	0
E. Administration	15	15	15	15	0	0	0	0	0	0
Subtotal	138	138	138	138	0	0	0	0	0	0
F. Meteorology/Oceanography/ Quality Control	5	5	5	5	0	0	0	0	0	0
TOTAL-FNWC MONTEREY	143	143	143	143	0	0	0	0	0	0
FNWC Omaha Equipment	0	0	0	2_1	2_1	2_1	2_1	2_1	2_1	2_1
A. Operators	0	0	0	40	40	40	40	40	40	40
B. Maintenance & Engineering	0	0	12	22	22	22	22	22	22	22
C. Systems Programming	0	0	4	7	7	7	7	7	7	7
D. Applications Programming	0	0	27	55	45	45	45	45	45	45
E. Administration	0	0	5	14	14	14	14	14	14	14
Subtotal	0	0	48	138	128	128	128	128	128	128
F. Meteorology/Oceanography/ Quality Control	0	0	0	5	4	4	4	4	4	4
TOTAL-FNWC OMAHA	0	0	48	143	132	132	132	132	132	132
AFGWC Omaha Equipment	4_1	4_1	4_1	4_1	4_1	4_1	4_1	4_1	4_1	4_1
A. Operators	95	95	95	95	95	95	95	95	95	95
B. Maintenance & Engineering	11	11	11	11	11	11	11	11	11	11
C. Systems Programming	30	30	30	30	30	30	30	30	30	30
D. Applications Programming	78	78	78	78	68	68	68	68	68	68
E. Administration	50	50	50	50	48	48	48	48	48	48
Subtotal	264	264	264	264	252	252	252	252	252	252
F. Meteorology/Oceanography/ Quality Control	228	228	228	228	203	203	203	203	203	203
TOTAL-AFGWC OMAHA	492	492	492	492	455	455	455	455	455	455
TOTAL OPTION 1	635	635	683	778	635	587	587	587	587	587

ANNEX G

PERSONNEL ESTIMATES FOR OPTION 2

	Actual FY 71	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80
FNWC-Monterey Equipment	2_1	3_1	3_1	3_1+1_3	$3_1+1_3+1_4$	$3_1+1_3+2_4$	$3_1+1_3+2_4$	$3_1+1_3+2_4$	$3_1+1_3+2_4$	$3_1+1_3+2_4$
A. Operators	39	59	59	79	99	119	119	119	119	119
B. Maintenance and Engineering	22	28	34	42	48	48	50	50	50	52
C. Systems Programmers	7	7	10	20	23	23	23	23	23	23
D. Appl. Programmers	55	55	75	95	105	105	105	105	105	105
E. Administration	15	18	22	30	35	38	39	39	39	39
Subtotal (EDP)	138	167	200	266	310	333	336	336	336	338
F. Meteor/Ocean Quality Control	5	5	5	10	15	25	30	30	30	30
FNWC Subtotal Before EPRF	143	172	205	276	325	358	366	366	366	368
EPRF R&D	0	0	20	40	60	60	60	60	60	60
FNWC TOTAL	143	172	225	316	385	418	426	426	426	428
FNWC-New (Cumulative) Major Applications	0	0	0	1	2	4	5	5	5	5
AFGWC-OMAHA Equipment	4_1	2_1+2_2	2_1+2_2	2_1+2_2	$2_1+2_2+1_4$	$2_1+2_2+2_4$	$2_1+2_2+2_4$	$2_1+2_2+2_4$	$2_1+2_2+2_4$	$2_1+2_2+2_4$
A. Operators	95	95	95	95	115	135	135	135	135	135
B. Maintenance and Engineering	11	11	11	13	13	13	15	15	15	17
C. Systems Programmers	30	30	30	40	43	43	43	43	43	43
D. Appl. Programmers	78	88	98	108	128	128	128	128	128	128
E. Administration	50	54	64	67	75	81	87	87	87	87
Subtotal (EDP)	264	278	298	323	374	400	408	408	408	410
F. Prod. Forecasters/ Observors	228	228	303	303	328	353	403	403	403	403
AFGWC TOTAL	492	506	601	626	702	753	811	811	811	813
AFGWC-New (Cumulative) Major Applications	0	0	3 (2 already prog.)	3	4	5	7	7	7	7
Satellite DPF-OMAHA Equipment	0	0	14	14	14	14	14	14	14	14
A. Operators	0	0	30	30	30	30	30	30	30	30
C. Systems Programmers	0	30	30	30	30	30	30	30	30	30
D. Applications Prog.	0	10	10	10	10	10	10	10	10	10
E. Administration	0	5	8	12	12	12	12	12	12	12
Subtotal (EDP)	0	45	78	82	82	82	82	82	82	82
B. Satellite Ground Station Operators	0	0	0	30	30	30	30	30	30	30
SDPF TOTAL	0	45	78	112	112	112	112	112	112	112
TOTAL EDP	402	490	576	671	766	815	826	826	826	830
TOTAL OPTION 2	635	723	904	1054	1149	1283	1349	1349	1349	1353

ANNEX H

PERSONNEL ESTIMATES FOR OPTION 3

	Actual FY 71	FY 72	FY 73	FY 74	FY 75	FY 76	FY 77	FY 78	FY 79	FY 80
FNWC-Monterey Equipment	2_1	3_1	3_1	3_1	3_1	3_1	0			
A. Operators	39	59	59	59	59	59				
B. Maintenance and Engineering	22	28	28	30	30	30				
C. Systems Programmers	7	7	7	7	7	7				
D. Appl. Programmers	55	55	55	55	55	55				
E. Administration	15	18	18	19	19	19				
Subtotal (EDP)	138	167	167	170	170	170				
F. Meteor/Ocean Quality Control	5	5	5	5	5	5				
FNWC TOTAL	143	172	172	175	175	175	0			
							REASSIGN			
AFGWC-OHAMA Equipment	4_1	2_1+2_2	2_1+2_2	2_1+2_2	2_1+2_2	2_1+2_2	0			
A. Operators	95	95	95	95	95	95				
B. Maintenance and Engineering	11	11	11	13	13	13				
C. Systems Programmers	30	30	30	30	30	30				
D. Applications Prog.	78	88	88	88	88	88				
E. Administration	50	54	63	63	63	63				
Subtotal (EDP)	264	278	287	289	289	289				
F. Prod. Forecasters/ Observors	228	228	303	303	303	303				
AFGWC TOTAL	492	506	590	592	592	592	0			
SITE C - Equipment	0	0	0	0	2_3+1_4	2_3+2_4	2_3+3_4	2_3+4_4	2_3+4_4	2_3+4_4
A. Operators	0	0	0	0	70	90	110	130	130	130
B. Maintenance and Engineering	0	0	0	7	13	20	28	28	28	30
C. Systems Programmers	0	0	0	63	66	69	72	72	72	72
D. Appl. Programmers	0	0	20	60	80	100	243	243	243	243
E. Administration	0	0	2	25	56	76	106	112	112	112
Subtotal (EDP)	0	0	22	155	285	355	559	585	585	587
F. Prod. Forecasters/Obs. Ocean/Meteor	0	0	0	77	209	321	403	433	433	433
B. Sat. Readout Function	0	0	0	0	30	30	30	30	30	30
EPRF R&D	0	0	20	40	60	60	60	60	60	60
TOTAL SITE C	0	0	42	272	584	766	1052	1108	1108	1110
Programmed Products	0	0	0	0	3	6	8+1970	10+1970	10+1970	10+1970
Total EDP	402	445	476	614	744	814	559	585	585	587
TOTAL OPTION 3	635	678	804	1039	1351	1533	1052	1108	1108	1110

ANNEX I

EXPLANATION OF FUNDS REPORTED IN FEDERAL PLANS (as abstracted on Table 1)

Examination of working papers and discussions with personnel in the Air Force and Navy offices that coordinated the Services' reports to the Federal Coordinator indicated that a meaningful reconciliation of funds reported in the Federal Plans vs. estimates prepared for this study would be a complicated and time-consuming task--hence abandoned--for reasons such as the following:

- The Federal Plan reports aggregate funding for world-wide weather communications as a separate function. For example, the cost of the entire Automated Weather Network (AWN) is lumped under the heading "Communications" and not identified to the using activity. (For this study, in contrast, it was necessary to identify the leased-line charges applicable to a weather central to assess the effect of a move.)

- The Federal Plan combines the funds for all maintenance and training activities under "General Support", regardless of where such activity takes place (i.e., the funds are not identified to a using activity such as FNWC).

- The Federal Plan, as indicated on Table 1, reports funding applicable to the "Analyses and Forecast" function in three categories: Primary Centers, Area and Guidance Centers and Specialized Centers. (Manning is not identified to type of center.) The $8 million allocated to Primary Centers in the Air Force, for example, applies strictly to the Analyses and Forecast operations done at these centers (excluding, for example, functions such as maintenance, training, etc., which are included under General Support, also excluding communications applicable to these centers which is reported separately but only in aggregate). Concerning the definition of Primary Centers, the Air Force defines as Primary centers not only AFGWC at Offutt AFB but also the European Weather Central at High Wycombe and the Asian Weather Central at Fuchu, Japan. The other centers that share the remaining reported $8 million of AF funds allocated to the Analysis and Forecast function are:

Area and Guidance Centers ($3 million)

1. Central Pacific Forecast Center, Hickam AFB, Hawaii
2. Southeast Asia Joint Operations Weather Center, Tan Son Nhut AB, Vietnam
3. United States Air Force in Europe Forecast Center, Kindsbach, Germany
4. U.S. Army Europe Forecast Center, Heidelberg, Germany
5. North American Air Defense Command Forecast Center, Cheyenne Mt Complex, Colorado (Ent AFB, Colorado)
6. Alaskan Command Forecast Center, Elmendorf AFB, Alaska
7. Tactical Air Command Forecast Center, Langley AFB, Virginia
8. Latin American Forecast Center, Charleston AFB, South Carolina

Specialized Centers ($5 million)

1. Joint Typhoon Warning Center, Nimitz Hill, Guam
2. ETAC, Washington Cy. D.C.
3. ETAC OL-A, Asheville, North Carolina

Man-Years Reported on Table 1

Table 1 shows 3303 man years for the Air Force. This figure includes 803 for training which, in turn, is composed of 41 persons engaged full time in training as well as 762 man-years of student time spent in training status. Furthermore, although the Air Force appears to be funding only 111 persons for communications, actually funding for an additional 1358 man-years of communications effort supplied by the Defense Communications Agency was allocated and included in the funding reported for Air Force weather functions.